



EUROPEAN RESEARCH EXECUTIVE AGENCY (REA)

REA.A – Marie Skłodowska-Curie Actions & Support to Experts
A.1 – MSCA Doctoral Networks

GRANT AGREEMENT

Project 101072454 — MWGaiaDN

PREAMBLE

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and

on the other part,

1. 'the coordinator':

UNIVERSITEIT LEIDEN (ULEI), PIC 999974553, established in RAPENBURG 70, LEIDEN 2311 EZ, Netherlands,

and the following other beneficiaries, if they sign their 'accession form' (see Annex 3 and Article 40):

2. **ISTITUTO NAZIONALE DI ASTROFISICA (INAF)**, PIC 999868920, established in VIALE DEL PARCO MELLINI 84, ROMA 00136, Italy,

3. **LUNDS UNIVERSITET (ULUND)**, PIC 999901318, established in Paradisgatan 5c, LUND 22100, Sweden,

4. **UNIVERSITAT DE BARCELONA (UB)**, PIC 999986387, established in GRAN VIA DE LES CORTS CATALANES 585, BARCELONA 08007, Spain,

5. **UNIVERSIDADE DE COIMBRA (UC)**, PIC 997826391, established in PACO DAS ESCOLAS, COIMBRA 3004-531, Portugal,

6. **TECHNISCHE UNIVERSITAET DRESDEN (TUD)**, PIC 999897729, established in HELMHOLTZSTRASSE 10, DRESDEN 01069, Germany,

7. **UNIVERSITE GRENOBLE ALPES (UGA)**, PIC 897379108, established in 621 AVENUE CENTRALE, GRENOBLE 38058, France,

8. **ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON (NKUA)**, PIC 999643007, established in 6 CHRISTOU LADA STR, ATHINA 10561, Greece,

Unless otherwise specified, references to ‘beneficiary’ or ‘beneficiaries’ include the coordinator and affiliated entities (if any).

If only one beneficiary signs the grant agreement (‘mono-beneficiary grant’), all provisions referring to the ‘coordinator’ or the ‘beneficiaries’ will be considered — mutatis mutandis — as referring to the beneficiary.

The parties referred to above have agreed to enter into the Agreement.

By signing the Agreement and the accession forms, the beneficiaries accept the grant and agree to implement the action under their own responsibility and in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

The Agreement is composed of:

Preamble

Terms and Conditions (including Data Sheet)

Annex 1 Description of the action¹

Annex 2 Estimated budget for the action

Annex 2a Additional information on unit costs and contributions (if applicable)

Annex 3 Accession forms (if applicable)²

Annex 3a Declaration on joint and several liability of affiliated entities (if applicable)³

Annex 4 Model for the financial statements

Annex 5 Specific rules (if applicable)

¹ Template published on [Portal Reference Documents](#).

² Template published on [Portal Reference Documents](#).

³ Template published on [Portal Reference Documents](#).

TERMS AND CONDITIONS

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DATA SHEET

1. General data

Project summary:

Project summary
<p>The Milky Way-Gaia Doctoral Network (MWGaiaDN): Revealing the Milky Way (MW) with Gaia - Excellent science, Extending techniques, Enhancing people skills, Effecting the next revolution in European led astronomy through leadership in astrometric-based science. What: Gaia, ESA's major space mission launched in Dec 2013, is now in its extended mission to map some two billion stars in the MW. It's upcoming data releases , that will provide chemical and physical annotation of the earlier positional releases, present major challenges in terms of complexity and size, hence research training to deliver a full science exploitation is essential, ensuring that Gaia is the 'game changer' for astronomy How: Our DN will link major partners responsible for the development of Gaia, to form an effective and unique training network combining the best research training with a range of academic and industrial placements, specialist research and knowledge transfer workshops. It will develop and train a cohort of young researchers through a set of key science projects pushing the Gaia data to its limits. Our DN will train 10 ESRs located across 10 European beneficiaries, benefiting from the participation of 13 associate partners. These include major industry (e.g. AirbusDS, TAS), at the forefront of Space and Information technologies; SME Industry (e.g. DAPCOM, Suil), innovating new technologies for Space and partners leading the development of next generation astrometry missions outside of Europe (NAOJ). Relevance: It will shape the delivery of training in astrometry and the study of the MW across Europe: delivering key insights into the structure and formation of our Galaxy; delivering the roadmap for the next generation of astrometric space telescopes; equipping the ESRs with skills to drive the next innovative steps in this crucial area of space discovery, as well as enabling them to contribute to the future, growth and challenges of the big data industry and commerce. MWGaiaDN</p>

Keywords:

- Formation and evolution of galaxies
- Formation of stars and planets
- Instrumentation - telescopes, detectors and techniques

Project number: 101072454

Project name: MWGaiaDN: Revealing the Milky Way with Gaia

Project acronym: MWGaiaDN

Call: HORIZON-MSCA-2021-DN-01

Topic: HORIZON-MSCA-2021-DN-01-01

Type of action: HORIZON TMA MSCA Doctoral Networks

Granting authority: European Research Executive Agency

Grant managed through EU Funding & Tenders Portal: Yes (eGrants)

Project starting date: fixed date: 1 February 2023

Project end date: 31 January 2027

Project duration: 48 months

Consortium agreement: Yes

2. Participants

List of participants:

Nº	Role	Short name	Legal name	Ctry	PIC	Total eligible contrib.	Max grant amount
1	COO	ULEI	UNIVERSITEIT LEIDEN	NL	999974553	274 370.40	274 370.40
2	BEN	INAF	ISTITUTO NAZIONALE DI ASTROFISICA	IT	999868920	259 437.60	259 437.60

N°	Role	Short name	Legal name	Ctry	PIC	Total eligible contrib.	Max grant amount
3	BEN	ULUND	LUNDS UNIVERSITET	SE	999901318	293 709.60	293 709.60
4	BEN	UB	UNIVERSITAT DE BARCELONA	ES	999986387	503 942.40	503 942.40
5	BEN	UC	UNIVERSIDADE DE COIMBRA	PT	997826391	243 403.20	243 403.20
6	BEN	TUD	TECHNISCHE UNIVERSITAET DRESDEN	DE	999897729	521 078.40	521 078.40
7	BEN	UGA	UNIVERSITE GRENOBLE ALPES	FR	897379108	282 693.60	282 693.60
8	BEN	NKUA	ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON	EL	999643007	240 098.40	240 098.40
9	AP	UNIPD	UNIVERSITA DEGLI STUDI DI PADOVA	IT	999995602	0.00	0.00
10	AP	JASMINE-NAOJ	JASMINE Project Officece, NAOJ	JP	896803219	0.00	0.00
11	AP	NRF	NATIONAL RESEARCH FOUNDATION	ZA	999543194	0.00	0.00
12	AP	DiRAC	DiRAC Institute	US	896633663	0.00	0.00
13	AP	DAPCOM	Dapcom Data Services S.L.	ES	936510460	0.00	0.00
14	AP	INTERSYS	InterSystems Iberia, S.L.	ES	896641132	0.00	0.00
15	AP	SPIN	SPIN WORKS SA	PT	992214068	0.00	0.00
16	AP	SUIL	Suil Interactive Ltd	IE	896653160	0.00	0.00
17	AP	OHB	OHB SYSTEM AG	DE	989360037	0.00	0.00
18	AP	LEO-LTD	LEONARDO UK LTD	UK	999612258	0.00	0.00
19	AP	AIRBUSDS	AIRBUS DEFENCE AND SPACE LTD	UK	999530778	0.00	0.00
20	AP	CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	FR	999997930	0.00	0.00
21	AP	TAS-UK	THALES ALENIA SPACE UK LTD	UK	936556147	0.00	0.00
22	AP	UCL	UNIVERSITY COLLEGE LONDON	UK	999975620	0.00	0.00
23	AP	UCAM	THE CHANCELLOR MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE	UK	999977172	0.00	0.00
Total						2 618 733.60	2 618 733.60

Coordinator:

- UNIVERSITEIT LEIDEN (ULEI)

3. Grant**Maximum grant amount, total estimated eligible costs and contributions and funding rate:**

Total eligible contributions (unit, flat-rate and lump sum contributions and financing not linked to costs)	Maximum grant amount (Annex 2)	Maximum grant amount (award decision)
2 618 733.60	2 618 733.60	2 618 733.60

Grant form: Unit**Grant mode:** Action grant**Budget categories/activity types:**

- A. Contributions for recruited researchers
 - A.1 Living allowance
 - A.2 Mobility allowance
 - A.3 Family allowance

- A.4 Long-term leave allowance
- A.5 Special needs allowance

- B. Institutional contributions
 - B.1 Research, training and networking contribution
 - B.2 Management and indirect contribution

Cost eligibility options:

- In-kind contributions eligible costs

Budget flexibility: Yes (flexibility with conditions)**4. Reporting, payments and recoveries****4.1 Continuous reporting** (art 21)**Deliverables:** see Funding & Tenders Portal Continuous Reporting tool**4.2 Periodic reporting and payments****Reporting and payment schedule** (art 21, 22):

Reporting					Payments	
Reporting periods			Type	Deadline	Type	Deadline (time to pay)
RP No	Month from	Month to				
					Initial prefinancing	30 days from entry into force/10 days before starting date – whichever is the latest
1	1	24	Periodic report	60 days after end of reporting period	Interim payment	90 days from receiving periodic report
2	25	48	Periodic report	60 days after end of reporting period	Final payment	90 days from receiving periodic report

Prefinancing payments and guarantees:

Prefinancing payment	
Type	Amount
Prefinancing 1 (initial)	2 094 986.88

Reporting and payment modalities (art 21, 22):

Mutual Insurance Mechanism (MIM): Yes

MIM contribution: 5% of the maximum grant amount (130 936.68), retained from the initial prefinancing

Restrictions on distribution of initial prefinancing: The prefinancing may be distributed only if the minimum number of beneficiaries set out in the call conditions (if any) have acceded to the Agreement and only to beneficiaries that have acceded.

Interim payment ceiling (if any): 90% of the maximum grant amount

No-profit rule: n/a

Late payment interest: ECB + 3.5%

Bank account for payments:

NL78RABO0102468869

Conversion into euros: n/a

Reporting language: Language of the Agreement

4.3 Certificates (art 24): n/a

4.4 Recoveries (art 22)

First-line liability for recoveries:

Beneficiary termination: Beneficiary concerned

Final payment: Each beneficiary for their own debt

After final payment: Beneficiary concerned

Joint and several liability for enforced recoveries (in case of non-payment):

Individual financial responsibility: Each beneficiary is liable only for its own debts (and those of its affiliated entities, if any)

5. Consequences of non-compliance, applicable law & dispute settlement forum

Suspension and termination:

Additional suspension grounds (art 31)

Additional termination grounds (art 32)

Applicable law (art 43):

Standard applicable law regime: EU law + law of Belgium

Dispute settlement forum (art 43):

Standard dispute settlement forum:

EU beneficiaries: EU General Court + EU Court of Justice (on appeal)

Non-EU beneficiaries: Courts of Brussels, Belgium (unless an international agreement provides for the enforceability of EU court judgements)

6. Other

Specific rules (Annex 5): Yes

Standard time-limits after project end:

Confidentiality (for X years after final payment): 5

Record-keeping (for X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

Reviews (up to X years after final payment): 2

Audits (up to X years after final payment): 2

Extension of findings from other grants to this grant (no later than X years after final payment): 2

Impact evaluation (up to X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and terms and conditions applicable to the grant awarded for the implementation of the action set out in Chapter 2.

ARTICLE 2 — DEFINITIONS

For the purpose of this Agreement, the following definitions apply:

Actions — The project which is being funded in the context of this Agreement.

Grant — The grant awarded in the context of this Agreement.

EU grants — Grants awarded by EU institutions, bodies, offices or agencies (including EU executive agencies, EU regulatory agencies, EDA, joint undertakings, etc.).

Participants — Entities participating in the action as beneficiaries, affiliated entities, associated partners, third parties giving in-kind contributions, subcontractors or recipients of financial support to third parties.

Beneficiaries (BEN) — The signatories of this Agreement (either directly or through an accession form).

Affiliated entities (AE) — Entities affiliated to a beneficiary within the meaning of Article 187 of EU Financial Regulation 2018/1046⁴ which participate in the action with similar rights and obligations as the beneficiaries (obligation to implement action tasks and right to charge costs and claim contributions).

Associated partners (AP) — Entities which participate in the action, but without the right to charge costs or claim contributions.

Purchases — Contracts for goods, works or services needed to carry out the action (e.g. equipment, consumables and supplies) but which are not part of the action tasks (see Annex 1).

Subcontracting — Contracts for goods, works or services that are part of the action tasks (see Annex 1).

In-kind contributions — In-kind contributions within the meaning of Article 2(36) of EU Financial

⁴ For the definition, see Article 187 Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012 ('EU Financial Regulation') (OJ L 193, 30.7.2018, p. 1): "**affiliated entities** [are]:

- (a) entities that form a sole beneficiary [(i.e. where an entity is formed of several entities that satisfy the criteria for being awarded a grant, including where the entity is specifically established for the purpose of implementing an action to be financed by a grant)];
- (b) entities that satisfy the eligibility criteria and that do not fall within one of the situations referred to in Article 136(1) and 141(1) and that have a link with the beneficiary, in particular a legal or capital link, which is neither limited to the action nor established for the sole purpose of its implementation".

Regulation 2018/1046, i.e. non-financial resources made available free of charge by third parties to a beneficiary.

Fraud — Fraud within the meaning of Article 3 of EU Directive 2017/1371⁵ and Article 1 of the Convention on the protection of the European Communities' financial interests, drawn up by the Council Act of 26 July 1995⁶, as well as any other wrongful or criminal deception intended to result in financial or personal gain.

Irregularities — Any type of breach (regulatory or contractual) which could impact the EU financial interests, including irregularities within the meaning of Article 1(2) of EU Regulation 2988/95⁷.

Grave professional misconduct — Any type of unacceptable or improper behaviour in exercising one's profession, especially by employees, including grave professional misconduct within the meaning of Article 136(1)(c) of EU Financial Regulation 2018/1046.

Applicable EU, international and national law — Any legal acts or other (binding or non-binding) rules and guidance in the area concerned.

Portal — EU Funding & Tenders Portal; electronic portal and exchange system managed by the European Commission and used by itself and other EU institutions, bodies, offices or agencies for the management of their funding programmes (grants, procurements, prizes, etc.).

CHAPTER 2 ACTION

ARTICLE 3 — ACTION

The grant is awarded for the action **101072454 — MWGaiadN** ('action'), as described in Annex 1.

ARTICLE 4 — DURATION AND STARTING DATE

The duration and the starting date of the action are set out in the Data Sheet (see Point 1).

CHAPTER 3 GRANT

ARTICLE 5 — GRANT

5.1 Form of grant

The grant is an action grant⁸ which takes the form of a unit grant.

⁵ Directive (EU) 2017/1371 of the European Parliament and of the Council of 5 July 2017 on the fight against fraud to the Union's financial interests by means of criminal law (OJ L 198, 28.7.2017, p. 29).

⁶ OJ C 316, 27.11.1995, p. 48.

⁷ Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).

⁸ For the definition, see Article 180(2)(a) EU Financial Regulation 2018/1046: '**action grant**' means an EU grant to finance "an action intended to help achieve a Union policy objective".

5.2 Maximum grant amount

The maximum grant amount is set out in the Data Sheet (see Point 3) and in the estimated budget (Annex 2).

5.3 Funding rate

Not applicable

5.4 Estimated budget, budget categories and forms of funding

The estimated budget for the action is set out in Annex 2.

It contains the estimated eligible contributions for the action (unit contributions), broken down by participant and budget category.

Annex 2 also shows the types of contributions (forms of funding)⁹ to be used for each budget category.

The details on the calculation of the unit contributions will be explained in Annex 2a.

5.5 Budget flexibility

The budget breakdown may be adjusted — without an amendment (see Article 39) — by transfers of units between participants, as long as this does not imply any substantive or important change to the description of the action in Annex 1. Transfers between budget categories are not allowed.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE CONTRIBUTIONS

6.1 General eligibility conditions

The **general eligibility conditions** for the unit contributions are the following:

(a) the units must:

- be actually used or produced by the beneficiary in the period set out in Article 4 (with the exception of units relating to the submission of the final periodic report, which may be used or produced afterwards; see Article 21)
- be necessary for the implementation of the action and

(b) the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 20).

6.2 Specific eligibility conditions for each budget category

For each budget category, the **specific eligibility conditions** are as follows:

A. Contributions for recruited researchers

Contributions for recruited researchers (A.1 Living allowance, A.2 Mobility allowance, A.3 Family

⁹ See Article 125 EU Financial Regulation 2018/1046.

allowance, A.4 Long-term leave allowance and A.5 Special needs allowance) are eligible, if they fulfil the general eligibility conditions and are calculated as unit contributions in accordance with the method set out in Annex 2a, and if:

for A.1 Living allowance and A.2 Mobility allowance:

- (a) the number of units declared:
- (i) corresponds to the number of months spent by the recruited researchers on the research training activities
 - (ii) does not exceed the maximum number of months (per researcher) set out in the call conditions and
 - (iii) comply with the requirements for non-academic exposure set out in the call conditions (for industrial doctorates only)
- (b) the recruited researchers comply with the following conditions:
- (i) be — at the date of recruitment — a doctoral candidate (i.e. not already in possession of a doctoral degree¹⁰)
 - (ii) be enrolled in a doctoral programme leading to the award of a (for joint doctorates: joint, multiple or double) degree in at least one EU Member State or Horizon Europe associated country (for joint doctorates: at least two)
 - (iii) be recruited by the beneficiaries under an employment contract (or other direct contract with equivalent benefits, including social security coverage) or — if not otherwise possible under national law — under a fixed amount fellowship agreement with minimum social security coverage, including during periods of secondment
 - (iv) be employed full-time, unless the granting authority has approved a part-time employment for personal or family reasons
 - (v) be working exclusively for the action
 - (vi) not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting beneficiary for more than 12 months in the 36 months immediately before the recruitment date — unless as part of a compulsory national service or a procedure for obtaining refugee status under the Geneva Convention¹¹
- For beneficiaries that are international European research organisations or international organisations: not have spent with the beneficiary more than 12 months in the 36 months immediately before the recruitment date
- (c) the contributions have been fully incurred for the benefit of the recruited researchers

This condition is met if:

¹⁰ As defined in the call conditions.

¹¹ 1951 Refugee Convention and the 1967 Protocol.

{ **total remuneration costs** (salaries, social security contributions, taxes and other costs included in the remuneration under the employment contract or other direct contract) or **total fixed-amount fellowship costs** for the researcher during the action

plus

total mobility costs (household, relocation and travel expenses and, if they must be paid under national law, taxes, duties and social security contributions) for the researcher during the action}

divided by

the number of actual units}.

is equal to or higher than the following amount:

{amount per unit contribution set out in Annex 2 as living allowance

plus

amount per unit contribution set out in Annex 2 as mobility allowance}.

for A.3 Family allowance:

(a) the recruited researchers have a family.

‘Family’ means persons linked to the researcher by marriage (or a relationship with equivalent status to a marriage recognised by the legislation of the country where this relationship was formalised) or dependent children who are actually being maintained by the researcher.

(b) the number of units declared:

- (i) corresponds to the number of months spent by the recruited researchers with a family on the research training activities and
- (ii) does not exceed the maximum number of months (per researcher) set out in the call conditions.

(c) the contributions have been incurred for the benefit of the recruited researchers

This condition is met if they have been fully used for the recruited researchers for whom they are claimed.

for A.4 Long-term leave¹² allowance:

(a) the general and specific eligibility conditions for the living and mobility allowances were fulfilled before the long-term leave and

(b) the number of units declared corresponds to the number of months paid by the beneficiary.

for A.5 Special needs allowance:

(a) they are used for recruited researchers with disabilities whose long-term physical, mental, intellectual or sensory impairments are certified by a competent national authority and of such

¹² Long-term leave includes maternity, paternity, parental, sick or special leave of more than 30 days.

nature that their participation in the action would not be possible without the special needs items or services

- (b) the special needs items or services are not already covered from another source (such as social security or health insurance)
- (c) the number of units declared corresponds to the number of special needs units that were needed for implementing the action.

B. Institutional contributions

Institutional contributions (B.1 Research, training and networking contribution and B.2 Management and indirect contribution) are eligible, if they are calculated as unit contributions in accordance with the method set out in Annex 2a, and if the living and mobility allowances are eligible.

Moreover, no more than 40% of the maximum grant amount may be allocated to beneficiaries located in the same country or to any one international European research organisation or international organisation.

6.3 Ineligible contributions

‘Ineligible contributions’ are:

- (a) units that do not comply with the conditions set out above (see Article 6.1 and 6.2)
- (b) units implemented during grant agreement suspension (see Article 31) and
- (c) units for activities already funded under other EU grants (or grants awarded by an EU Member State, non-EU country or other body implementing the EU budget), except for the following case:
 - (i) Synergy actions: not applicable
- (d) other:
 - (i) country restrictions for eligible costs: not applicable.

6.4 Consequences of non-compliance

If a beneficiary declares unit contributions that are ineligible, they will be rejected (see Article 27).

This may also lead to other measures described in Chapter 5.

CHAPTER 4 GRANT IMPLEMENTATION

SECTION 1 CONSORTIUM: BENEFICIARIES, AFFILIATED ENTITIES AND OTHER PARTICIPANTS

ARTICLE 7 — BENEFICIARIES

The beneficiaries, as signatories of the Agreement, are fully responsible towards the granting authority for implementing it and for complying with all its obligations.

They must implement the Agreement to their best abilities, in good faith and in accordance with all the obligations and terms and conditions it sets out.

They must have the appropriate resources to implement the action and implement the action under their own responsibility and in accordance with Article 11. If they rely on affiliated entities or other participants (see Articles 8 and 9), they retain sole responsibility towards the granting authority and the other beneficiaries.

They are jointly responsible for the *technical* implementation of the action. If one of the beneficiaries fails to implement their part of the action, the other beneficiaries must ensure that this part is implemented by someone else (without being entitled to an increase of the maximum grant amount and subject to an amendment; see Article 39). The *financial* responsibility of each beneficiary in case of recoveries is governed by Article 22.

The beneficiaries (and their action) must remain eligible under the EU programme funding the grant for the entire duration of the action. Unit contributions will be eligible only as long as the beneficiary and the action are eligible.

The **internal roles and responsibilities** of the beneficiaries are divided as follows:

(a) Each beneficiary must:

- (i) keep information stored in the Portal Participant Register up to date (see Article 19)
- (ii) inform the granting authority (and the other beneficiaries) immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 19)
- (iii) submit to the coordinator in good time:
 - the prefinancing guarantees (if required; see Article 23)
 - the financial statements and certificates on the financial statements (CFS) (if required; see Articles 21 and 24.2 and Data Sheet, Point 4.3)
 - the contribution to the deliverables and technical reports (see Article 21)
 - any other documents or information required by the granting authority under the Agreement
- (iv) submit via the Portal data and information related to the participation of their affiliated entities.

(b) The coordinator must:

- (i) monitor that the action is implemented properly (see Article 11)
- (ii) act as the intermediary for all communications between the consortium and the granting authority, unless the Agreement or granting authority specifies otherwise, and in particular:

- submit the prefinancing guarantees to the granting authority (if any)
 - request and review any documents or information required and verify their quality and completeness before passing them on to the granting authority
 - submit the deliverables and reports to the granting authority
 - inform the granting authority about the payments made to the other beneficiaries (report on the distribution of payments; if required, see Articles 22 and 32)
- (iii) distribute the payments received from the granting authority to the other beneficiaries without unjustified delay (see Article 22).

The coordinator may not delegate or subcontract the above-mentioned tasks to any other beneficiary or third party (including affiliated entities).

However, coordinators which are public bodies may delegate the tasks set out in Point (b)(ii) last indent and (iii) above to entities with ‘authorisation to administer’ which they have created or which are controlled by or affiliated to them. In this case, the coordinator retains sole responsibility for the payments and for compliance with the obligations under the Agreement.

Moreover, coordinators which are ‘sole beneficiaries’¹³ (or similar, such as European research infrastructure consortia (ERICs)) may delegate the tasks set out in Point (b)(i) to (iii) above to one of their members. The coordinator retains sole responsibility for compliance with the obligations under the Agreement.

The beneficiaries must have **internal arrangements** regarding their operation and co-ordination, to ensure that the action is implemented properly.

If required by the granting authority (see Data Sheet, Point 1), these arrangements must be set out in a written **consortium agreement** between the beneficiaries, covering for instance:

- the internal organisation of the consortium
- the management of access to the Portal
- different distribution keys for the payments and financial responsibilities in case of recoveries (if any)
- additional rules on rights and obligations related to background and results (see Article 16)
- settlement of internal disputes
- liability, indemnification and confidentiality arrangements between the beneficiaries.

The internal arrangements must not contain any provision contrary to this Agreement.

ARTICLE 8 — AFFILIATED ENTITIES

¹³ For the definition, see Article 187(2) EU Financial Regulation 2018/1046: “Where several entities satisfy the criteria for being awarded a grant and together form one entity, that entity may be treated as the **sole beneficiary**, including where it is specifically established for the purpose of implementing the action financed by the grant.”

Not applicable

ARTICLE 9 — OTHER PARTICIPANTS INVOLVED IN THE ACTION

9.1 Associated partners

The following entities which cooperate with a beneficiary will participate in the action as ‘associated partners’:

- **UNIVERSITA DEGLI STUDI DI PADOVA (UNIPD)**, PIC 999995602
- **JASMINE Project Office, NAOJ (JASMINE-NAOJ)**, PIC 896803219
- **NATIONAL RESEARCH FOUNDATION (NRF)**, PIC 999543194
- **DiRAC Institute (DiRAC)**, PIC 896633663
- **Dapcom Data Services S.L. (DAPCOM)**, PIC 936510460, associated partner of UNIVERSITAT DE BARCELONA (UB)
- **InterSystems Iberia, S.L. (INTERSYS)**, PIC 896641132
- **SPIN WORKS SA (SPIN)**, PIC 992214068
- **Suil Interactive Ltd (SUIL)**, PIC 896653160
- **OHB SYSTEM AG (OHB)**, PIC 989360037
- **LEONARDO UK LTD (LEO-LTD)**, PIC 999612258
- **AIRBUS DEFENCE AND SPACE LTD (AIRBUSDS)**, PIC 999530778
- **CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (CNRS)**, PIC 999997930, associated partner of UNIVERSITE GRENOBLE ALPES (UGA)
- **THALES ALENIA SPACE UK LTD (TAS-UK)**, PIC 936556147
- **UNIVERSITY COLLEGE LONDON (UCL)**, PIC 999975620
- **THE CHANCELLOR MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE (UCAM)**, PIC 999977172

Associated partners must implement the action tasks attributed to them in Annex 1 in accordance with Article 11. They may not charge contributions to the action (no unit contributions) and the costs for their tasks are not eligible.

The tasks must be set out in Annex 1.

The beneficiaries must ensure that their contractual obligations under Articles 11 (proper implementation), 12 (conflict of interests), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the associated partners.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the associated partners.

9.2 Third parties giving in-kind contributions to the action

Other third parties may give in-kind contributions to the action (i.e. personnel, equipment, other goods, works and services, etc. which are free-of-charge) if necessary for the implementation.

Third parties giving in-kind contributions do not implement any action tasks. They may not charge contributions to the action (no unit contributions) and their costs are considered entirely covered by the unit contributions paid to the beneficiaries.

The third parties and their in-kind contributions should be set out in Annex 1.

9.3 Subcontractors

Subcontractors may participate in the action, if necessary for the implementation.

Subcontractors must implement their action tasks in accordance with Article 11. The beneficiaries' costs for subcontracting are considered entirely covered by the unit contributions (irrespective of the actual subcontracting costs incurred, if any).

The beneficiaries must ensure that their contractual obligations under Articles 11 (proper implementation), 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the subcontractors.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the subcontractors.

9.4 Recipients of financial support to third parties

If the action includes providing financial support to third parties (e.g. grants, prizes or similar forms of support), the beneficiaries must ensure that their contractual obligations under Articles 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the third parties receiving the support (recipients).

The beneficiaries must also ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the recipients.

ARTICLE 10 — PARTICIPANTS WITH SPECIAL STATUS

10.1 Non-EU participants

Participants which are established in a non-EU country (if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles, environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)

- for the submission of certificates under Article 24: to use qualified external auditors which are independent and comply with comparable standards as those set out in EU Directive 2006/43/EC¹⁴
- for the controls under Article 25: to allow for checks, reviews, audits and investigations (including on-the-spot checks, visits and inspections) by the bodies mentioned in that Article (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.).

Special rules on dispute settlement apply (see Data Sheet, Point 5).

10.2 Participants which are international organisations

Participants which are international organisations (IOs; if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles, environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)
- for the submission of certificates under Article 24: to use either independent public officers or external auditors which comply with comparable standards as those set out in EU Directive 2006/43/EC
- for the controls under Article 25: to allow for the checks, reviews, audits and investigations by the bodies mentioned in that Article, taking into account the specific agreements concluded by them and the EU (if any).

For such participants, nothing in the Agreement will be interpreted as a waiver of their privileges or immunities, as accorded by their constituent documents or international law.

Special rules on applicable law and dispute settlement apply (see Article 43 and Data Sheet, Point 5).

10.3 Pillar-assessed participants

Pillar-assessed participants (if any) may rely on their own systems, rules and procedures, in so far as they have been positively assessed and do not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries.

‘Pillar-assessment’ means a review by the European Commission on the systems, rules and procedures which participants use for managing EU grants (in particular internal control system, accounting system, external audits, financing of third parties, rules on recovery and exclusion, information on recipients and protection of personal data; see Article 154 EU Financial Regulation 2018/1046).

Participants with a positive pillar assessment may rely on their own systems, rules and procedures, in particular for:

- record-keeping (Article 20): may be done in accordance with internal standards, rules and procedures

¹⁴ Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts or similar national regulations (OJ L 157, 9.6.2006, p. 87).

- currency conversion for financial statements (Article 21): may be done in accordance with usual accounting practices
- guarantees (Article 23): for public law bodies, prefinancing guarantees are not needed
- certificates (Article 24):
 - certificates on the financial statements (CFS): may be provided by their regular internal or external auditors and in accordance with their internal financial regulations and procedures
 - certificates on usual accounting practices (CoMUC): are not needed if those practices are covered by an ex-ante assessment

and use the following specific rules, for:

- recoveries (Article 22): in case of financial support to third parties, there will be no recovery if the participant has done everything possible to retrieve the undue amounts from the third party receiving the support (including legal proceedings) and non-recovery is not due to an error or negligence on its part
- checks, reviews, audits and investigations by the EU (Article 25): will be conducted taking into account the rules and procedures specifically agreed between them and the framework agreement (if any)
- impact evaluation (Article 26): will be conducted in accordance with the participant's internal rules and procedures and the framework agreement (if any)
- grant agreement suspension (Article 31): certain costs incurred during grant suspension are eligible (notably, minimum costs necessary for a possible resumption of the action and costs relating to contracts which were entered into before the pre-information letter was received and which could not reasonably be suspended, reallocated or terminated on legal grounds)
- grant agreement termination (Article 32): the final grant amount and final payment will be calculated taking into account also costs relating to contracts due for execution only after termination takes effect, if the contract was entered into before the pre-information letter was received and could not reasonably be terminated on legal grounds
- liability for damages (Article 33.2): the granting authority must be compensated for damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement only if the damage is due to an infringement of the participant's internal rules and procedures or due to a violation of third parties' rights by the participant or one of its employees or individual for whom the employees are responsible.

Participants whose pillar assessment covers procurement and granting procedures may also do purchases, subcontracting and financial support to third parties (Article 6.2) in accordance with their internal rules and procedures for purchases, subcontracting and financial support.

Participants whose pillar assessment covers data protection rules may rely on their internal standards, rules and procedures for data protection (Article 15).

The participants may however not rely on provisions which would breach the principle of equal treatment of applicants or beneficiaries or call into question the decision awarding the grant, such as in particular:

- eligibility (Article 6)
- consortium roles and set-up (Articles 7-9)
- security and ethics (Articles 13, 14)
- IPR (including background and results, access rights and rights of use), communication, dissemination and visibility (Articles 16 and 17)
- information obligation (Article 19)
- payment, reporting and amendments (Articles 21, 22 and 39)
- rejections, reductions, suspensions and terminations (Articles 27, 28, 29-32)

If the pillar assessment was subject to remedial measures, reliance on the internal systems, rules and procedures is subject to compliance with those remedial measures.

Participants whose assessment has not yet been updated to cover (the new rules on) data protection may rely on their internal systems, rules and procedures, provided that they ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subject
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes
- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed
- accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the personal data.

Participants must inform the coordinator without delay of any changes to the systems, rules and procedures that were part of the pillar assessment. The coordinator must immediately inform the granting authority.

Pillar-assessed participants that have also concluded a framework agreement with the EU, may moreover — under the same conditions as those above (i.e. not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries) — rely on the provisions set out in that framework agreement.

SECTION 2 RULES FOR CARRYING OUT THE ACTION

ARTICLE 11 — PROPER IMPLEMENTATION OF THE ACTION

11.1 Obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement, the call conditions and all legal obligations under applicable EU, international and national law.

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 12 — CONFLICT OF INTERESTS

12.1 Conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the Agreement could be compromised for reasons involving family, emotional life, political or national affinity, economic interest or any other direct or indirect interest ('conflict of interests').

They must formally notify the granting authority without delay of any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The granting authority may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28) and the grant or the beneficiary may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 13 — CONFIDENTIALITY AND SECURITY

13.1 Sensitive information

The parties must keep confidential any data, documents or other material (in any form) that is identified as sensitive in writing ('sensitive information') — during the implementation of the action and for at least until the time-limit set out in the Data Sheet (see Point 6).

If a beneficiary requests, the granting authority may agree to keep such information confidential for a longer period.

Unless otherwise agreed between the parties, they may use sensitive information only to implement the Agreement.

The beneficiaries may disclose sensitive information to their personnel or other participants involved in the action only if they:

- (a) need to know it in order to implement the Agreement and
- (b) are bound by an obligation of confidentiality.

The granting authority may disclose sensitive information to its staff and to other EU institutions and bodies.

It may moreover disclose sensitive information to third parties, if:

- (a) this is necessary to implement the Agreement or safeguard the EU financial interests and
- (b) the recipients of the information are bound by an obligation of confidentiality.

The confidentiality obligations no longer apply if:

- (a) the disclosing party agrees to release the other party
- (b) the information becomes publicly available, without breaching any confidentiality obligation
- (c) the disclosure of the sensitive information is required by EU, international or national law.

Specific confidentiality rules (if any) are set out in Annex 5.

13.2 Classified information

The parties must handle classified information in accordance with the applicable EU, international or national law on classified information (in particular, Decision 2015/444¹⁵ and its implementing rules).

Deliverables which contain classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving classified information may be subcontracted only after explicit approval (in writing) from the granting authority.

Classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

Specific security rules (if any) are set out in Annex 5.

13.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 14 — ETHICS AND VALUES

14.1 Ethics

¹⁵ Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

The action must be carried out in line with the highest ethical standards and the applicable EU, international and national law on ethical principles.

Specific ethics rules (if any) are set out in Annex 5.

14.2 Values

The beneficiaries must commit to and ensure the respect of basic EU values (such as respect for human dignity, freedom, democracy, equality, the rule of law and human rights, including the rights of minorities).

Specific rules on values (if any) are set out in Annex 5.

14.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 15 — DATA PROTECTION

15.1 Data processing by the granting authority

Any personal data under the Agreement will be processed under the responsibility of the data controller of the granting authority in accordance with and for the purposes set out in the Portal Privacy Statement.

For grants where the granting authority is the European Commission, an EU regulatory or executive agency, joint undertaking or other EU body, the processing will be subject to Regulation 2018/1725¹⁶.

15.2 Data processing by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with the applicable EU, international and national law on data protection (in particular, Regulation 2016/679¹⁷).

They must ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subjects
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes

¹⁶ Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC (OJ L 295, 21.11.2018, p. 39).

¹⁷ Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC ('GDPR') (OJ L 119, 4.5.2016, p. 1).

- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed
- accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the data.

The beneficiaries may grant their personnel access to personal data only if it is strictly necessary for implementing, managing and monitoring the Agreement. The beneficiaries must ensure that the personnel is under a confidentiality obligation.

The beneficiaries must inform the persons whose data are transferred to the granting authority and provide them with the Portal Privacy Statement.

15.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 16 — INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS — ACCESS RIGHTS AND RIGHTS OF USE

16.1 Background and access rights to background

The beneficiaries must give each other and the other participants access to the background identified as needed for implementing the action, subject to any specific rules in Annex 5.

‘Background’ means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that is:

- (a) held by the beneficiaries before they acceded to the Agreement and
- (b) needed to implement the action or exploit the results.

If background is subject to rights of a third party, the beneficiary concerned must ensure that it is able to comply with its obligations under the Agreement.

16.2 Ownership of results

The granting authority does not obtain ownership of the results produced under the action.

‘Results’ means any tangible or intangible effect of the action, such as data, know-how or information, whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights.

16.3 Rights of use of the granting authority on materials, documents and information received for policy, information, communication, dissemination and publicity purposes

The granting authority has the right to use non-sensitive information relating to the action and materials and documents received from the beneficiaries (notably summaries for publication, deliverables, as well as any other material, such as pictures or audio-visual material, in paper or electronic form) for policy, information, communication, dissemination and publicity purposes — during the action or afterwards.

The right to use the beneficiaries' materials, documents and information is granted in the form of a royalty-free, non-exclusive and irrevocable licence, which includes the following rights:

- (a) **use for its own purposes** (in particular, making them available to persons working for the granting authority or any other EU service (including institutions, bodies, offices, agencies, etc.) or EU Member State institution or body; copying or reproducing them in whole or in part, in unlimited numbers; and communication through press information services)
- (b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes)
- (c) **editing or redrafting** (including shortening, summarising, inserting other elements (e.g. meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation)
- (d) **translation**
- (e) **storage** in paper, electronic or other form
- (f) **archiving**, in line with applicable document-management rules
- (g) the right to authorise **third parties** to act on its behalf or sub-license to third parties the modes of use set out in Points (b), (c), (d) and (f), if needed for the information, communication and publicity activity of the granting authority
- (h) **processing**, analysing, aggregating the materials, documents and information received and **producing derivative works**.

The rights of use are granted for the whole duration of the industrial or intellectual property rights concerned.

If materials or documents are subject to moral rights or third party rights (including intellectual property rights or rights of natural persons on their image and voice), the beneficiaries must ensure that they comply with their obligations under this Agreement (in particular, by obtaining the necessary licences and authorisations from the rights holders concerned).

Where applicable, the granting authority will insert the following information:

“© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the [name of granting authority] under conditions.”

16.4 Specific rules on IPR, results and background

Specific rules regarding intellectual property rights, results and background (if any) are set out in Annex 5.

16.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

ARTICLE 17 — COMMUNICATION, DISSEMINATION AND VISIBILITY

17.1 Communication — Dissemination — Promoting the action

Unless otherwise agreed with the granting authority, the beneficiaries must promote the action and its results by providing targeted information to multiple audiences (including the media and the public), in accordance with Annex 1 and in a strategic, coherent and effective manner.

Before engaging in a communication or dissemination activity expected to have a major media impact, the beneficiaries must inform the granting authority.

17.2 Visibility — European flag and funding statement

Unless otherwise agreed with the granting authority, communication activities of the beneficiaries related to the action (including media relations, conferences, seminars, information material, such as brochures, leaflets, posters, presentations, etc., in electronic form, via traditional or social media, etc.), dissemination activities and any infrastructure, equipment, vehicles, supplies or major result funded by the grant must acknowledge EU support and display the European flag (emblem) and funding statement (translated into local languages, where appropriate):



Funded by the
European Union



Co-funded by the
European Union



Funded by the
European Union



Co-funded by the
European Union

The emblem must remain distinct and separate and cannot be modified by adding other visual marks, brands or text.

Apart from the emblem, no other visual identity or logo may be used to highlight the EU support.

When displayed in association with other logos (e.g. of beneficiaries or sponsors), the emblem must be displayed at least as prominently and visibly as the other logos.

For the purposes of their obligations under this Article, the beneficiaries may use the emblem without first obtaining approval from the granting authority. This does not, however, give them the right to exclusive use. Moreover, they may not appropriate the emblem or any similar trademark or logo, either by registration or by any other means.

17.3 Quality of information — Disclaimer

Any communication or dissemination activity related to the action must use factually accurate information.

Moreover, it must indicate the following disclaimer (translated into local languages where appropriate):

“Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or [name of the granting authority]. Neither the European Union nor the granting authority can be held responsible for them.”

17.4 Specific communication, dissemination and visibility rules

Specific communication, dissemination and visibility rules (if any) are set out in Annex 5.

17.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 18 — SPECIFIC RULES FOR CARRYING OUT THE ACTION

18.1 Specific rules for carrying out the action

Specific rules for implementing the action (if any) are set out in Annex 5.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

SECTION 3 GRANT ADMINISTRATION

ARTICLE 19 — GENERAL INFORMATION OBLIGATIONS

19.1 Information requests

The beneficiaries must provide — during the action or afterwards and in accordance with Article 7 — any information requested in order to verify eligibility of the unit contributions declared, proper implementation of the action and compliance with the other obligations under the Agreement.

The information provided must be accurate, precise and complete and in the format requested, including electronic format.

19.2 Participant Register data updates

The beneficiaries must keep — at all times, during the action or afterwards — their information stored in the Portal Participant Register up to date, in particular, their name, address, legal representatives, legal form and organisation type.

19.3 Information about events and circumstances which impact the action

The beneficiaries must immediately inform the granting authority (and the other beneficiaries) of any of the following:

- (a) **events** which are likely to affect or delay the implementation of the action or affect the EU's financial interests, in particular:
 - (i) changes in their legal, financial, technical, organisational or ownership situation (including changes linked to one of the exclusion grounds listed in the declaration of honour signed before grant signature)
 - (ii) linked action information: not applicable
- (b) **circumstances** affecting:
 - (i) the decision to award the grant or
 - (ii) compliance with requirements under the Agreement.

19.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 20 — RECORD-KEEPING

20.1 Keeping records and supporting documents

The beneficiaries must — at least until the time-limit set out in the Data Sheet (see Point 6) — keep records and other supporting documents to prove the proper implementation of the action in line with the accepted standards in the respective field (if any).

In addition, the beneficiaries must — for the same period — keep adequate records and supporting documents to prove the number of units declared; beneficiaries do not need to keep specific records on the actual costs incurred.

The records and supporting documents must be made available upon request (see Article 19) or in the context of checks, reviews, audits or investigations (see Article 25).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Article 25), the beneficiaries must keep these records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The granting authority may accept non-original documents if they offer a comparable level of assurance.

20.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, unit contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 21 — REPORTING

21.1 Continuous reporting

The beneficiaries must continuously report on the progress of the action (e.g. **deliverables, milestones, outputs/outcomes, critical risks, indicators**, etc; if any), in the Portal Continuous Reporting tool and in accordance with the timing and conditions it sets out (as agreed with the granting authority).

Standardised deliverables (e.g. progress reports not linked to payments, reports on cumulative expenditure, special reports, etc; if any) must be submitted using the templates published on the Portal.

21.2 Periodic reporting: Technical reports and financial statements

In addition, the beneficiaries must provide reports to request payments, in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2):

- for additional prefinancings (if any): an **additional prefinancing report**
- for interim payments (if any) and the final payment: a **periodic report**.

The prefinancing and periodic reports include a technical and financial part.

The technical part includes an overview of the action implementation. It must be prepared using the template available in the Portal Periodic Reporting tool.

The financial part of the additional prefinancing report includes a statement on the use of the previous prefinancing payment.

The financial part of the periodic report includes:

- the financial statements (individual and consolidated; for all beneficiaries/affiliated entities)

- the explanation on the use of resources (or detailed cost reporting table, if required)
- the certificates on the financial statements (CFS): not applicable.

The **financial statements** must detail the contributions for the units implemented in the reporting period.

Unit contributions which are not declared in a financial statement will not be taken into account by the granting authority.

By signing the financial statements (directly in the Portal Periodic Reporting tool), the beneficiaries confirm that:

- the information provided is complete, reliable and true
- the unit contributions declared are eligible (see Article 6)
- the contributions can be substantiated by adequate records and supporting documents (see Article 20) that will be produced upon request (see Article 19) or in the context of checks, reviews, audits and investigations (see Article 25)

Beneficiaries will have to submit also the financial statements of their affiliated entities (if any). In case of recoveries (see Article 22), beneficiaries will be held responsible also for the financial statements of their affiliated entities.

21.3 Currency for financial statements and conversion into euros

The financial statements must be drafted in euro.

21.4 Reporting language

The reporting must be in the language of the Agreement, unless otherwise agreed with the granting authority (see Data Sheet, Point 4.2).

21.5 Consequences of non-compliance

If a report submitted does not comply with this Article, the granting authority may suspend the payment deadline (see Article 29) and apply other measures described in Chapter 5.

If the coordinator breaches its reporting obligations, the granting authority may terminate the grant or the coordinator's participation (see Article 32) or apply other measures described in Chapter 5.

ARTICLE 22 — PAYMENTS AND RECOVERIES — CALCULATION OF AMOUNTS DUE

22.1 Payments and payment arrangements

Payments will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

They will be made in euro to the bank account indicated by the coordinator (see Data Sheet, Point 4.2)

and must be distributed without unjustified delay (restrictions may apply to distribution of the initial prefinancing payment; see Data Sheet, Point 4.2).

Payments to this bank account will discharge the granting authority from its payment obligation.

The cost of payment transfers will be borne as follows:

- the granting authority bears the cost of transfers charged by its bank
- the beneficiary bears the cost of transfers charged by its bank
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

Payments by the granting authority will be considered to have been carried out on the date when they are debited to its account.

22.2 Recoveries

Recoveries will be made, if — at beneficiary termination, final payment or afterwards — it turns out that the granting authority has paid too much and needs to recover the amounts undue.

Each beneficiary's financial responsibility in case of recovery is in principle limited to their own debt and undue amounts of their affiliated entities.

In case of enforced recoveries (see Article 22.4), affiliated entities will be held liable for repaying debts of their beneficiaries, if required by the granting authority (see Data Sheet, Point 4.4).

22.3 Amounts due

22.3.1 Prefinancing payments

The aim of the prefinancing is to provide the beneficiaries with a float.

It remains the property of the EU until the final payment.

For **initial prefinancings** (if any), the amount due, schedule and modalities are set out in the Data Sheet (see Point 4.2).

For **additional prefinancings** (if any), the amount due, schedule and modalities are also set out in the Data Sheet (see Point 4.2). However, if the statement on the use of the previous prefinancing payment shows that less than 70% was used, the amount set out in the Data Sheet will be reduced by the difference between the 70% threshold and the amount used.

The contribution to the Mutual Insurance Mechanism will be retained from the prefinancing payments (at the rate and in accordance with the modalities set out in the Data Sheet, see Point 4.2) and transferred to the Mechanism.

Prefinancing payments (or parts of them) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.2 Amount due at beneficiary termination — Recovery

At beneficiary termination there will be no payment, but the grant must be provisionally closed for the beneficiary which leaves the consortium (and the affiliated entities which had to end their participation together with the beneficiary, if any).

Payments (if any) will be made with the next interim or final payment.

The **amount due** will be calculated in the following step:

Step 1 — Calculation of the total accepted EU contribution

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the ‘accepted EU contribution’ for the beneficiary for all reporting periods, by calculating the unit contributions for the accepted units.

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the ‘total accepted EU contribution’ for the beneficiary.

The **balance** is then calculated by deducting the payments received (if any; see report on the distribution of payments in Article 32), from the total accepted EU contribution:

$$\left\{ \begin{array}{l} \text{total accepted EU contribution for the beneficiary} \\ \text{minus} \\ \text{\{prefinancing and interim payments received (if any)\}} \end{array} \right\}.$$

If the balance is **positive**, the amount will be included in the next interim or final payment to the consortium.

If the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount due, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered and ask this amount to be paid to the coordinator (**confirmation letter**).

If payment is not made to the coordinator by the date specified in the confirmation letter, the granting authority may call on the Mutual Insurance Mechanism to intervene, if continuation of the action is guaranteed and the conditions set out in the rules governing the Mechanism are met.

In this case, it will send a **beneficiary recovery letter**, together with a **debit note** with the terms and date for payment.

The debit note for the beneficiary will include the amount calculated for the affiliated entities which also had to end their participation (if any).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

The amounts will later on also be taken into account for the next interim or final payment.

22.3.3 Interim payments

Interim payments reimburse the eligible contributions claimed for the units implemented during the reporting periods (if any).

Interim payments (if any) will be made in accordance with the schedule and modalities set out the Data Sheet (see Point 4.2).

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **interim payment** will be calculated by the granting authority in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the interim payment ceiling

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the ‘accepted EU contribution’ for the action for the reporting period, by calculating the unit contributions for the accepted units.

After that, the granting authority will take into account grant reductions from beneficiary termination (if any). The resulting amount is the ‘total accepted EU contribution’.

Step 2 — Limit to the interim payment ceiling

The resulting amount is then capped to ensure that the total amount of prefinancing and interim payments (if any) does not exceed the interim payment ceiling set out in the Data Sheet (see Point 4.2).

Interim payments (or parts of them) may be offset (without the beneficiaries’ consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.4 Final payment — Final grant amount — Revenues and Profit — Recovery

The final payment (payment of the balance) reimburses the eligible contributions claimed for the remaining units implemented (if any).

The final payment will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

Payment is subject to the approval of the final periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **final grant amount for the action** will be calculated in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the maximum grant amount

Step 3 — Reduction due to the no-profit rule

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the ‘accepted EU contribution’ for the action for all reporting periods, by calculating the unit contributions for the accepted units.

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the ‘total accepted EU contribution’.

Step 2 — Limit to the maximum grant amount

If the resulting amount is higher than the maximum grant amount set out in Article 5.2, it will be limited to the latter.

Step 3 — Reduction due to the no-profit rule

Not applicable

The **balance** (final payment) is then calculated by deducting the total amount of prefinancing and interim payments already made (if any), from the final grant amount:

$$\left. \begin{array}{l} \{\text{final grant amount} \\ \text{minus} \\ \{\text{prefinancing and interim payments made (if any)}\} \end{array} \right\}$$

If the balance is **positive**, it will be **paid** to the coordinator.

The amount retained for the Mutual Insurance Mechanism (see above) will be released and **paid** to the coordinator (in accordance with the rules governing the Mechanism).

The final payment (or part of it) may be offset (without the beneficiaries’ consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

If — despite the release of the Mutual Insurance Mechanism contribution — the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to recover, the final grant amount, the amount to be recovered and the reasons why
- requesting a report on the distribution of payments to the beneficiaries within 30 days of receiving notification and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received) and the coordinator has submitted the report on the distribution of payments, it will calculate the **share of the debt per beneficiary**, by:

(a) identifying the beneficiaries for which the amount calculated as follows is negative:

$$\left\{ \left\{ \begin{array}{l} \text{\{\{total accepted EU contribution for the beneficiary} \\ \text{divided by} \\ \text{total accepted EU contribution for the action\}} \\ \text{multiplied by} \\ \text{final grant amount for the action\}}, \\ \text{minus} \\ \text{\{prefinancing and interim payments received by the beneficiary (if any)\}} \end{array} \right\} \right\}$$

and

(b) dividing the debt:

$$\left\{ \begin{array}{l} \text{\{amount calculated according to point (a) for the beneficiary concerned} \\ \text{divided by} \\ \text{the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to} \\ \text{point (a)\}} \\ \text{multiplied by} \\ \text{the amount to be recovered\}}. \end{array} \right\}$$

and confirm the amount to be recovered from each beneficiary concerned (**confirmation letter**), together with **debit notes** with the terms and date for payment.

The debit notes for beneficiaries will include the amounts calculated for their affiliated entities (if any).

If the coordinator has not submitted the report on the distribution of payments, the granting authority will **recover** the full amount from the coordinator (**confirmation letter** and **debit note** with the terms and date for payment).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.3.5 Audit implementation after final payment — Revised final grant amount — Recovery

If — after the final payment (in particular, after checks, reviews, audits or investigations; see Article 25) — the granting authority rejects unit contributions (see Article 27) or reduces the grant (see Article 28), it will calculate the **revised final grant amount** for the beneficiary concerned.

The **beneficiary revised final grant amount** will be calculated in the following step:

Step 1 — Calculation of the revised total accepted EU contribution

Step 1 — Calculation of the revised total accepted EU contribution

The granting authority will first calculate the ‘revised accepted EU contribution’ for the beneficiary, by calculating the ‘revised accepted contributions’.

After that, it will take into account grant reductions (if any). The resulting ‘revised total accepted EU contribution’ is the beneficiary revised final grant amount.

If the revised final grant amount is lower than the beneficiary’s final grant amount (i.e. its share in the final grant amount for the action), it will be **recovered** in accordance with the following procedure:

The **beneficiary final grant amount** (i.e. share in the final grant amount for the action) is calculated as follows:

$$\left\{ \begin{array}{l} \text{total accepted EU contribution for the beneficiary} \\ \text{divided by} \\ \text{total accepted EU contribution for the action} \end{array} \right\} \times \left\{ \begin{array}{l} \text{multiplied by} \\ \text{final grant amount for the action} \end{array} \right\}.$$

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered (**confirmation letter**), together with a **debit note** with the terms and the date for payment.

Recoveries against affiliated entities (if any) will be handled through their beneficiaries.

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.4 Enforced recovery

If payment is not made by the date specified in the debit note, the amount due will be recovered:

- (a) by offsetting the amount — without the coordinator or beneficiary’s consent — against any amounts owed to the coordinator or beneficiary by the granting authority.

In exceptional circumstances, to safeguard the EU financial interests, the amount may be offset before the payment date specified in the debit note.

For grants where the granting authority is the European Commission or an EU executive agency, debts may also be offset against amounts owed by other Commission services or executive agencies.

- (b) financial guarantee(s): not applicable
- (c) joint and several liability of beneficiaries: not applicable
- (d) by holding affiliated entities jointly and severally liable (if any, see Data Sheet, Point 4.4)
- (e) by taking legal action (see Article 43) or, provided that the granting authority is the European Commission or an EU executive agency, by adopting an enforceable decision under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 100(2) of EU Financial Regulation 2018/1046.

If the Mutual Insurance Mechanism was called on by the granting authority to intervene, recovery will be continued in the name of the Mutual Insurance Mechanism. If two debit notes were sent, the second one (in the name of the Mutual Insurance Mechanism) will be considered to replace the first one (in the name of the granting authority). Where the MIM intervened, offsetting, enforceable decisions or any other of the above-mentioned forms of enforced recovery may be used mutatis mutandis.

The amount to be recovered will be increased by **late-payment interest** at the rate set out in Article 22.5, from the day following the payment date in the debit note, up to and including the date the full payment is received.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2015/2366¹⁸ applies.

For grants where the granting authority is an EU executive agency, enforced recovery by offsetting or enforceable decision will be done by the services of the European Commission (see also Article 43).

22.5 Consequences of non-compliance

22.5.1 If the granting authority does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros (‘reference rate’), plus the rate specified in the Data Sheet (Point 4.2). The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

¹⁸ Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC (OJ L 337, 23.12.2015, p. 35).

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only on request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

If payments or the payment deadline are suspended (see Articles 29 and 30), payment will not be considered as late.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

22.5.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 29) and the grant or the coordinator may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 23 — GUARANTEES

Not applicable

ARTICLE 24 — CERTIFICATES

Not applicable

ARTICLE 25 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

25.1 Granting authority checks, reviews and audits

25.1.1 Internal checks

The granting authority may — during the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing unit contributions, deliverables and reports.

25.1.2 Project reviews

The granting authority may carry out reviews on the proper implementation of the action and compliance with the obligations under the Agreement (general project reviews or specific issues reviews).

Such project reviews may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiary concerned and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent, outside experts. If it uses outside experts, the coordinator or beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The coordinator or beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The granting authority may request beneficiaries to provide such information to it directly. Sensitive information and documents will be treated in accordance with Article 13.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with the outside experts.

For **on-the-spot visits**, the beneficiary concerned must allow access to sites and premises (including to the outside experts) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a **project review report** will be drawn up.

The granting authority will formally notify the project review report to the coordinator or beneficiary concerned, which has 30 days from receiving notification to make observations.

Project reviews (including project review reports) will be in the language of the Agreement.

25.1.3 Audits

The granting authority may carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Such audits may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the beneficiary concerned and will be considered to start on the date of the notification.

The granting authority may use its own audit service, delegate audits to a centralised service or use external audit firms. If it uses an external firm, the beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. Sensitive information and documents will be treated in accordance with Article 13.

For **on-the-spot** visits, the beneficiary concerned must allow access to sites and premises (including for the external audit firm) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a **draft audit report** will be drawn up.

The auditors will formally notify the draft audit report to the beneficiary concerned, which has 30 days from receiving notification to make observations (contradictory audit procedure).

The **final audit report** will take into account observations by the beneficiary concerned and will be formally notified to them.

Audits (including audit reports) will be in the language of the Agreement.

25.2 European Commission checks, reviews and audits in grants of other granting authorities

Where the granting authority is not the European Commission, the latter has the same rights of checks, reviews and audits as the granting authority.

25.3 Access to records for assessing simplified forms of funding

The beneficiaries must give the European Commission access to their statutory records for the periodic assessment of simplified forms of funding which are used in EU programmes.

25.4 OLAF, EPPO and ECA audits and investigations

The following bodies may also carry out checks, reviews, audits and investigations — during the action or afterwards:

- the European Anti-Fraud Office (OLAF) under Regulations No 883/2013¹⁹ and No 2185/96²⁰
- the European Public Prosecutor's Office (EPPO) under Regulation 2017/1939
- the European Court of Auditors (ECA) under Article 287 of the Treaty on the Functioning of the EU (TFEU) and Article 257 of EU Financial Regulation 2018/1046.

If requested by these bodies, the beneficiary concerned must provide full, accurate and complete information in the format requested (including complete accounts, individual salary statements or other personal data, including in electronic format) and allow access to sites and premises for on-the-spot visits or inspections — as provided for under these Regulations.

To this end, the beneficiary concerned must keep all relevant information relating to the action, at least until the time-limit set out in the Data Sheet (Point 6) and, in any case, until any ongoing checks, reviews, audits, investigations, litigation or other pursuits of claims have been concluded.

25.5 Consequences of checks, reviews, audits and investigations — Extension of results of reviews, audits or investigations

25.5.1 Consequences of checks, reviews, audits and investigations in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to rejections (see Article 27), grant reduction (see Article 28) or other measures described in Chapter 5.

Rejections or grant reductions after the final payment will lead to a revised final grant amount (see Article 22).

¹⁹ Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18/09/2013, p. 1).

²⁰ Council Regulation (Euratom, EC) No 2185/1996 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15/11/1996, p. 2).

Findings in checks, reviews, audits or investigations during the action implementation may lead to a request for amendment (see Article 39), to change the description of the action set out in Annex 1.

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations in any EU grant may also lead to consequences in other EU grants awarded under similar conditions ('extension to other grants').

Moreover, findings arising from an OLAF or EPPO investigation may lead to criminal prosecution under national law.

25.5.2 Extension from other grants

Results of checks, reviews, audits or investigations in other grants may be extended to this grant, if:

- (a) the beneficiary concerned is found, in other EU grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and
- (b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — within the time-limit for audits set out in the Data Sheet (see Point 6).

The granting authority will formally notify the beneficiary concerned of the intention to extend the findings and the list of grants affected.

If the extension concerns **rejections of unit contributions**: the notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings
- (b) the request to submit revised financial statements for all grants affected
- (c) the correction rate for extrapolation, established on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected, if the beneficiary concerned:
 - (i) considers that the submission of revised financial statements is not possible or practicable or
 - (ii) does not submit revised financial statements.

If the extension concerns **grant reductions**: the notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings and
- (b) the **correction rate for extrapolation**, established on the basis of the systemic or recurrent errors and the principle of proportionality.

The beneficiary concerned has **60 days** from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method/rate**.

On the basis of this, the granting authority will analyse the impact and decide on the implementation (i.e. start rejection or grant reduction procedures, either on the basis of the revised financial statements or the announced/alternative method/rate or a mix of those; see Articles 27 and 28).

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, unit contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 26 — IMPACT EVALUATIONS

26.1 Impact evaluation

The granting authority may carry out impact evaluations of the action, measured against the objectives and indicators of the EU programme funding the grant.

Such evaluations may be started during implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiaries and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent outside experts.

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

26.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the granting authority may apply the measures described in Chapter 5.

CHAPTER 5 CONSEQUENCES OF NON-COMPLIANCE

SECTION 1 REJECTIONS AND GRANT REDUCTION

ARTICLE 27 — REJECTION OF CONTRIBUTIONS

27.1 Conditions

The granting authority will — at beneficiary termination, interim payment, final payment or afterwards — reject any unit contributions which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 25).

The rejection may also be based on the extension of findings from other grants to this grant (see Article 25).

Ineligible unit contributions will be rejected.

27.2 Procedure

If the rejection does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the rejection, the amounts and the reasons why. The coordinator or

beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the rejection (payment review procedure).

If the rejection leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

27.3 Effects

If the granting authority rejects unit contributions, it will deduct them from the contributions declared and then calculate the amount due (and, if needed, make a recovery; see Article 22).

ARTICLE 28 — GRANT REDUCTION

28.1 Conditions

The granting authority may — at beneficiary termination, final payment or afterwards — reduce the grant for a beneficiary, if:

- (a) the beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or
- (b) the beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (see Article 25).

The amount of the reduction will be calculated for each beneficiary concerned and proportionate to the seriousness and the duration of the errors, irregularities or fraud or breach of obligations, by applying an individual reduction rate to their accepted EU contribution.

28.2 Procedure

If the grant reduction does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the reduction, the amount to be reduced and the reasons why. The coordinator or beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the reduction (payment review procedure).

If the grant reduction leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

28.3 Effects

If the granting authority reduces the grant, it will deduct the reduction and then calculate the amount due (and, if needed, make a recovery; see Article 22).

SECTION 2 SUSPENSION AND TERMINATION

ARTICLE 29 — PAYMENT DEADLINE SUSPENSION

29.1 Conditions

The granting authority may — at any moment — suspend the payment deadline if a payment cannot be processed because:

- (a) the required report (see Article 21) has not been submitted or is not complete or additional information is needed
- (b) there are doubts about the amount to be paid (e.g. ongoing audit extension procedure, queries about eligibility, need for a grant reduction, etc.) and additional checks, reviews, audits or investigations are necessary, or
- (c) there are other issues affecting the EU financial interests.

29.2 Procedure

The granting authority will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day the notification is sent.

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining time to pay (see Data Sheet, Point 4.2) will resume.

If the suspension exceeds two months, the coordinator may request the granting authority to confirm if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the report and the revised report is not submitted (or was submitted but is also rejected), the granting authority may also terminate the grant or the participation of the coordinator (see Article 32).

ARTICLE 30 — PAYMENT SUSPENSION

30.1 Conditions

The granting authority may — at any moment — suspend payments, in whole or in part for one or more beneficiaries, if:

- (a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

- (b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant.

If payments are suspended for one or more beneficiaries, the granting authority will make partial payment(s) for the part(s) not suspended. If suspension concerns the final payment, the payment (or recovery) of the remaining amount after suspension is lifted will be considered to be the payment that closes the action.

30.2 Procedure

Before suspending payments, the granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to suspend payments and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

At the end of the suspension procedure, the granting authority will also inform the coordinator.

The suspension will **take effect** the day after the confirmation notification is sent.

If the conditions for resuming payments are met, the suspension will be **lifted**. The granting authority will formally notify the beneficiary concerned (and the coordinator) and set the suspension end date.

During the suspension, no prefinancing will be paid to the beneficiaries concerned. For interim payments, the periodic reports for all reporting periods except the last one (see Article 21) must not contain any financial statements from the beneficiary concerned (or its affiliated entities). The coordinator must include them in the next periodic report after the suspension is lifted or — if suspension is not lifted before the end of the action — in the last periodic report.

ARTICLE 31 — GRANT AGREEMENT SUSPENSION

31.1 Consortium-requested GA suspension

31.1.1 Conditions and procedure

The beneficiaries may request the suspension of the grant or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 35) — make implementation impossible or excessively difficult.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the suspension takes effect; this date may be before the date of the submission of the amendment request and

- the expected date of resumption.

The suspension will **take effect** on the day specified in the amendment.

Once circumstances allow for implementation to resume, the coordinator must immediately request another **amendment** of the Agreement to set the suspension end date, the resumption date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the amendment. This date may be before the date of the submission of the amendment request.

During the suspension, no prefinancing will be paid. Moreover, no units may be implemented. Ongoing units must be interrupted and no new units may be started. Unit contributions for activities implemented during grant suspension are not eligible (see Article 6.3).

31.2 EU-initiated GA suspension

31.2.1 Conditions

The granting authority may suspend the grant or any part of it, if:

- (a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or
- (b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant
- (c) other:
 - (i) linked action issues: not applicable
 - (ii) the action has lost its scientific or technological relevance

31.2.2 Procedure

Before suspending the grant, the granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to suspend the grant and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the

observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

The suspension will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification).

Once the conditions for resuming implementation of the action are met, the granting authority will formally notify the coordinator a **lifting of suspension letter**, in which it will set the suspension end date and invite the coordinator to request an amendment of the Agreement to set the resumption date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the lifting of suspension letter. This date may be before the date on which the letter is sent.

During the suspension, no prefinancing will be paid. Moreover, no units may be implemented. Ongoing units must be interrupted and no new units may be started. Unit contributions for activities implemented during suspension are not eligible (see Article 6.3).

The beneficiaries may not claim damages due to suspension by the granting authority (see Article 33).

Grant suspension does not affect the granting authority's right to terminate the grant or a beneficiary (see Article 32) or reduce the grant (see Article 28).

ARTICLE 32 — GRANT AGREEMENT OR BENEFICIARY TERMINATION

32.1 Consortium-requested GA termination

32.1.1 Conditions and procedure

The beneficiaries may request the termination of the grant.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the consortium ends work on the action ('end of work date') and
- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

The termination will **take effect** on the termination date specified in the amendment.

If no reasons are given or if the granting authority considers the reasons do not justify termination, it may consider the grant terminated improperly.

32.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the

report submitted and taking into account the unit contributions for activities implemented before the end of work date (see Article 22).

If the granting authority does not receive the report within the deadline, only unit contributions which are included in an approved periodic report will be taken into account (no contributions if no periodic report was ever approved).

Improper termination may lead to a grant reduction (see Article 28).

After termination, the beneficiaries' obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.2 Consortium-requested beneficiary termination

32.2.1 Conditions and procedure

The coordinator may request the termination of the participation of one or more beneficiaries, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing)
- the date the beneficiary ends work on the action ('end of work date')
- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

If the termination concerns the coordinator and is done without its agreement, the amendment request must be submitted by another beneficiary (acting on behalf of the consortium).

The termination will **take effect** on the termination date specified in the amendment.

If no information is given or if the granting authority considers that the reasons do not justify termination, it may consider the beneficiary to have been terminated improperly.

32.2.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a **report on the distribution of payments** to the beneficiary concerned
- (ii) a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, the financial statement and the explanation on the use of resources
- (iii) a second **request for amendment** (see Article 39) with other amendments needed (e.g.

reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted and taking into account the unit contributions for activities implemented before the end of work date (see Article 22).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only unit contributions which are included in an approved periodic report will be taken into account (no contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

If the second request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the second request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

Improper termination may lead to a reduction of the grant (see Article 31) or grant termination (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.3 EU-initiated GA or beneficiary termination

32.3.1 Conditions

The granting authority may terminate the grant or the participation of one or more beneficiaries, if:

- (a) one or more beneficiaries do not accede to the Agreement (see Article 40)
- (b) a change to the action or the legal, financial, technical, organisational or ownership situation of a beneficiary is likely to substantially affect the implementation of the action or calls into question the decision to award the grant (including changes linked to one of the exclusion grounds listed in the declaration of honour)
- (c) following termination of one or more beneficiaries, the necessary changes to the Agreement (and their impact on the action) would call into question the decision awarding the grant or breach the principle of equal treatment of applicants

- (d) implementation of the action has become impossible or the changes necessary for its continuation would call into question the decision awarding the grant or breach the principle of equal treatment of applicants
- (e) a beneficiary (or person with unlimited liability for its debts) is subject to bankruptcy proceedings or similar (including insolvency, winding-up, administration by a liquidator or court, arrangement with creditors, suspension of business activities, etc.)
- (f) a beneficiary (or person with unlimited liability for its debts) is in breach of social security or tax obligations
- (g) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has been found guilty of grave professional misconduct
- (h) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed fraud, corruption, or is involved in a criminal organisation, money laundering, terrorism-related crimes (including terrorism financing), child labour or human trafficking
- (i) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) was created under a different jurisdiction with the intent to circumvent fiscal, social or other legal obligations in the country of origin (or created another entity with this purpose)
- (j) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.)
- (k) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (extension of findings from other grants to this grant; see Article 25)
- (l) despite a specific request by the granting authority, a beneficiary does not request — through the coordinator — an amendment to the Agreement to end the participation of one of its affiliated entities or associated partners that is in one of the situations under points (d), (f), (e), (g), (h), (i) or (j) and to reallocate its tasks, or
- (m) other:
 - (i) linked action issues: not applicable
 - (ii) the action has lost its scientific or technological relevance

32.3.2 Procedure

Before terminating the grant or participation of one or more beneficiaries, the granting authority will send a **pre-information letter** to the coordinator or beneficiary concerned:

- formally notifying the intention to terminate and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the termination and the date it will take effect (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

For beneficiary terminations, the granting authority will — at the end of the procedure — also inform the coordinator.

The termination will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification; ‘termination date’).

32.3.3 Effects

(a) for **GA termination**:

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the last open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the report submitted (see Article 22). Only units implemented until termination will be accepted.

If the grant is terminated for breach of the obligation to submit reports, the coordinator may not submit any report after termination.

If the granting authority does not receive the report within the deadline, only unit contributions which are included in an approved periodic report will be taken into account (no contributions if no periodic report was ever approved).

Termination does not affect the granting authority’s right to reduce the grant (see Article 28) or to impose administrative sanctions (see Article 34).

The beneficiaries may not claim damages due to termination by the granting authority (see Article 33).

After termination, the beneficiaries’ obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

(b) for **beneficiary termination**:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a **report on the distribution of payments** to the beneficiary concerned

- (ii) a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, the financial statement, and the explanation on the use of resources
- (iii) a **request for amendment** (see Article 39) with any amendments needed (e.g. reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted (see Article 22). Only units implemented until termination will be accepted.

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only unit contributions included in an approved periodic report will be taken into account (no contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

If the request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

SECTION 3 OTHER CONSEQUENCES: DAMAGES AND ADMINISTRATIVE SANCTIONS

ARTICLE 33 — DAMAGES

33.1 Liability of the granting authority

The granting authority cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of the implementation of the Agreement, including for gross negligence.

The granting authority cannot be held liable for any damage caused by any of the beneficiaries or other participants involved in the action, as a consequence of the implementation of the Agreement.

33.2 Liability of the beneficiaries

The beneficiaries must compensate the granting authority for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement, provided that it was caused by gross negligence or wilful act.

The liability does not extend to indirect or consequential losses or similar damage (such as loss of profit, loss of revenue or loss of contracts), provided such damage was not caused by wilful act or by a breach of confidentiality.

ARTICLE 34 — ADMINISTRATIVE SANCTIONS AND OTHER MEASURES

Nothing in this Agreement may be construed as preventing the adoption of administrative sanctions (i.e. exclusion from EU award procedures and/or financial penalties) or other public law measures, in addition or as an alternative to the contractual measures provided under this Agreement (see, for instance, Articles 135 to 145 EU Financial Regulation 2018/1046 and Articles 4 and 7 of Regulation 2988/95²¹).

SECTION 4 FORCE MAJEURE

ARTICLE 35 — FORCE MAJEURE

A party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

‘Force majeure’ means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties’ control,
- was not due to error or negligence on their part (or on the part of other participants involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

CHAPTER 6 FINAL PROVISIONS

ARTICLE 36 — COMMUNICATION BETWEEN THE PARTIES

36.1 Forms and means of communication — Electronic management

²¹ Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).

EU grants are managed fully electronically through the EU Funding & Tenders Portal ('Portal').

All communications must be made electronically through the Portal, in accordance with the Portal Terms and Conditions and using the forms and templates provided there (except if explicitly instructed otherwise by the granting authority).

Communications must be made in writing and clearly identify the grant agreement (project number and acronym).

Communications must be made by persons authorised according to the Portal Terms and Conditions. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a 'legal entity appointed representative (LEAR)'. The role and tasks of the LEAR are stipulated in their appointment letter (see Portal Terms and Conditions).

If the electronic exchange system is temporarily unavailable, instructions will be given on the Portal.

36.2 Date of communication

The sending date for communications made through the Portal will be the date and time of sending, as indicated by the time logs.

The receiving date for communications made through the Portal will be the date and time the communication is accessed, as indicated by the time logs. Formal notifications that have not been accessed within 10 days after sending, will be considered to have been accessed (see Portal Terms and Conditions).

If a communication is exceptionally made on paper (by e-mail or postal service), general principles apply (i.e. date of sending/receipt). Formal notifications by registered post with proof of delivery will be considered to have been received either on the delivery date registered by the postal service or the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

36.3 Addresses for communication

The Portal can be accessed via the Europa website.

The address for paper communications to the granting authority (if exceptionally allowed) is the official mailing address indicated on its website.

For beneficiaries, it is the legal address specified in the Portal Participant Register.

ARTICLE 37 — INTERPRETATION OF THE AGREEMENT

The provisions in the Data Sheet take precedence over the rest of the Terms and Conditions of the Agreement.

Annex 5 takes precedence over the Terms and Conditions; the Terms and Conditions take precedence over the Annexes other than Annex 5.

Annex 2 takes precedence over Annex 1.

ARTICLE 38 — CALCULATION OF PERIODS AND DEADLINES

In accordance with Regulation No 1182/71²², periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

‘Days’ means calendar days, not working days.

ARTICLE 39 — AMENDMENTS

39.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

39.2 Procedure

The party requesting an amendment must submit a request for amendment signed directly in the Portal Amendment tool.

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3). If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why
- the appropriate supporting documents and
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The granting authority may request additional information.

If the party receiving the request agrees, it must sign the amendment in the tool within 45 days of receiving notification (or any additional information the granting authority has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected.

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date of entry into force or other date specified in the amendment.

²² Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8/6/1971, p. 1).

ARTICLE 40 — ACCESSION AND ADDITION OF NEW BENEFICIARIES

40.1 Accession of the beneficiaries mentioned in the Preamble

The beneficiaries which are not coordinator must accede to the grant by signing the accession form (see Annex 3) directly in the Portal Grant Preparation tool, within 30 days after the entry into force of the Agreement (see Article 44).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 44).

If a beneficiary does not accede to the grant within the above deadline, the coordinator must — within 30 days — request an amendment (see Article 39) to terminate the beneficiary and make any changes necessary to ensure proper implementation of the action. This does not affect the granting authority's right to terminate the grant (see Article 32).

40.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 39. It must include an accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool.

New beneficiaries will assume the rights and obligations under the Agreement with effect from the date of their accession specified in the accession form (see Annex 3).

Additions are also possible in mono-beneficiary grants.

ARTICLE 41 — TRANSFER OF THE AGREEMENT

In justified cases, the beneficiary of a mono-beneficiary grant may request the transfer of the grant to a new beneficiary, provided that this would not call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiary must submit a request for **amendment** (see Article 39), with

- the reasons why
- the accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool and
- additional supporting documents (if required by the granting authority).

The new beneficiary will assume the rights and obligations under the Agreement with effect from the date of accession specified in the accession form (see Annex 3).

ARTICLE 42 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE GRANTING AUTHORITY

The beneficiaries may not assign any of their claims for payment against the granting authority to

any third party, except if expressly approved in writing by the granting authority on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the granting authority has not accepted the assignment or if the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the granting authority.

ARTICLE 43 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

43.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

Special rules may apply for beneficiaries which are international organisations (if any; see Data Sheet, Point 5).

43.2 Dispute settlement

If a dispute concerns the interpretation, application or validity of the Agreement, the parties must bring action before the EU General Court — or, on appeal, the EU Court of Justice — under Article 272 of the Treaty on the Functioning of the EU (TFEU).

For non-EU beneficiaries (if any), such disputes must be brought before the courts of Brussels, Belgium — unless an international agreement provides for the enforceability of EU court judgements.

For beneficiaries with arbitration as special dispute settlement forum (if any; see Data Sheet, Point 5), the dispute will — in the absence of an amicable settlement — be settled in accordance with the Rules for Arbitration published on the Portal.

If a dispute concerns administrative sanctions, offsetting or an enforceable decision under Article 299 TFEU (see Articles 22 and 34), the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice — under Article 263 TFEU.

For grants where the granting authority is an EU executive agency (see Preamble), actions against offsetting and enforceable decisions must be brought against the European Commission (not against the granting authority; see also Article 22).

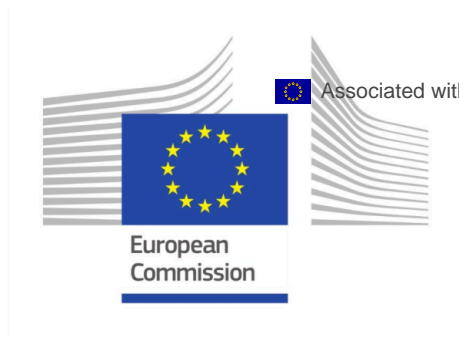
ARTICLE 44 — ENTRY INTO FORCE

The Agreement will enter into force on the day of signature by the granting authority or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

For the granting authority



ANNEX 1



Horizon Europe (HORIZON)

Description of the action (DoA)

Part A

Part B

DESCRIPTION OF THE ACTION (PART A)

COVER PAGE

Part A of the Description of the Action (DoA) must be completed directly on the Portal Grant Preparation screens.

PROJECT	
<i>Grant Preparation (General Information screen) — Enter the info.</i>	
Project number:	101072454
Project name:	MWGaiaDN: Revealing the Milky Way with Gaia
Project acronym:	MWGaiaDN
Call:	HORIZON-MSCA-2021-DN-01
Topic:	HORIZON-MSCA-2021-DN-01-01
Type of action:	HORIZON-TMA-MSCA-DN
Service:	REA/A/01
Project starting date:	fixed date: 1 February 2023
Project duration:	48 months

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List of deliverables	12
List of milestones (outputs/outcomes)	21
List of critical risks	22

PROJECT SUMMARY

Project summary

Grant Preparation (General Information screen) — Provide an overall description of your project (including context and overall objectives, planned activities and main achievements, and expected results and impacts (on target groups, change procedures, capacities, innovation etc)). This summary should give readers a clear idea of what your project is about.

Use the project summary from your proposal.

The Milky Way-Gaia Doctoral Network (MWGaiaDN): Revealing the Milky Way (MW) with Gaia - Excellent science, Extending techniques, Enhancing people skills, Effecting the next revolution in European led astronomy through leadership in astrometric-based science. What: Gaia, ESA's major space mission launched in Dec 2013, is now in its extended mission to map some two billion stars in the MW. It's upcoming data releases, that will provide chemical and physical annotation of the earlier positional releases, present major challenges in terms of complexity and size, hence research training to deliver a full science exploitation is essential, ensuring that Gaia is the 'game changer' for astronomy How: Our DN will link major partners responsible for the development of Gaia, to form an effective and unique training network combining the best research training with a range of academic and industrial placements, specialist research and knowledge transfer workshops. It will develop and train a cohort of young researchers through a set of key science projects pushing the Gaia data to its limits. Our DN will train 10 ESRs located across 10 European beneficiaries, benefiting from the participation of 13 associate partners. These include major industry (e.g. AirbusDS, TAS), at the forefront of Space and Information technologies; SME Industry (e.g. DAPCOM, Suil), innovating new technologies for Space and partners leading the development of next generation astrometry missions outside of Europe (NAOJ). Relevance: It will shape the delivery of training in astrometry and the study of the MW across Europe: delivering key insights into the structure and formation of our Galaxy; delivering the roadmap for the next generation of astrometric space telescopes; equipping the ESRs with skills to drive the next innovative steps in this crucial area of space discovery, as well as enabling them to contribute to the future, growth and challenges of the big data industry and commerce. MWGaiaDN

LIST OF PARTICIPANTS

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
1	COO	ULEI	UNIVERSITEIT LEIDEN	NL	999974553
2	BEN	INAF	ISTITUTO NAZIONALE DI ASTROFISICA	IT	999868920
3	BEN	ULUND	LUNDS UNIVERSITET	SE	999901318
4	BEN	UB	UNIVERSITAT DE BARCELONA	ES	999986387
5	BEN	UC	UNIVERSIDADE DE COIMBRA	PT	997826391
6	BEN	TUD	TECHNISCHE UNIVERSITAET DRESDEN	DE	999897729
7	BEN	UGA	UNIVERSITE GRENOBLE ALPES	FR	897379108
8	BEN	NKUA	ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON	EL	999643007
9	AP	UNIPD	UNIVERSITA DEGLI STUDI DI PADOVA	IT	999995602
10	AP	JASMINE-NAOJ	JASMINE Project Office, NAOJ	JP	896803219
11	AP	NRF	NATIONAL RESEARCH FOUNDATION	ZA	999543194
12	AP	DiRAC	DiRAC Institute	US	896633663

PARTICIPANTS*Grant Preparation (Beneficiaries screen) — Enter the info.*

Number	Role	Short name	Legal name	Country	PIC
13	AP	DAPCOM	Dapcom Data Services S.L.	ES	936510460
14	AP	INTERSYS	InterSystems Iberia, S.L.	ES	896641132
15	AP	SPIN	SPIN WORKS SA	PT	992214068
16	AP	SUIL	Suil Interactive Ltd	IE	896653160
17	AP	OHB	OHB SYSTEM AG	DE	989360037
18	AP	LEO-LTD	LEONARDO UK LTD	UK	999612258
19	AP	AIRBUSDS	AIRBUS DEFENCE AND SPACE LTD	UK	999530778
20	AP	CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	FR	999997930
21	AP	TAS-UK	THALES ALENIA SPACE UK LTD	UK	936556147
22	AP	UCL	UNIVERSITY COLLEGE LONDON	UK	999975620
23	AP	UCAM	THE CHANCELLOR MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE	UK	999977172

LIST OF WORK PACKAGES

Work packages						
<i>Grant Preparation (Work Packages screen) — Enter the info.</i>						
Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverable No(s)
WP1	MWGaia DN Management	1 - ULEI	8.00	1	48	D1.2, D1.1, D1.4, D1.3
WP2	MWGaia DN Network Training	4 - UB	8.00	1	48	D2.3, D2.1, D2.2
WP3	Gaia Frontiers: The MW as a Galaxy	7 - UGA	101.00	1	48	D3.3, D3.1, D3.2
WP4	Gaia Frontiers: Stars and Planets	2 - INAF	100.00	1	48	D4.3, D4.1, D4.2
WP5	Gaia Fundamentals: Space and Time	3 - ULUND	135.00	1	48	D5.2, D5.3, D5.4, D5.1
WP6	MWGaiaDN Communications, Dissemination and Data Management	23 - UCAM	8.00	1	48	D6.2, D6.4, D6.6, D6.5, D6.3, D6.1

Work package WP1 – MWGaia DN Management

Work Package Number	WP1	Lead Beneficiary	1. ULEI
Work Package Name	MWGaia DN Management		
Start Month	1	End Month	48

Objectives
The large size of the MWGaiaDN network and the fact that it integrates partners across a wide area, both in terms of the multidisciplinary aspects of the programme and the geographical spread of the network nodes, means that a clear and effective management structure is vital in order to ensure the success of DN. The management structures are composed in a manner to ensure that the training and subsidiary objectives of the network are effectively fulfilled. It follows that successfully adopted in managing the previous GREAT-ITN FP7 network (which was of a similar size and complexity to this).

Description
<p>The management (MGT) WP includes the organization of the DN's advisory and management boards. The consortium's Supervisory Board (CSB) will be responsible for the overall management of the MWGaiaDN programme. The Project Coordinator (PC) will chair the CSB. Each beneficiary and partner organization will have one representative on the CSB.</p> <p>The Project Coordinator (PC) will be the principal point of contact between the network and the European Commission (EC). The PC will manage the network budget, according to the principles laid down by the CSB and guidelines issued by the EC. The PC will be the main point of contact with external bodies. The PC will have overall executive responsibility for the project and will provide leadership, supported by the DTC, RCC, PEIC, REOC (see Sec 3.1.5) for the projects training, research, public engagement and equality aspects respectively. The Project Office and Project Assistant at UCAM (with science/admin support staff) will be responsible for the financial and legal aspects of the network management. The Consortium Agreement will formalise the operational procedures of the network.</p> <p>In order to ensure that the DN's scientific, innovation and training goals are effectively met, expert advice will be taken from the consortium's Science, Training and Innovation Advisory Panel (STIAP, see Sec 3.1.5).</p> <p>The main tasks of WP1 are to initially establish the structure and policies of the DN, support the regular operation of the network and to ensure the successful conclusion of the network.</p> <p>Task 1: Initial setup of the project, setup of the Project Office including development and implementation of the DN policies governing the management of knowledge and intellectual property developed during the DN.</p> <p>Task 2: Network project management and network evaluation.</p> <p>Task 3: Development and monitoring of the DN risk management plan.</p> <p>Task 4: Develop a plan for maximising the use of results and foreground generated by the DN.</p> <p>Task 5: Close of the project.</p>

Work package WP2 – MWGaia DN Network Training

Work Package Number	WP2	Lead Beneficiary	4. UB
Work Package Name	MWGaia DN Network Training		
Start Month	1	End Month	48

Objectives
The MWGaia DN young researchers will interact at a number of levels: Within local research programmes, as active members of the existing node research teams, play a role in building research partnerships outside of the team and being the link to MWGaia DN; Within the MWGaia DN WPs, interaction will focus on common science topics; Via interactions across WPs for instance link galaxies (WP3) to stars (WP4). MWGaia DN network-wide training will be provided for acquiring knowledge of: underpinning scientific concepts; underpinning technical concepts; the commercial process; societal impact process (from public engagement to social innovation). This WP is structured to manage these training interactions.

Description
<p>Description of Work and Role of Specific Beneficiaries / Associated partners</p> <p>In order to directly manage the cross-network training activities, the consortium's Doctoral Training Committee (DTC) will be constituted. The DTC will consist of the DN WP Leaders (WPL), two Industrial partner representatives, one from the academic partner nodes, and the PC. The DTC will be chaired by the lead of WP2. With full WP representation, the DTC will align the network-wide training with the individual WP science-based training. The DTC is responsible to ensure that there is equivalence of training opportunity for all ESRs, irrespective of host location. The DTC will meet by telecon bi-monthly and face-to-face at least once per year at the annual network meetings. The DTC will review the ESR personal development plans and their training records, and assess progress against their individual plans. The WPLs are responsible for managing the science interactions between the research nodes within their WP. They will encourage and monitor the networking between the ESRs in their WP. They will report activity through the DTC bi-monthly meetings. Within each WP, the supervisors of each ESR will be responsible for the academic and pastoral care of their ESRs. They will aid WP2 in the coordination of the cross-network training.</p> <p>The WP will be structured into four training themes, which provide the network researchers with the skills required to underpin their research, and equip them with knowledge and experience applicable for their future career paths in industry or academia. The main science/technical secondments are given in the list of ESR projects in section 3.1.4. with an overview in Tab 1.2a</p> <p>Theme A: Astrometric and Observational Techniques: training in astrometric techniques, and supporting observational techniques. / Theme B: Computational Techniques: training in the use of new tools required to meet the challenges of working with huge data sets from Gaia. Topics include: 'programming languages and techniques', 'statistical techniques', 'advanced data mining', 'understanding errors – the limitations of data', 'techniques in numerical simulations', 'understanding Galaxy models'. / Theme C: Managing complex systems: including 'project management techniques', 'finance management', 'time management techniques', 'communication'. / Theme D: Presenting Complex Systems: including 'presentation skills', 'proposal writing', 'scientific writing', 'language training', 'public engagement', 'media skills'.</p>

Work package WP3 – Gaia Frontiers: The MW as a Galaxy

Work Package Number	WP3	Lead Beneficiary	7. UGA
Work Package Name	Gaia Frontiers: The MW as a Galaxy		
Start Month	1	End Month	48

Objectives
<p>We will exploit the Gaia data in combination with other survey data (especially spectroscopic surveys and multi-wavelength photometry) to address some of the most important questions in the formation and evolution of our Galaxy. These questions include (Topic 1) the structure, star formation history, and dynamical evolution (both secular and by accretion) of the MW. Our work will cover investigation of (Topic 2) substructures, such as open clusters and accretion debris. This will be at the forefront of exploring the MW with Gaia data. Our results will be submitted for publication in the international astronomical literature and presented at international conferences. In addition to the scientific results, we will develop novel data analysis techniques that will be of broader applicability (and made publicly available). Our detailed experience of using the Gaia data will allow us to identify the most important steps in the future of astrometry from the point of view of the Galaxy and local cosmology.</p>

Description
<p>Description of Work and Role of Specific Beneficiaries / Associated partners</p> <p>The scientific work is divided into two main topics, each organized into a number of tasks to be carried out by the ESRs.</p> <p>Topic 1: The global structure and history of the MW. Lead partners: UGA, LEID, UCL (with contributing partners: TUD) lead the three main scientific projects in this topic by hosting ESRs 8, 2 and 10. TUD is the secondment destinations for ESR 2 and will provide vital training and expertise. OBSPM provides expert training on stellar multiplicity for ESR8. LEON provides training on IR detectors and science case development for ESR10.</p> <p>Topic 2: MW substructure. Lead partners: UB. Contributing partners: UGA. UB leads the scientific projects in this topic (hosting ESR 5). UGA is the secondment destinations for the ESR and brings in important skills and knowledge to the projects. Industry secondments to INSYS for high performance data and visualisation training</p>

There will also be involvement in both topics from NKUA/WP6 (for outreach purposes), and TUD/WP5 to whom WP3 provides science requirements for producing the roadmap on the future of astrometry.

Work package WP4 – Gaia Frontiers: Stars and Planets

Work Package Number	WP4	Lead Beneficiary	2. INAF
Work Package Name	Gaia Frontiers: Stars and Planets		
Start Month	1	End Month	48

Objectives

This WP will throw new light on the constituents of the MW, which will not only improve our understanding of stellar and planetary structure and evolution, but which will also be of fundamental importance to improve our understanding of galaxy formation and evolution in general. In WP4 we will focus on three central aspects of this: 1) the properties of single and binary stars; 2) the star cluster properties; 3) the relationship of the environment of host stars to their exoplanets. The specific objectives are:

a) improve our understanding of stellar models through analysis of the high-quality observables provided by Gaia and spectroscopic survey, such as stellar absolute luminosities, effective temperatures, dynamical masses of binaries, abundances of chemical elements. This will also include the study of star clusters and the field population, considering stellar multiplicity; b) improve the knowledge of exoplanet formation

Description

Description of Work and Role of Specific Beneficiaries / Associated partners:

WP4 is divided into the following tasks:

Task 4.1: Use stellar clusters for stellar model improvements and testing. The stellar census in clusters will be derived down the low mass regime. The derived color-magnitude diagrams together with chemical abundances from spectroscopic surveys will be used to put further constraints on stellar models and isochrones. Lead: INAF ESR 3 (observational analyses of star clusters). Contributors: UB (new cluster detection) and NKUA (ages, chemical abundances). Secondments: DAPCOM, LEID, and UGA

Task 4.2: Use carbon, nitrogen and oxygen abundance ratios and their specific isotopic ratios study the chemical evolution of stars, especially during the red giant branch phases. The evolutionary effects of CN abundance and carbon isotopic ratios will be studied in the context of the stellar masses, ages and distances and compared with chemical evolution models.

Lead NKUA: ESR9: Secondments, INAF (Padova), DAPC

Task 4.3: Use Gaia and spectroscopy data to determine the Galactic star-formation history and the stellar mixing rate as a function of time and position in the Galactic disc and detailed chemo-dynamical properties of the environment of host stars of exoplanets, and look for correlations with the properties of their exoplanets. Use of novel Virtual Reality environments to visualise and analyse the rich multivariate data sets. Lead UB: ESR1 Secondments: UGA, LEID, UCAM. Contribution of associate partner UCAM PhD.

Work package WP5 – Gaia Fundamentals: Space and Time

Work Package Number	WP5	Lead Beneficiary	3. ULUND
Work Package Name	Gaia Fundamentals: Space and Time		
Start Month	1	End Month	48

Objectives

In recent years several astrometric projects have been suggested as a reaction on the recommendations in the Report of the Senior Survey Committee on the Selection of Science Themes for the L2 and L3 Missions . Two clear ways forward for future astrometry have emerged: 1) expanding the wavelength range from the visible to the NIR and 2) moving from μs to sub- μs astrometry for small field astrometry. These two approaches were pursued in the proposals submitted to

ESA's Voyage2050 call (e.g. an all-sky astrometric NIR mission GaiaNIR, see Section 1.1.3.3). This WP aims to address the fundamentals of both approaches to identify what can be achieved and if necessary to choose which approach gives the greatest science return.

In WP5 various aspects of both Gaia and future astrometry will be scrutinized from both technical and scientific point of view: necessary technical developments, strategies for the data modelling and processing, the role of combination of astrometric data from various sources. Several scientific areas will be considered: AGNs and reference frame, distance ladder and Solar System studies.

WP5 will also be responsible for preparing a roadmap of the activities required to realize the path toward NIR and sub- μ s astrometry. This subtask will be led by LUND. This WP seeks to carefully refine the science case for future space astrometry missions in order to better define the astrometric survey requirements (e.g. relative vs. absolute astrometry, all-sky vs. limited-angle/pencil beam surveys, survey wavelength). At the same time, the scientific and engineering challenges for taking the next big step in space astrometry will be identified, so that they can be acted on by the European scientific and engineering/industry communities. The roadmap will build on the science results from WPs 3 and 4 and on the challenges identified elsewhere within WP5.

Description

Description of Work and Role of Specific Beneficiaries / Associated partners

Rather than trying to cover the many different technical challenges of NIR and sub- μ s astrometry, we focus on five ESR projects where relevant insight can be gained by using and extrapolating the Gaia experience. ESR4 assesses the science return of NIR astrometry and the synergies between various astrometric missions. ESR6 and ESR10 study various properties of AGNs in the Gaia astrometry and investigates the astrometric systematics of the AGN used for the Gaia reference frame. Finally, ESR7 investigates the fundamental limitations of relativistic modelling for Gaia and a hypothetical mission aiming at 10 nano-as accuracy. Several more ESRs touch on the technical challenges of 'complex data' and 'big data' and their implications when going to the sub- μ s level. Conclusions feed into WP5. Three thematic workshops will be organized: The Art of Astrometry and Computation; Gravitation and Astrometry; Technical challenges of space based astronomy.

The final activities of WP5 will be to synthesize the science and technical challenges into a coherent Roadmap.

Task 5.1: Ensure that the research projects in WPs 3 and 4 include the identification of the next level of astrometric and complementary data needed to make further scientific progress (e.g. through an 'outlook' chapter in the PhD theses). Lead partner: TUD. Contributing partners: ALL, with ESR7 industrial training at ABUSDS.

Task 5.2: Synthesize the results from the ESR projects in WP5 and from the 'Space-based astronomy challenges' workshop, and turn these into recommendations on scientific and engineering development activities to be undertaken in preparation for the next space astrometry mission. Lead partner: LUND. Contributing partners: TUD, UC, UCAM, LEID, with ESR4 industrial training at TAS.

Task 5.3: Study the impact of Gaia astrometric accuracy on future autonomous space navigation and approach to targets. Characterisation of future space mission targets by exploiting Gaia astrometry, photometry and wide-band spectrophotometry.

Lead partner UC. Contributors: UB, LEID. Secondments; SPINW for ESR6.

Work package WP6 – MWGaiaDN Communications, Dissemination and Data Management

Work Package Number	WP6	Lead Beneficiary	23. UCAM
Work Package Name	MWGaiaDN Communications, Dissemination and Data Management		
Start Month	1	End Month	48

Objectives

This WP will organise the network Outreach and Communications activities. It will also be responsible for the Data Management plan – generating the data policy and ensuring open access to data and publications generated by the network. We will aim to enthuse school children in the excitement of space and astronomy. We will organise a networking event building on the 'Gaia Live in Schools' concept. This will link ESA and Gaia with children across tens of schools in Europe and Africa, with in-school presentations and activities by our ESRs. This will be organised with cooperation from the ESA education department, and the IAU-OAD (at SAAO). Other activities will include public engagement talks at the major MWGaiaDN conferences and workshops. We have scientific networking events at major astronomy meetings in Europe (the EAS EWASS) and the IAU General Assembly. Dissemination will be enhanced via our commitment to

provide open access to the DN's generated data and publications. Links to data will be available through the <https://mwgaia.ast.cam.ac.uk/DN> portal, with the data themselves maintained by well-established data repositories (e.g. at ESA). Taking advantage of opportunities offered through the wider GREAT/MW-Gaia network, ESRs will participate in relevant workshops and conferences, visiting programmes, summer schools, and expert classes.

Description

Description of Work and Role of Specific Beneficiaries / Associated partners

Task a) MWGaiaDN Communication: Stand and sessions organised at major meetings like IAU and EWASS: NKUA/UCAM

Task b) Public Engagement activities: Produce a 3D movie to explore the solar neighbourhood (within 2.5 kpc), with other animations, like the 3D structure of open clusters, a movie of variable objects moving in the HR diagram, etc This will be done in close collaboration with the ESR projects in the other WPs.

- Gaia-Map Live in Schools - School event, linking Africa to Europe: UCAM/ NKUA/ SAAO

- Events for school students and young students at important meetings like EWASS, IAU meetings.

Task c) Data management: UB/ UCAM / NKUA | Task d) Data dissemination: LEID/ NKUA

STAFF EFFORT

Staff effort per participant							
<i>Grant Preparation (Work packages - Effort screen) — Enter the info.</i>							
Participant	WP1	WP2	WP3	WP4	WP5	WP6	Total Person-Months
1 - ULEI	1.00	1.00	33.00			1.00	36.00
2 - INAF	1.00	1.00		33.00		1.00	36.00
3 - ULUND	1.00	1.00			33.00	1.00	36.00
4 - UB	1.00	1.00	35.00	34.00		1.00	72.00
5 - UC	1.00	1.00			33.00	1.00	36.00
6 - TUD	1.00	1.00			69.00	1.00	72.00
7 - UGA	1.00	1.00	33.00			1.00	36.00
8 - NKUA	1.00	1.00		33.00		1.00	36.00
Total Person-Months	8.00	8.00	101.00	100.00	135.00	8.00	360.00

LIST OF DELIVERABLES

Deliverables						
<i>Grant Preparation (Deliverables screen) — Enter the info.</i>						
<i>The labels used mean:</i>						
<i>Public — fully open (⚠ automatically posted online)</i>						
<i>Sensitive — limited under the conditions of the Grant Agreement</i>						
<i>EU classified —RESTREINT-UE/EU-RESTRICTED, CONFIDENTIEL-UE/EU-CONFIDENTIAL, SECRET-UE/EU-SECRET under Decision 2015/444</i>						
Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D1.1	Supervisory Board of the network	WP1	1 - ULEI	OTHER	SEN - Sensitive	2
D1.2	Project Website	WP1	1 - ULEI	DEC —Websites, patent filings, videos, etc	PU - Public	2
D1.3	Progress report / Year 1	WP1	1 - ULEI	R — Document, report	SEN - Sensitive	13
D1.4	Final DN report and sustainability plan	WP1	1 - ULEI	R — Document, report	SEN - Sensitive	48
D2.1	Network Career Development Information Site.	WP2	4 - UB	DEC —Websites, patent filings, videos, etc	PU - Public	10
D2.2	Career Development plans	WP2	4 - UB	R — Document, report	SEN - Sensitive	13
D2.3	WP3/4/5 research published in final conf proceedings	WP2	4 - UB	R — Document, report	PU - Public	48
D3.1	WP3 Year 1 Milky Way report	WP3	7 - UGA	R — Document, report	SEN - Sensitive	13
D3.2	WP3 Near-IR astrometry requirements MW report	WP3	7 - UGA	R — Document, report	SEN - Sensitive	24
D3.3	WP3 final research report	WP3	7 - UGA	R — Document, report	PU - Public	47
D4.1	WP4 Year 1 Stars & Planets report	WP4	2 - INAF	R — Document, report	SEN - Sensitive	13

Deliverables						
<i>Grant Preparation (Deliverables screen) — Enter the info.</i>						
<i>The labels used mean:</i>						
<i>Public — fully open (⚠ automatically posted online)</i>						
<i>Sensitive — limited under the conditions of the Grant Agreement</i>						
<i>EU classified — RESTREINT-UE/EU-RESTRICTED, CONFIDENTIEL-UE/EU-CONFIDENTIAL, SECRET-UE/EU-SECRET under Decision 2015/444</i>						
Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D4.2	WP4 Near-IR requirements Stars/Planets report	WP4	2 - INAF	R — Document, report	SEN - Sensitive	24
D4.3	WP4 final research report	WP4	2 - INAF	R — Document, report	PU - Public	47
D5.1	WP5 Year 1 Astrometry & Roadmap report	WP5	3 - ULUND	R — Document, report	SEN - Sensitive	13
D5.2	WP5 Near-IR requirements Astrometry report	WP5	3 - ULUND	R — Document, report	SEN - Sensitive	24
D5.3	WP5 final research report	WP5	3 - ULUND	R — Document, report	PU - Public	47
D5.4	MWGaiaDN Roadmap: Towards Near-IR astrometry	WP5	3 - ULUND	R — Document, report	SEN - Sensitive	47
D6.1	Data Management Plan	WP6	23 - UCAM	DMP — Data Management Plan	SEN - Sensitive	13
D6.2	Plan for the dissemination and exploitation of results, including communication activities	WP6	23 - UCAM	R — Document, report	SEN - Sensitive	13
D6.3	MWGaiaDN @ IAU General Assembly	WP6	23 - UCAM	DEC — Websites, patent filings, videos, etc	PU - Public	19
D6.4	Public Engagement Event ‘Gaia Map’	WP6	23 - UCAM	OTHER	PU - Public	19
D6.5	Closing Conference	WP6	23 - UCAM	DEC — Websites, patent filings, videos, etc	PU - Public	47
D6.6	Plan for the dissemination and exploitation	WP6	23 - UCAM	R — Document, report	SEN - Sensitive	48

Deliverables

Grant Preparation (Deliverables screen) — Enter the info.

The labels used mean:

Public — fully open (⚠ automatically posted online)

Sensitive — limited under the conditions of the Grant Agreement

EU classified — RESTREINT-UE/EU-RESTRICTED, CONFIDENTIEL-UE/EU-CONFIDENTIAL, SECRET-UE/EU-SECRET under Decision [2015/444](#)

Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
	of results, including communication activities (Update)					

Deliverable – Supervisory Board of the network

Deliverable Number	D1.1	Lead Beneficiary	1. ULEI
Deliverable Name	Supervisory Board of the network		
Type	OTHER	Dissemination Level	SEN - Sensitive
Due Date (month)	2	Work Package No	WP1

Description
Document establishing the supervisory board and defining the way of working

Deliverable – Project Website

Deliverable Number	D1.2	Lead Beneficiary	1. ULEI
Deliverable Name	Project Website		
Type	DEC —Websites, patent filings, videos, etc	Dissemination Level	PU - Public
Due Date (month)	2	Work Package No	WP1

Description
Project Website

Deliverable – Progress report / Year 1

Deliverable Number	D1.3	Lead Beneficiary	1. ULEI
Deliverable Name	Progress report / Year 1		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	13	Work Package No	WP1

Description
Progress Report submitted to the REA covering the first year implementation of the project

Deliverable – Final DN report and sustainability plan

Deliverable Number	D1.4	Lead Beneficiary	1. ULEI
Deliverable Name	Final DN report and sustainability plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	48	Work Package No	WP1

Description
Final DN report and sustainability plan

Deliverable – Network Career Development Information Site.

Deliverable Number	D2.1	Lead Beneficiary	4. UB
Deliverable Name	Network Career Development Information Site.		
Type	DEC — Websites, patent filings, videos, etc	Dissemination Level	PU - Public
Due Date (month)	10	Work Package No	WP2

Description
Network Career Development Information Site.

Deliverable – Career Development plans

Deliverable Number	D2.2	Lead Beneficiary	4. UB
Deliverable Name	Career Development plans		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	13	Work Package No	WP2

Description
Document describing how the individual Career Development Plans have been established (listing also the researchers for whom such plans have been put in place). To be submitted before the mid-term meeting.

Deliverable – WP3/4/5 research published in final conf proceedings

Deliverable Number	D2.3	Lead Beneficiary	4. UB
Deliverable Name	WP3/4/5 research published in final conf proceedings		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	48	Work Package No	WP2

Description
WP3/4/5 research published in proceedings of the final doctoral network conference

Deliverable – WP3 Year 1 Milky Way report

Deliverable Number	D3.1	Lead Beneficiary	7. UGA
Deliverable Name	WP3 Year 1 Milky Way report		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	13	Work Package No	WP3

Description
Report on WP3 progress in Year 1

Deliverable – WP3 Near-IR astrometry requirements MW report

Deliverable Number	D3.2	Lead Beneficiary	7. UGA
Deliverable Name	WP3 Near-IR astrometry requirements MW report		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	24	Work Package No	WP3

Description
WP3 requirements input for next generation near-IR astrometry

Deliverable – WP3 final research report

Deliverable Number	D3.3	Lead Beneficiary	7. UGA
Deliverable Name	WP3 final research report		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	47	Work Package No	WP3

Description
WP3 final research report.

Deliverable – WP4 Year 1 Stars & Planets report

Deliverable Number	D4.1	Lead Beneficiary	2. INAF
Deliverable Name	WP4 Year 1 Stars & Planets report		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	13	Work Package No	WP4

Description
Report on WP4 Year 1 progress.

Deliverable – WP4 Near-IR requirements Stars/Planets report

Deliverable Number	D4.2	Lead Beneficiary	2. INAF
Deliverable Name	WP4 Near-IR requirements Stars/Planets report		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	24	Work Package No	WP4

Description
WP4 requirements input for next generation near-IR astrometry

Deliverable – WP4 final research report

Deliverable Number	D4.3	Lead Beneficiary	2. INAF
Deliverable Name	WP4 final research report		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	47	Work Package No	WP4

Description
WP4 final research report.

Deliverable – WP5 Year 1 Astrometry & Roadmap report

Deliverable Number	D5.1	Lead Beneficiary	3. ULUND
Deliverable Name	WP5 Year 1 Astrometry & Roadmap report		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	13	Work Package No	WP5

Description
Report on WP5 Year 1 progress.

Deliverable – WP5 Near-IR requirements Astrometry report

Deliverable Number	D5.2	Lead Beneficiary	3. ULUND
Deliverable Name	WP5 Near-IR requirements Astrometry report		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	24	Work Package No	WP5

Description
WP5 requirements input for next generation near-IR astrometry

Deliverable – WP5 final research report

Deliverable Number	D5.3	Lead Beneficiary	3. ULUND
Deliverable Name	WP5 final research report		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	47	Work Package No	WP5

Description
WP5 final research report.

Deliverable – MWGaiaDN Roadmap: Towards Near-IR astrometry

Deliverable Number	D5.4	Lead Beneficiary	3. ULUND
Deliverable Name	MWGaiaDN Roadmap: Towards Near-IR astrometry		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	47	Work Package No	WP5

Description
Roadmap for next generation near-IR astrometry

Deliverable – Data Management Plan

Deliverable Number	D6.1	Lead Beneficiary	23. UCAM
Deliverable Name	Data Management Plan		
Type	DMP — Data Management Plan	Dissemination Level	SEN - Sensitive
Due Date (month)	13	Work Package No	WP6

Description
Data Management Plan submitted to the REA (updated towards the end of the project if needed)

Deliverable – Plan for the dissemination and exploitation of results, including communication activities

Deliverable Number	D6.2	Lead Beneficiary	23. UCAM
Deliverable Name	Plan for the dissemination and exploitation of results, including communication activities		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	13	Work Package No	WP6

Description
Plan for the dissemination and exploitation of results, including communication activities, submitted at mid-term (M13)

Deliverable – MWGaiaDN @ IAU General Assembly

Deliverable Number	D6.3	Lead Beneficiary	23. UCAM
Deliverable Name	MWGaiaDN @ IAU General Assembly		
Type	DEC — Websites, patent filings, videos, etc	Dissemination Level	PU - Public
Due Date (month)	19	Work Package No	WP6

Description

The DN will host an outreach exhibition stand at the IAU GA, which is to be held in Cape Town, August 2024, updating on MWGaiaDN activities.

Deliverable – Public Engagement Event ‘Gaia Map’

Deliverable Number	D6.4	Lead Beneficiary	23. UCAM
Deliverable Name	Public Engagement Event ‘Gaia Map’		
Type	OTHER	Dissemination Level	PU - Public
Due Date (month)	19	Work Package No	WP6

Description

Gaia Live event at the IAU General Assembly, Cape Town, Aug 2024.

Deliverable – Closing Conference

Deliverable Number	D6.5	Lead Beneficiary	23. UCAM
Deliverable Name	Closing Conference		
Type	DEC — Websites, patent filings, videos, etc	Dissemination Level	PU - Public
Due Date (month)	47	Work Package No	WP6

Description

Closing conference of the network, showcasing the science results achieved and the roadmap toward sub-microarcsecond astrometry. This conference will be public and open to participation from scientists outside the network.

Deliverable – Plan for the dissemination and exploitation of results, including communication activities (Update)

Deliverable Number	D6.6	Lead Beneficiary	23. UCAM
Deliverable Name	Plan for the dissemination and exploitation of results, including communication activities (Update)		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	48	Work Package No	WP6

Description

Plan for the dissemination and exploitation of results, including communication activities, submitted at mid-term (M13) and an update towards the end of the project (M48).

LIST OF MILESTONES

Milestones					
<i>Grant Preparation (Milestones screen) — Enter the info.</i>					
Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
1	Consortium Agreement	WP1	1-ULEI	Consortium Agreement signed	2
2	ESR Induction	WP3, WP6, WP5, WP2, WP4, WP1	4-UB	ESR Induction school takes place	9
3	Planned recruitments completed	WP2	4-UB	Planned recruitments completed - ESRs in place.	12
4	All recruited fellows enrolled in PhD programme	WP3, WP2, WP5, WP4	4-UB	All recruited fellows enrolled in PhD programme	12
5	Project mid-term check	WP1	1-ULEI	Project mid-term check at month 13-15 - meeting between REA and consortium	15
6	Outreach Event 'Gaia Map'	WP6	-	Outreach Event 'Gaia Map' evaluation	19
7	WP3 1st Science	WP3	7-UGA	peer review paper(s) submitted from WP3	36
8	WP4 1st Science	WP4	2-INAF	peer review paper(s) submitted from WP4	36
9	WP5 1st Science	WP5	6-TUD	peer review paper(s) submitted from WP5	36
10	MWGaiaDN astrometry roadmap	WP5	3-ULUND	MWGaiaDN astrometry roadmap presented at final network conference.	47
11	WP5 mid term roadmap	WP6, WP1	3-ULUND	Update on roadmap at the WP5: Roadmap: Technical Challenges workshop	24
12	DN ESR "36 months"	WP2, WP1	1-ULEI	All ESRs complete their 36 months of training	48

LIST OF CRITICAL RISKS

Critical risks & risk management strategy			
<i>Grant Preparation (Critical Risks screen) — Enter the info.</i>			
Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
1	Inability to recruit appropriate ESRs at each node (LI: L; SE: H) (level of (i) likelihood (LI), and (ii) severity (SE): Low/Medium/High)	WP3, WP6, WP2, WP5, WP4, WP1	A coordinated recruitment campaign will be launched to fill all positions across the network. All institutes have a record of attracting PhD students
2	Failure to reach agreement on the policies and strategies for the project (LI: L; SE: M)	WP1	The DN contract sets out the partners' commitment to the DN objectives. Conflicts will be resolved between the partners, in the final instance by the CSB. Partners have a track record of delivery of collaborative projects
3	The ESR research project proceeds slowly (LI: M; SE: M)	WP3, WP5, WP4	The ESR supervisor/ ST/ DTC will review progress and suggest alternative research approaches.
4	ESR resigns from post (LI: L; SE: L)	WP3, WP5, WP4	A new ESR will be appointed if >3 months of ESR time remaining. All institutes will fund the additional PhD time required for a replacement ESR
5	ESR training affected by too high a load of exchanges & workshops (LI: L; SE: L)	WP3, WP5, WP4	The ESR supervisor and DTC review progress, invite feedback from ESRs. If the programme is too heavy, it will be revised at each of the yearly reviews.
6	Academic supervisor leaves original node (LI: L; SE: M)	WP2	Another academic supervisor will be appointed at the host node, with the original supervisor offered a role in supervision if appropriate.
7	Failure to achieve inter and intra WP coordination (LI: L; SE: L)	WP1	The impact of the DN comes from the sum of the research programmes. Regular interaction of the WP leaders will aid in inter WP work, whilst the consortium wide activities will forge the intra WP links.
8	Limited impact of network due to poor communications and engagement. (LI: L; SE: L)	WP6	Dedicated WP (WP6) to coordinate all public engagement and dissemination activities across the network.
9	UK does not fully associate to the Horizon Europe programme. (LI: L; SE: M)	WP1	In principle the UK and EU have agreed that the UK will join the Horizon Europe programme. If the association is not ratified, then the network coordinator role will pass to another beneficiary node.
10	Covid-19 related risks (LI: M; SE: M)	WP2, WP1	Covid-19 continues globally. If physical travel is not possible, meetings and engagements will be organised remotely. All partners now have experience if continuing to work with

Critical risks & risk management strategy			
<i>Grant Preparation (Critical Risks screen) — Enter the info.</i>			
Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
			covid restrictions. Also, the project is essentially non-laboratory based, hence the research can be carried out remotely.



**Horizon Europe (HORIZON)
Marie Skłodowska-Curie Actions
Doctoral Networks (MSCA-DN)**

ANNEX 1

Description of the action (DoA)

Part B

**101072454 – MWGaiaDN
HORIZON – MSCA – 2021 – DN
The Milky Way-Gaia Doctoral Network**



List of Changes

Date	Who	Section(s)	Change Description
20220601	AB	3.1.4, Tables 1.1 and 1.3, 3.2.4, Table 3.1d	Second TUD ESR (no 10) description added. ESR10 should be in WP5, this has been made consistent throughout the document. Comments from project officer included. Various minor edits to grammar and spelling. In section 3.2.4 text was added concerning the funding of non-associated third countries. Added the UCAM and UCL ESRs to table 3.1d and 1.3a with a clarification on their funding added as a note to the table.
20220417	NAW	Several	Part B generated from proposal Part B. Removed cover page Deleted the header Replaced the footer with new info Removed list of participants Table 1.1 list of WPs removed Table 1.3.b: updated dates of meetings to reflect the new start date (1 Feb 2023 c.f. 1 Aug 2022 foreseen in the the original proposal). Table 3.1 a Description of WPs removed Table 3.1 b Deliverables List removed Table 3.1 c Milestones List removed Table 3.1e Implementation Risks removed Created section 4 with ethics self-assessment Added table with list of changes Updates related to the ESR feedback: i) Goals related to research on Gaia Frontiers: added text to end of sec's 1.1.2.1 and 1.1.2.2 to note how the mid project deliverables include an assessment of need for future near-IR astrometry. ii) Methodology approach: added text to end of sec 1.2.2 noting that the methodological approach will be reviewed at the network kick-off meeting. iii) Sec 1.4.1 – added some additional comments on the quality of the supervision – all supervisors have significant supervision experience
20220419	NAW	Table 1.3.b	Additional date changes of meetings to reflect the new start date
		Sec 1.3.1.2	Removed ref to Aug 2022 IAU General assembly (now before start of network)
		Sec 2.3.1	Changed IAU GA Busan (2022) to Cape Town (2024)
20220503	NAW	Sec 5.1 (Leiden)	Updated the description of Leiden University to note that the department involved is the Faculty of Science (ensures consistency with the entry in SYGMA). Leiden Observatory is a sub unit of the Faculty of Science.
20220519	NAW	several	Updates to reflect change of status of UK partners from beneficiaries to associate partners, after confirmation from REA that associate partners able to lead non MGT WPs. New coordinator will be Anthony Brown at LEID.
		declarations	Added CNRS/UGA link
		1.1.2, 2.4.1	Updated references to the ESRs, including the UK funded associate partner PhDs in UCAM and UCL
		Table 1.1	Re-assigned WP leads – WP1 now LEID, WP6 now UCAM. Re-assigned the ESRs to WP – ESR1 is now UB (previously UCAM) and ESR10 TUD (previously UCL)

		Sec 3	Updated start date to 1 Feb 2023 (and corresponding changes to dates for student hires)
		Table 3.1d	Updated Deliverables to reflect new numbering for all Fellow ESR descriptions. Replaced ESR1 and ESR10 from the UCAM and UCL descriptions to the new UB and TUD projects.
		3.2.4	Update on UCAM and UCL transferring associate partner status.

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LIST OF PARTICIPATING ORGANISATIONS

Consortium Member	Legal Entity Short Name	Academic (tick)	Non-academic (tick)	Awards Doctoral Degrees (tick)	Country	Dept./ Division / Laboratory	Scientist-in-Charge	Role of associated Partner ¹ or link to beneficiary
<u>Beneficiaries</u>								
1: UNIVERSITEIT LEIDEN	LEID	✓		✓	NL	Leiden Observatory	Anthony BROWN	
2: ISTITUTO NAZIONALE DI ASTROFISICA	INAF	✓		²	IT	Padua	Antonella VALLENARI	
3: LUNDS UNIVERSITET	LUND	✓		✓	SE	Lund Observatory	David HOBBS	
4: UNIVERSITAT DE BARCELONA	UB	✓		✓	ES	Institute of Cosmic Science/ Dpt. Quantum Physics and Astrophysics	Carme JORDI	
5: UNIVERSIDADE DE COIMBRA	UC	✓		✓	PT	Departamento de Fisica	Sonia ANTON	
6: TECHNISCHE UNIVERSITAET DRESDEN	TUD	✓		✓	DE	Lohrmann Observatory	Sergei KLIONER	
7: UNIVERSITÉ GRENOBLE ALPES	UGA	✓		✓	FR	Institut de Planétologie et d'Astrophysique de Grenoble	Carine BABUSIAUX	
8: NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS	NKUA	✓		✓	EL	Department of Physics	Despina HATZIDIMITRIOU	
<u>Partner Organisations</u>								
23: UNIVERSITY OF CAMBRIDGE	UCAM	✓		✓	UK	Institute of Astronomy	Nicholas WALTON	ESR-HOST/ TRN/ EXCH
22: UNIVERSITY COLLEGE LONDON	UCL	✓		✓	UK	Mullard Space Science Laboratory	Daisuke KAWATA	ESR-HOST/ TRN/ EXCH
19: AIRBUS DEFENCE AND SPACE	ABUSDS		✓		UK	Future Programmes & Proposals	Paolo D'ARRIGO	ESR-HOST/ TRN/ EXCH
13: DAPCOM DATA SERVICES	DAPC		✓		ES		Francesc JULBE	ESR-HOST/ TRN/ EXCH
18: LEONARDO LTD	LEON		✓		UK		Keith BARNES	ESR-HOST/ TRN/ EXCH
14: INTERSYSTEMS IBERIA	INSYS		✓		ES		Jose Tomas SALVADOR	ESR-HOST/ TRN/ EXCH
17: OHB SYSTEM AG	OHB		✓		DE	Scientific Payloads	Maximilian KLEBOR	ESR-HOST/ TRN/ EXCH
15: SPIN.WORKS	SPINW		✓		PT		Tiago HORMIGO	ESR-HOST/ TRN/ EXCH
16: SUIL INTERACTIVE LTD	SUIL		✓		IE		Owen HARRIS	ESR-HOST/ TRN/ EXCH

¹ For example, delivering specialised training courses, hosting secondments, etc.

² The INAF Padua ESR will be enrolled on PhD programs at the University of Padua (UNIPD)

21: THALES ALENIA SPACE UK LTD	TAS		✓		UK	Advanced concepts	Roger WARD	ESR-HOST/ TRN/ EXCH
20: CNRS	OBSPM	✓			FR	GEPI lab, Paris Observatory	Frédéric ARENOU	ESR-HOST/ TRN/ EXCH
12: DIRAC INSTITUTE	DIRAC	✓		✓	US		Mario JURIC	ESR-HOST/ TRN/ EXCH
10: NATIONAL ASTRONOMICAL OBSERVATORY OF JAPAN	NAOJ	✓		³	JP	NAOJ-Jasmine Office	Naoteru GOUDA	ESR-HOST/ TRN/ EXCH
11: NATIONAL RESEARCH FOUNDATION	SAAO	✓			ZA	South African Astronomical Observatory & IAU Office of Astronomy for Development	Patricia WHITELOCK	TRN/ COMMS/ EXCH
9: UNIVERSITÀ DEGLI STUDI DI PADOVA	UNIPD	✓		✓	IT	Dipartimento di Fisica e Astronomia	Giovanni CARRARO	ESR-HOST/ TRN/ EXCH

Declarations

Name (institution / individual)	Nature of inter-relationship
DAPCOM Data Services (15: DAPC)	DAPCOM Data Services is a spin-off company of the University of Barcelona (UB) and the Politecnic University of Catalunya (UPC). UB is one of the beneficiaries of the MWGaiaDN.
CNRS	The Institut de Planetologie et d'Astrophysique de Grenoble (IPAG), i.e. the department of beneficiary UGA joining the project, is a joint research unit between UGA and CNRS (which is an associated partner).

³ NAOJ itself does not award degrees. However, NAOJ is a member of the Graduate University for Advanced Studies (SOKENDAI) and awards degrees through this (with some graduate students enrolled at the University of Tokyo).

1. Excellence

MWGaiaDN will deliver **Excellent** science, **Extending** techniques, **Enhancing** people skills, **Effecting** the next revolution in European led astronomy through leadership in astrometric-based science.

Gaia, ESA's major space satellite was successfully launched in Dec 2013. It is now on its extended mission to map some two billion stars in our **Milky Way** (hereafter: **MW**). Its first three data releases, of primarily astrometric and photometric data, in 2016, 2018, 2020 have already proved to be a 'game changer' for astronomy. The upcoming data releases though present major challenges in terms of complexity and size, bringing in for the first time significant new advanced data products such as the astrophysical properties of the stars, hence preparation to ensure full science exploitation is essential. **MWGaiaDN** will link the key partners responsible for the development and creation of Gaia, forming an effective and unique training network powerfully combining the best research training with a range of academic and industrial placements, specialist research and knowledge transfer workshops. It will develop and train a cohort of young researchers through a set of key science projects pushing the Gaia data to its limits. It will shape the delivery of training in astrometry and the study of the MW across Europe: delivering key insights into the structure and formation of our Galaxy; delivering the roadmap for the next generation of astrometric space telescopes; equipping the DN's recruited Early Stage Researchers (ESRs) with skills to drive the next innovative steps (e.g. the recently identified priority ESA future large MW/near infrared astrometry mission for the mid-30's) in this key area of space discovery, as well as enabling them to contribute to the future, growth and challenges of the big data industry and commerce.

The MWGaiaDN ESRs will generate excellent science in the mid 20's, form a cohort driving future discovery in the mid 30's. With the major new Gaia DR3 release in Q2 2022, our DN is perfectly timed for maximum impact.

1.1 Quality and pertinence of the project's research and innovation objectives

1.1.1 Introduction, objectives and overview of the research programme

Introduction: Astrometry is the technique of measuring the positions of celestial objects over time to high precision. We can determine the parallax, and thus distance, as well as the space motions of the objects. Accurate knowledge of the distances and motions of objects provide fundamental insights into the widest range of astrophysical questions, from the evolution and formation of our Sun and solar system, to that of our MW, and the cosmology of the Universe. Measuring the distance to even the nearest star requires measuring angles on the sky of less than an arcsecond (one 3600th of a degree). Gaia is the ESA cornerstone mission that is revolutionising our understanding of the MW and the Universe. Launched in December 2013, it is now measuring stellar positions to derive the astrometric parameters of some two billion stars between 2nd and 21st magnitudes in brightness to exquisite accuracies: to ~ 10 micro-arcseconds (μas) for the brightest stars, and to a few tens of μas for 15th magnitude stars (a jump of one to two orders of magnitude in accuracy and four orders of magnitude in number of stars compared to the earlier ESA Hipparcos mission). Gaia Data Release 1 (Sep 2016), saw the publication of the sky positions of 1.1 billion stars, and distances of more than 2 million stars using the Tycho-Gaia Astrometric Solution. Gaia Early Data Release 3 (EDR3: Dec 2020) contained the 3D positions of 1.47 billion stars, making this the largest and most accurate astrometric map ever published⁴. Gaia EDR3 (and the earlier Gaia DR2 April 2018 release) also contained four new data types: broadband colour information, radial velocities for 7 million stars, stellar characteristics such as the surface temperature and radius of more than 77 million stars, and the positions of more than 14,000 Solar System objects, mainly asteroids. Gaia EDR3/DR2 have enabled the construction of the most accurate three-dimensional map of the positions and motions of stars in our Galaxy. By back-calculating trajectories of all the stars measured by Gaia, we are now directly reconstructing the history of our Galaxy's formation and evolution⁵.

Gaia is having a transformational impact in mapping and understanding our MW⁶, through advances across all areas of stellar astrophysics, solar system science, extragalactic astrophysics, and fundamental physics⁷. The Gaia data is also identifying new problems and directions that astrophysics will need to take. Gaia is now in its extended mission phase (in flight operations to mid 2025) and with final Gaia data releases in 2030).

The upcoming Q2 2022 full Gaia Data Release 3⁸ (DR3) will release an increased range of rich data products, including crucially, the object classifications and astrophysical parameters (e.g. T_{eff} , chemistry) of some billion objects, enabling a multi-dimensional annotated map of the MW to be created. This will usher in the next wave of Gaia powered discovery.

⁴ Gaia Collaboration et al., 2018, Gaia Data Release 2. Summary of the contents and survey properties, A&A 616, A2

⁵ Helmi et al., 2018, The merger that led to the formation of the MW's inner stellar halo and thick disk, Nature 563, 7729

⁶ Antoja et al., 2018, A dynamically young and perturbed MW disk, Nature 561, 7723

⁷ To date (Nov 2021) there have been over 5,700 peer reviewed papers making use of Gaia data, making Gaia ESA's most productive space science mission. The current list of publications can be found linked from <https://www.cosmos.esa.int/web/gaia/peer-reviewed-journals>

⁸ Gaia DR3 content is described at <https://www.cosmos.esa.int/web/gaia/dr3> (we understand reviewers will ignore these links, but we provide them for completeness!)

Gaia is establishing the astronomical distance scale for at least the next two decades. Nonetheless, the next European missions to follow Gaia, delivering Gaia-like accuracies in the infrared, are already being envisaged. The white paper ‘Space-Time Structure Explorer Sub- μ s astrometry for the 2030s’⁹ prepared for ESA, outlined a range of potential key science drivers for the 2030s, potential development pathways, and likely technical challenges that would need to be overcome. The recent Voyage2050 white paper ‘All-Sky Visible and Near Infrared Space Astrometry’¹⁰ did the same for an ambitious near-Infra Red (IR) space astrometry mission (named GaiaNIR). Recently, in June 2021, ESA released the result of its Senior Committee final recommendation for the ESA Voyage 2050 plan. Through this evaluation process ESA has chosen its future science mission themes, defining those which will drive the next three large-class missions, and identify potential themes for future medium-class missions. Importantly a GaiaNIR mission is identified as one of the top priorities for a future large-class mission under the “From temperate exoplanets to the Milky Way”¹¹ theme (NB: this theme envisages either an exoplanet focused IR spectroscopy mission, or a GaiaNIR global astrometry mission. The ESA senior committee note that the decision on which to focus on will take place in the next few years, with significant concerns raised as to whether a capable exoplanet atmosphere characterisation mission will be possible within a large-class mission budget. At this stage, the GaiaNIR MW focussed mission is more likely to go forward, especially as the recent NASA-NSF astro2020 decadal review¹² is prioritising a very large exoplanet characterisation space telescope, with ESA being seen as leading on the global astrometry mission. Uniquely, in the report, near IR astrometry is also a possible medium-class mission theme, hence there is significant work **now** required to further define GaiaNIR as a large or medium class mission.

Gaia has established European science and industry as leaders in high precision astrometry, and is allowing corresponding scientific leadership in many areas of astrophysics to be established or reinforced. The technical achievements of industry in delivering Gaia are now enabling wider commercial advantages: e.g. silicon carbide structures, large format sensor camera arrays, and cold gas micro propulsion systems developed for Gaia are cutting edge technology, of **significant value for the European space sector**.

In the next few years, further definition of these science priorities and the required technologies will be critical in ensuring that the next steps in understanding the ecosystem of the MW are furthered, through the development of the GaiaNIR ESA large mission. This presents opportunities for the Space Science commercial sector and related industries in responding to the technical challenges inherent in creating the next generation satellites.

DN Objectives: MWGaiaDN aims to [**Objective 1 (O1)**] **shape a critical mass of expertise** with the fundamental skills required to power the scientific exploitation of Gaia over the coming decade and to [**O2**] **drive the development of the next major steps in astrometry**. It will achieve this by focusing on [**O3**] **state-of-the-art research projects** linking key centres of expertise in Europe, with each project pushing the boundaries of Gaia science. Each project will deliver insights into the requirements for next generation facilities, and inform the [**O4**] **scientific roadmap towards future space astrometry** missions capable of μ s accuracies in the near-IR strengthening the case identified by ESA as a Large Mission theme in the Voyage 2050 programme.

DN Integrated Research Programme: structured around ten individual research projects carried out by the recruited Early Stage Researchers (**ESRs**) located across the ten beneficiaries of the network. The network science themes are organised into three main interlinked science training Work Packages (WP). **WP3** addresses the structure of our Galaxy, **WP4** encompasses projects focussing on the physics of stars themselves. **WP5** covers projects exploring fundamental space and time challenges. Each of the individual ESR projects will deliver key science results through the duration of the network [**O3**], and importantly, will provide insight into where the key science challenges will lie when looking to extend astrometric capabilities into the near-IR. This road mapping exercise (finalised within **WP5**) [**O4**] will provide a key stepping stone in driving future astrometry, with the trained ESRs being optimally placed to lead that process in the decade after Gaia. The relationships between ESR projects is given in 1.1.2 and Tab 3.1d.

The ten research projects are described in Table 3.1d, all supervised by experts in the field, at forefront European research institutes, embedded within a rich collaborative environment established between the network partners. All research projects have clearly defined and measurable objectives, that are realistically achievable within the PhD programme. The ESRs will deliver pertinent publishable science based on the newest Gaia data releases, and also contribute to the science definition studies for the next generation GaiaNIR mission (large or medium class). Upon gaining their degrees, the ESRs will be in a position to drive the future programmes (both scientific and technical) to answer the fundamental questions of the ecosystem that is our MW. The DN ESR cohort will form the nucleus of excellence maintaining the leadership of Europe at the forefront of Galactic astronomy into the 2030’s.

⁹ http://www.rssd.esa.int/doc_fetch.php?id=3210644

¹⁰ <https://ui.adsabs.harvard.edu/abs/2021ExA....51..783H/abstract>

¹¹ See: https://www.esa.int/Science_Exploration/Space_Science/Voyage_2050_sets_sail_ESA_chooses_future_science_mission_themes

¹² (<https://www.nationalacademies.org/our-work/decadal-survey-on-astronomy-and-astrophysics-2020-astro2020>)

MWGaiaDN builds on and extends the Gaia Research for European Astronomy Training Network (GREAT)¹³ (initiated by the Gaia Science Team (GST) and the Gaia Data Processing and Analysis Consortium (DPAC) Executive in 2009). Notable GREAT results included community input into the shape of the Gaia Archive¹⁴, community building for major ground based wide-field spectroscopic surveys of the MW, support for the formation of follow-up networks of Gaia observations of transient objects and solar system objects, new approaches to realistic chemo-dynamical modelling of the MW, and a range of strategy papers detailing how topic areas could benefit from and should prepare for GaiaNIR. The GREAT-Initial Training Network¹⁵ (2011-2015) successfully trained seventeen ESRs all of whom gained their PhDs and continued their careers in academia or industry. The final conference of the network demonstrated the excellent science carried out in the network¹⁶. The current MW-Gaia COST Action¹⁰ networks a large scientific Gaia community across Europe. MWGaiaDN will synergistically leverage the MW-Gaia network, with a range of ESR projects aligned with these key science and technological objectives.

MWGaiaDN beneficiaries represent the ESA GST (Cambridge, Barcelona, Dresden) and the Gaia DPAC (Leiden, INAF (Padua), Grenoble, Lund, Athens, UCL). They are active at the forefront of the development and science exploitation of Gaia. They are responsible for designing and developing the sophisticated data analysis systems required to process the complex Gaia data stream. They are running and enhancing the ground data processing system and delivering the Gaia science data products. MWGaiaDN's industrial partners have played key roles in delivering Gaia, ABUSDS was prime contractor for Gaia, INSYS provides the high-performance database system, at the heart of the astrometric processing system for Gaia. DAPC has a key role in the operations of the core processing system for Gaia, and development of the Gaia Archive.

With an effective set of collaborative projects and an integrated training programme, the MWGaiaDN alliance is optimally shaped. This proposal will extend the GREAT training programme into the era of high-precision Gaia data, not only to train a new cohort of young experts in exploiting the exquisite data expected from Gaia, but also to define the scientific roadmap for continued development in the field of space astrometry. **This will ensure the European leadership in this cutting-edge field of science, and will provide a pool of new innovation-orientated expertise with the excellent skill set required to pursue high impact careers in either astronomy or commerce.**

1.1.2 Pertinence and innovative aspects of the research programme

1.1.2.1 WP3: Gaia Frontiers: The MW as a Galaxy

The formation and evolution of galaxies across cosmic time is a central theme in astrophysics. The study of the MW takes a natural place in this work, as it is the one galaxy we can study in exquisite detail – if we have the right observations. The arrival of the Gaia data is currently revolutionizing our picture of the MW. The positions and transverse motions provided through the astrometry done by Gaia must be complemented with ground based spectroscopic follow-up (e.g. Gaia-ESO survey, 4MOST, WEAVE¹⁷), to derive the full 3D velocities of the stars as well as their elemental abundances. These data will enable us to study the structure and history of the MW centre (**UCL PhD**), disk and halo (**ESR2**), including substructures such as stellar clusters and accretion debris (**ESR5**).

The research includes study of the dynamical structure and history of the Galaxy, also known as Galactic archaeology. We only observe the stars where they are now, but from stellar dynamics and improved knowledge of stellar ages we can use the large ensemble of Gaia and spectroscopic observations to infer the state of the Galaxy at earlier times. This establishes the history of star formation in various Galactic components, which helps understand and compare galaxy formation scenarios, in particular its merger and accretion history that Gaia EDR3 has shown to be a major key to understanding the overall history, current structure and dynamical status of our MW.

In Our Galaxy we see significant substructure in the form of molecular clouds, open clusters, globular clusters, moving groups, stellar streams and accretion debris. How do these structures fit into the overall picture of galaxy formation and evolution? Most stars that populate the Galaxy presumably formed in some kind of cluster/association, rather than in isolation. But are the open clusters we see typical sites, or are they just the long-lived and visible tail of the star formation process? Gaia's accurate astrometry on hundreds of known clusters of a wide range of ages (themselves determined more accurately by Gaia parallaxes and photometry) allows us to determine the cluster membership and disruption, e.g., at what rate do cluster stars or accretion debris populate the Galaxy. Gaia further has enormous discovery potential: using advanced data mining techniques, Gaia's astrometry is being used to identify disrupted clusters and stellar streams: these may be so spread out that they are no longer detectable as a spatial over density, yet remain detectable in velocity space and via a common chemical composition.

¹³ <http://www.great-esf.eu>: ESF research network (2010-2015) and <http://www.mw-gaia.org>: COST Action CA18104 (2019-2023)

¹⁴ <http://great.ast.cam.ac.uk/Greatwiki/GaiaDataAccess/GdaScenariosFeedback>

¹⁵ GREAT-ITN: Grant Agreement 264895 - see <https://cordis.europa.eu/project/id/264895>

¹⁶ <http://www.eas-journal.org/articles/eas/abs/2014/03/contents/contents.html>

¹⁷ See <http://www.gaia-eso.eu>, <http://www.4most.eu> and <http://www.ing.iac.es/weave> respectively. All of these are massive spectroscopic surveys with key leadership from the DN partners.

With the new Gaia DR3 the increase in precision as well as the amount of complementary information (from Gaia, e.g., spectrophotometry, binarity information and external spectroscopic follow-ups) will enable to make new large steps forwards. The new binarity information over the Gaia DR3 HR-diagram (**ESR8**) will permit to fully revise the initial mass function and the star formation history of the not so local anymore neighbourhood. Gaia DR3 spectrophotometry and spectroscopic follow-up add dimensionality to the clustering approach, enabling to identify new weak structures and their potential disruption within field stars to an unprecedented level. The new data will enable a full characterization of those weak structures, either open clusters or accretion debris, in particular in terms of mass and age, revealing their contribution to the global MW history. We will also experiment with a new way of constraining the MW history by studying the tilting rate of the galactic disk which will be measurable with the increased precision of upcoming data releases and will definitely lead to requirements on future astrometric missions.

During the initial phase of MWGaiaDN, ESRs 2, 5, 8 and UCL PhD will exploit Gaia Data Release 3 as outlined in the project descriptions in Sec 3.1.3. This will inform the requirements for next generation near infra-red astrometry, where the optical Gaia mission will not provide sufficient sensitivity or coverage in addressing follow-on investigations of Milky Way formation (for instance in mapping the detailed disk structure towards the galactic centre).

1.1.2.2 WP4: Gaia Frontiers: Stars and Planets

This theme addresses the main advances expected from Gaia data on the fundamental properties of planets and stars as fossils of the formation and evolution of the MW

The life of Stars. As described in sec. 1.1.3.1 large samples of stars of well-known parameters spanning wide age and metallicity ranges enable the study of the formation and evolution of the MW. However, the determination of stellar parameters often relies critically on the completeness and accuracy of stellar models. In spite of the recent progress in stellar evolution modelling, several open problems remain. In particular the effects of mixing in stellar interiors, stellar rotation, and magnetic fields remain poorly understood. While 3D stellar modelling is still quite challenging, 1D stellar models prescribe or approximate multidimensional phenomena introducing a simple parameterization. Due to their chemical and age homogeneity, open clusters are a key tool for stellar model calibration. MWGaiaDN will exploit Gaia data and supporting ground based spectroscopic surveys to answer a fundamental question *Can we put further constraints on stellar physics to safely use stars as fossils for Galactic formation and evolution?* The immediate goals are: (a) calibrate stellar structure and evolution models; (b) refine our knowledge of the properties of the star clusters for Galactic study; (c) define the properties of stars hosting exoplanets. These key topics of study include:

- a) Use open clusters to refine and calibrate stellar models. Do stellar models properly reproduce empirical HR diagrams? Do we really understand the evolution of AGB star? Do we have a good description of the mass-luminosity relation? Do we really understand the evolution of stars at the low mass end? Having well defined ages and distances, star clusters provide an immediate link to stellar properties, such as absolute magnitudes and masses. This allows to calibrate isochrone properties (**ESR9**). Combining this with the analysis of chemical elements, we can get insight into stellar models. In particular, because it only survives in the outer layers of star, Li is a very sensitive tracer of stellar evolution and non-standard mixing, while s-elements in young stars can trace the stellar chromospheric activity and ultimately how magnetic fields influence the formation of lines in stellar spectra (**ESR3**).
- b) Refine our knowledge of the properties of the stars and clusters (**ESR1, ESR3, ESR9**). Revised stellar models can lead to a more accurate definition of star cluster properties such as stellar content, IMF, ages. The effects of binarity, rotation, and chemical compositions will be thoroughly explored. Ultimately, this will provide an accurate data base of open clusters which will be fundamental to trace the properties of the Galactic disk.
- c) Exoplanet host stars (**UCAM PhD**) will be studied to investigate the how the properties of these stars relate to their exoplanet systems. Are solar type stars more likely to host multi-exoplanet systems such as ours, rocky terrestrial planets close in, with more massive gas giants further out? What is the role of stellar multiplicity on exoplanet system architecture? This project will benefit from the long period systems to be published in Gaia DR3 (at the start of the network) and the much fuller list to be release in Gaia DR4 towards the end of the network activity, and the availability of high-resolution spectroscopy from e.g., WEAVE on the 4.2-m William Herschel Telescope.

During the initial phase of MWGaiaDN, ESRs 1, 2, 9 and UCAM PhD will exploit Gaia Data Release 3 as outlined in the project descriptions in Sec 3.1.3. This will inform the requirements for next generation near infra-red astrometry, where the optical Gaia mission will not provide sufficient sensitivity or coverage in addressing follow-on investigations of Milky Way stellar astrophysics (for instance in exploring young stellar clusters in the hitherto optically obscured regions towards the galactic centre).

1.1.2.3 WP5: Gaia Fundamentals: Space and Time

Future Astrometry, probing the Galaxy with Visible-NearIR Astrometry and Gravitational Waves: Gaia was first proposed over 20 years ago and is now delivering its first results with further releases in the coming years. Gaia has unique capabilities, which will keep it at the forefront of astrophysics for the foreseeable future, through to the 2030s. Its scientific results are already raising new questions, and the survey will continue to uncover surprises. To address these we will need the next level of astrometric data, beyond Gaia. The main concepts for this is to shift all-sky Gaia-like absolute astrometry into the Near-InfraRed (NIR). Recently, Hobbs et al. (2021)¹⁸ submitted a white paper to ESA's Voyage2050 call outlining the science case for all-sky NIR astrometry, known as GaiaNIR. This concept requires new technology developments and the development of methodology to extract the science from these challenging missions. To develop an all-sky NIR astrometry mission new efficient detectors in the optical and NIR are required. The conventional CCDs used on Gaia are not sensitive in the NIR. Additionally, to scan the entire sky and make global absolute parallax measurements the spacecraft must have a constant rotation, and this requires the detectors operate in Time Delayed Integration (TDI) mode or similar. A TDI solution would give similar accuracies as Gaia despite doubling the wavelength range. The science return from such a mission is very promising but a solution to the technology problem of implementing a TDI like solution in large format NIR detectors must now be found.

The Voyage2050 white paper (Hobbs et al., 2021) detailed three science cases for a NIR mission:

- a. NIR astrometry and simultaneous photometry is crucial for penetrating obscured regions of the MW to obtain a dense sampling of the phase space necessary to study the bulge, bar, bar-disk interface and spiral arms.
- b. A new mission could be combined with the older Gaia catalogue (currently ~ 1.7 billion sources) with a 20-year interval to give a much longer baseline of 25–35 years, with very accurate proper motions (a factor of 14–20 better in the two components) and improved parallaxes needed to measure to larger distances.
- c. A new mission would allow the slowly degrading accuracy of the Gaia visible reference frame, which will become the fundamental Celestial Reference Frame and the basis for all modern astronomical measurements, to be re-initialised back to a maximal precision. The mission will also allow the reference frame to be extended into the NIR which will provide a much denser grid suitable for future ground and space-based observatories (many will have IR instruments).

A NIR mission would observe at least 5 times as many stars as Gaia, assuming the same magnitude range, giving a huge increase in the catalogue size. This will present data processing challenges and collaboration with experts (e.g. Vera Rubin Observatory/LSST) will be important as they are pioneering expertise in this field.

A mission with sub- μ as accuracies presents a number of significant challenges, e.g.;

- The next level of astrometric accuracy will demand the next level of relativistic modelling of astrometric measurements. This requires research to refine the currently employed models and also, requires a refinement of our knowledge of the solar system and all parameters entering the model (e.g., better planetary ephemerides, asteroid masses, more accurate orbit of the spacecraft).
- Approaching sub- μ as levels, simple models of the time dependence of source coordinates may not be sufficient. Research into sources of astrometric jitter (e.g. star spots, faculae, or micro-lensing) and their effect on the interpretation of image locations in the data stream is required.
- Will the Gaia reference stars be sufficiently accurate in 20 years' time for an astrometry mission to achieve sub- μ as astrometry?
- How to manage the extreme spacecraft positioning and stability requirements.

Both of the above approaches will require system calibrations that are much better (by an order of magnitude) than the astrometric accuracy aimed for, which will be extremely challenging. This implies that the design of the instruments and mission concept will have to incorporate the data processing demands from the start. The question of how to combine the data from multiple missions with different accuracies and sky coverage at multiple epochs arises and international collaboration is needed to establish a standard framework for this (**ESR4**).

The completeness of detection of the AGN (used to fix the Gaia reference frame and link this to the ICRF) will be investigated, to increase the known catalogue in Gaia and determine how the detectability limits will change with GaiaNIR (**ESR6**, **ESR10**). The study will look for exotic binary AGN to probe fundamental galaxy growth scenarios.

Fundamental Parameters Considering greater accuracy of future astrometry (both from sub- μ as astrometry missions and from a combination of Gaia and future μ as astrometry from e.g., GaiaNIR) it is very important to ensure meaningful determination of various scientific parameters. This concerns physical or relativistic parameters (**ESR7**) that enter the corresponding astrometric model (e.g., the parameters of the relativistic deflection of light) and astrophysical parameters and, first of all, distances. In the latter case it is crucial to investigate various steps of the cosmic ladder from the very local to the 100 Mpc universe that will greatly benefit from Gaia and from future

¹⁸ Hobbs et al, 2021, Exp Astron, 51, 783: <https://link.springer.com/article/10.1007/s10686-021-09705-z>

astrometric programmes. The complementary expertise of the various nodes will be integrated in order to provide an accurate calibration of primary and secondary distance indicators and investigate the requirements on observation and source modelling for sub- μ as astrometry.

MWGaiaDN is highly original in addressing many key questions exploiting the Gaia and associated data available through the duration of the network (2022-2026). In parallel with these here and now studies, the network will lay the underpinnings for the next steps, where it is already clear that current missions are not sufficient, for example the need to probe more precisely the inner regions of our MW where the bulk of the stars and galaxy mass are. This requires science case and technical assessments to be progressed during the network, to enhance the likelihood of a future mission launching in the mid 2030's. This essential preparatory work now ensures the future. To address these questions, MWGaiaDN includes a work activity (within WP5) that will synthesize the results obtained over the lifetime of the network into a roadmap for achieving the next step in space astrometry. The scientific requirements on the next mission will be refined based on the outcome of the research projects defined in WPs 3, 4 and 5, while the science, technical, and engineering challenges will be more clearly identified from the research carried out in WP5 feeding through to Impact and Engagement in WP6. All the ESRs will be stimulated to provide an outlook on the next level of data required to address the new questions uncovered by their research. The preparation and synthesis of the Roadmap will be carried out in WP5, but with input from the ESRs across the network. This will be complemented by workshops on the art of astrometry and the challenges of future space-based astronomy. The work will culminate with a presentation of the Roadmap at the MWGaiaDN final conference, where initial community feedback will be gathered. The Roadmap document will be valuable to industry, who will have access to this requirements/scoping document, of relevance when participating in future mission proposals

Table 1.1: Work Package (WP) List

WP No.	WP Title	Lead Beneficiary No.	Start Month ¹⁹	End month	Activity Type ²⁰	Lead Beneficiary Short Name	ESR involvement (by ESR number)
1	Network Management	1	1	48	MGT	ULEI	ALL (partially)
2	Network Training,	4	1	48	TRN	UB	ALL (partially)
3	Gaia Frontiers: The MW as a Galaxy	7	1	48	RTD	UGA	2, 5, 8
4	Gaia Frontiers: Stars and Planets	2	1	48	RTD	INAF	1, 3, 9
5	Gaia Fundamentals: Space and Time	3	1	48	RTD	LUND	4, 6, 7,10
6	Impact, Inclusiveness and Public Engagement	23	1	48	DIS	UCAM	ALL (partially)

1.2 Soundness of the proposed methodology

1.2.1 Overall methodology

MWGaiaDN is built around the four network objectives, the four 'E's, namely: it will generate **Excellent** science exploiting the current state-of-the-art Gaia mission [O3]; it will **Extend** the techniques for sub- μ as astrometry [O4]; it will **Enhance** the skills of the next generation of scientists [O1], and it will **Effect** the next revolution in European-led astronomy with leadership in astrometrically grounded science [O2].

In order to advance the major science goals of the network, the research programmes are organised into **three research-oriented WPs (WP 3, 4, 5)** that cover the key science frontiers of Gaia. These inform the development of the roadmap (finalised in WP5) defining the future requirements and challenges progressing towards Near InfraRed (NIR) and sub- μ arcsec astrometry. The **management of the network (WP1)**, the oversight and coordination of the **ESR training programme (WP2)**, and the organisation of the network's **public engagement, communications, and data management (WP6)**, ensure that the research and training will achieve their maximum impact.

The following sections describe the key scientific challenges for each of the WP themes, noting the science and node-based research programmes for the network ESRs. There will be significant interaction between the ESRs at a range of levels. Within the theme-based WPs, the ESRs will interact through regular science progress teleconferences, meetings, and dedicated instant messaging platforms. Sec. 1.2 describes the network-wide training activities providing the underpinning for training in the techniques (scientific, technical, organisational) needed in addressing the science challenges. This will be organised and overseen by WP2. We highlight the synergies between the academic and industrial partners in Sec. 1.4.3. Deliverables and milestones are listed in Tab. 3.1b and Tab. 3.1c, respectively. The ESRs will all be enrolled in a PhD course leading to the award of a PhD.

¹⁹ Network start month, M1 will be Feb 2021.

²⁰ MGT: Management, RTD: Research, TRN: Training, DIS: Dissemination and Public Engagement.

1.2.2 Integration of methods and disciplines to pursue the objectives

The research programme is structured around the exploitation of Gaia data to further our understand of the evolution of the Milky Way. A range of techniques will be used: observational, theoretical, statistical, computational, Machine Learning. The DN contains experts in these various disciplines, and the ESR projects are structured to ensure that the research acquires a broad range of multi-disciplinary training through appropriate secondments to other beneficiaries or associate partners, bring in additional competences. Thus, ESR10 developing dynamical MW models will gain expertise in the visit to UGA in stellar populations. Challenges with immersive visualisation will addressed with expert input from our industrial partner (SUIL), who will provide network wide training through input to workshops (e.g., statistics and visualisation) and host an ESR project. The research outputs will be used to inform the next steps towards next generation near-infrared astrometry space missions. This involves assessments of science drivers with technical capability, this work will be undertaken in exchange placements at the DN industrial partners with expertise in space mission design (e.g., TAS, AIRBUS), guidance (SPIN), detectors (LEON).

The methodological approach to be adopted, especially in the areas of stellar evolution, astrostatistics and machine learning, will be reviewed at the kick off meeting of MWGaiaDN. This will allow any required adjustments in approach to be made in the light of insights resulting from the June 2022 release of Gaia data release 3.

1.2.3 Gender dimension and other diversity aspects

The research programme is focused on furthering our understanding of the cosmos, an undertaking that is important to all humankind, irrespective of gender or other diversity considerations. Our DN aims to promote gender equality in carrying out the research and innovation in our network through a range of concrete measures, leveraging the techniques embedded in the partner teams institutionally and through their existing collaborative partnerships. For instance, at the institute level, the IoA, Cambridge has a strong focus on equality & diversity²¹, and promotes gender inclusion through initiatives such as ‘Celebrating Women in Astronomy’²², participation in International Women’s Day, active mentoring of students, promoting female role models and so forth. Gender equality is embedded in the IoA culture, in training, recruitment, career progression and recognised through the University possessing the Athena Swan and Juno charter marks. Other beneficiary institutes have a similar focus on delivering on gender equality. More widely the Gaia collaboration encourages gender and diversity balance, promoting role models, for instance Gaia Women in Science. In recruiting our DN researchers best practice will be followed, and training will be provided, both institutionally, but also through specific MWGaiaDN events such as during induction and specific diversity training (see Tab 1.3b).

1.2.4 Open science practices

MWGaiaDN will place open science practices at the heart of the DN’s research methodology. The data generated in astronomy is published openly and widely. In particular, the success of Gaia is underpinned by the approach of releasing its data to the global community without restriction. Within the DN, its collaborative research will be shared at an early stage. Research outputs will be published as open access articles, with pre-prints made available in advance of publications through the ArXiv preprint server²³. The DN website will facilitate sharing of research, data will be linked via DOI’s, articles will be published through mechanisms such as Zenodo to ensure that material of a more technical nature, of contributions to workshops, are shared. Code generated through the network will be shared through a common code repository. The impact of the DN outputs will be increased through sharing more widely, e.g. channelling through our associate partner SAAO’s IAU Office of Astronomy for Development²⁴.

1.2.5 Research data management and management of other research outputs

The Data Management Plan (D6.1) is an early deliverable. This plan will define how all data generated during network activities will be accessed, mined, exploited, reproduced and disseminated, making the data findable, accessible, interoperable and reusable. Within MWGaiaDN a range of research outputs will be generated, including new survey data outputs, images and catalogues, simulations and software algorithms. The data volumes are significant (100’s GB for WEAVE survey data for instance – ESR1) but disk and processing resources are readily available to the beneficiary partner group teams. Data outputs will be made available through Virtual Observatory (IVOA)²⁵ protocols, e.g. WEAVE data will be available at the WEAVE Archive, and catalogues associated with publications will be made available via the CDS VizieR data repository²⁶. Software will be published on the

²¹ IoA, Cambridge equality and diversity pages at <https://www.ast.cam.ac.uk/about/equality.diversity.inclusion>

²² <https://www.ast.cam.ac.uk/about/equality.diversity/celebrating.women.astronomy>

²³ Open source: <http://www.zenodo.com>, <https://arxiv.org/archive/astro-ph>, <https://github.com/>

²⁴ The Office for Development: <https://www.astro4dev.org/>

²⁵ International Virtual Observatory Alliance: <https://www.ivoa.net> – generate data access protocols, implemented widely.

²⁶ <https://vizier.cds.unistra.fr/viz-bin/VizieR>

MWGaiaDN github repository²⁷. All data generated will be published conforming to FAIR principles, with standard metadata being provided to ensure that the data is described. The beneficiaries are all at the front of ensuring open access to data, and Gaia has been at the forefront of this open revolution. MWGaiaDN will continue this tradition.

1.3 Quality and credibility of the training programme

1.3.1 Overview and content structure of the doctoral training programme

Table 1.3 a Recruitment Deliverables per Beneficiary

Researcher No.	Recruiting Participant (short name)	PhD awarding entities	Planned Start Month 0-45	Duration (months) 3-36
1.	UB	University of Barcelona	8	36
2.	LEID	Leiden University	8	36
3.	INAF (Padova)	University of Padova	8	36
4.	LUND	Lund University	8	36
5.	UB	University of Barcelona	8	36
6.	UC	University of Coimbra	8	36
7.	TUD	Technical University Dresden	8	36
8.	UGA	Universite Grenoble Alpes	8	36
9.	NKUA	National and Kapodistrian University of Athens	8	36
10.	TUD	Technical University Dresden	8	36
Total				360
11*	UCAM	University of Cambridge	9	36
12*	UCL	University College London	8	36

* Researchers 11 and 12 are recruited by UK-based associated partners, they are not supported by EU funds, and will be supported by UK funds.

The training programmes seek to **develop the expertise of ESRs** across the key science topics where Gaia will have a major impact. These topics, taken as a whole, will lead to fundamental breakthroughs in our understanding of the properties of the MW and its constituents. Each research topic, working at the limits of the possibilities offered by the Gaia data will act to inform the requirements on future programmes aimed at delivering NIR astrometry.

The training programmes offered at each of the nodes are tailored to the specific needs of that particular science question. The ESRs will be working with leading experts in those fields. The ESR training will be matched to their individual career development plans (Sec. 3.1.10). The benefit of the network is fully realised with the **integration of the science themes**, coupled with the application of cross theme technique developments. In order to progress beyond each of the science themes, new techniques will need to be developed and utilised to address a range of technological challenges. The network wide training will emphasise expert training in these techniques and technologies. Science theme training will be delivered through interactions within the WPs and through a PhD study programme for each of the ESRs.

The training is structured to provide **cross science theme technology and complementary skills training**, organised primarily on the network wide basis. Here the involvement and the expertise from the industrial partners in the MWGaiaDN are of paramount importance. This training, coupled with the WP/node-based science thematic training, ensures that each ESR receives the best possible blend of training delivered by the experts in the network. The training exposes the ESRs not only to the non-academic sector, through visits and workshops involving all the industrial partners, but also provides opportunities to attend workshops and secondments across Europe, with involvement of experts in a range of disciplines (e.g., astronomers, engineers, computer experts).

The training at the **non-academic partners will extend the core academic training**. At ABUSDS and SPINW, the ESRs will learn how scientific priorities are implemented in the industrial and commercial settings in the context of both large and SME organisations, and how the trade-off process is managed. At INSYS, the ESR will learn how advanced IT systems can be commercialised, e.g., the economics of software as a service, and cloud-based computing charging structures. Training at DIRAC will show how the largest ground-based telescope project (LSST/VRO) in the USA is being developed, and how the significant data handling issues will be addressed. Training at DAPC will focus on the integration of ESR developed algorithms to directly access the Gaia data in a production environment. MWGaiaDN training involves **core science and transferable skills schools**, together with WP specific workshops, in addition to student (and indeed expert researcher) exchanges. The training events all involve expert organisation, the full organising committee for each event would have ESR involvement (with appropriate gender balance). It is valuable to have ESR involvement in the training organisation; this benefits the ESRs and brings the student voice to the forefront of the network. All meetings will involve presentations from network experts complemented by external experts.

²⁷ See <https://github.com/agabrown/PyGaia> for an example of Gaia related software published via GitHub

For most workshops and schools, we would seek to co-organise (and co-fund) through the wider GREAT/MW-Gaia network (see Sec. 1.1.1) or other related networks, as this allows for greater interaction (and hence impact) with partners and students outside of MWGaiaDN. This interaction worked extremely well with the GREAT ESF RNP and EC FP7 GREAT-ITN networks.

Workshops and schools will publish on-line the talks and presentation materials. The final conference will be published as a proceeding via an open access journal.

The training programme will result in a group of motivated and skilled young researchers.

Table 1.3 b Main Network-Wide Training Events, Conferences and Contribution of Beneficiaries

	Main Training Events & Conferences	ECTS ²⁸ (if any)	Lead Institution	Action Month (estimated)
1	WP1: MWGaiaDN Kick-Off: full network meeting (FM1) [Cambridge]	-	LEID/ UCAM	2
2	WP2: The MWGaiaDN Training programme: Kick-Off Workshop [Barcelona]	-	UB	6
3	WP2: ESR Induction School: Introduction to the Science and Data of Gaia [Leiden]	1	LEID	9
4	WP3: Thematic Workshop: Galaxy Modelling [London]	0.5	UCL	10
5	WP4: Thematic Workshop: The frontiers of stellar physics: comparing theory with observations [Padova]	0.5	INAF (Padova)	11
6	WP2: ESR School: Introduction to Astro-statistics and data visualisation [Coimbra]	1	UC	12
7	WP1: MWGaiaDN mid-term review and full network meeting (FM2) [Leiden]	-	LEID	13
8	WP5: Thematic Workshop: The Art of Astrometry and computation [Lund]	0.5	LUND	15
9	WP2: ESR Transferable Skills School: Managing Complex Systems & Enterprise [Barcelona]	1	UB/ DAPC	16
11	WP6: OUTREACH Event: Gaia Map@ IAU GA [Cape Town/ Athens/ Cambridge]	0.5	SAAO/ NKUA	19
11	WP2: ESR School: Astro Big Data [Seattle]	1	DIRAC	20
12	WP2: Diversity, Public Engagement and Communication training [Leiden]	0.5	LEID	21
13	WP5: Roadmap: Technical Challenges workshop [Cambridge]	0.5	LUND	26
14	WP3: Thematic Workshop: The Galactic Centre [Grenoble]	0.5	UGA	29
15	WP5: Thematic Workshop: Gravitation and Astrometry [Dresden]	0.5	TUD	30
16	WP1: Year 4 and final full network meeting (FM3) [Padova]	0.5	INAF (Padova)	42
17	WP6: At the Frontiers of Gaia: pushing boundaries, exploring NIR astrometry and breaking the microarcsec barrier. An international conference [Athens]	1	NKUA	47

1.3.1.1 Core Training Schools

These core training schools will constitute keystones of the training programme for each ESR. The main cross network training events will occur in the second and third years of the network, to ensure that all ESRs will be able to benefit, recognising that all ESRs will be in place by the end of the first year. All core schools will take place after the Gaia DR3 release²⁹, hence the ESRs will benefit from access to high quality Gaia data. The envisaged core schools are:

- a) **Induction school** [5days] for all new ESRs (Lorentz Centre, Leiden, NL) to introduce all to Gaia and its science potential. Each science theme will be addressed via expert invited talks. Each ESR science project will be introduced. Specific sessions devoted to working with the rich data from Gaia, e.g., new spectrophotometric data forming a key component of Gaia DR3, to ground all ESRs in the use of techniques for exploiting Gaia data. Sessions on improving ESR scientific presentation skills (where feedback on the ESR presentations will be given by professional trainers), project management (for international collaborations) and grant proposal writing.
- b) **Astro-statistics school and data visualisation** [5days] (University of Coimbra, PT): providing an intense hands-on course covering practical approaches to the statistical analysis and interpretation of astronomical data. This will be organised by UC, DIRAC and SUIL, taking advantage of their expertise in developing machine learning and data mining for astronomy³⁰ and immersive visualisation³¹.

²⁸ Indicated ECTS credits are the approximate credit equivalent of the training. Computed using the NL level of 1 ECTS = 28 hours of training and preparation time. NB; not all countries in the network have implemented the ECTS system (e.g. not used at the University of Cambridge).

²⁹ Gaia data release schedule at <http://www.cosmos.esa.int/web/gaia/release>. Gaia DR3 is due Q2 2022 and will be available for the ESR projects, with the Gaia DR4 likely 2025, hence available for the final year of a typical researcher 4 year PhD project.

³⁰ See e.g. the AstroML site at <http://www.astronml.org/> (developed by the Washington, DIRAC partners).

³¹ See Suil's immersive visualisation in the context of annotated cellular analysis. This will be transferred to the case of annotated stellar data from Gaia. <https://cancergrandchallenges.org/news/why-virtual-reality-future>

- c) **Astro-Big data school** [4 days] (DIRAC, University of Washington, Seattle, USA): providing a focused course covering approaches to the handling and interpretation of large (big) data, and in particular complex Gaia data. Co-organised by the DIRAC and UCL and follows the earlier astro-statistics course.

1.3.1.2 Core Project Management, Entrepreneurship and Public Engagement Training

These core schools will provide key additional training in addition to that normally found within the academic PhD programmes. These skills will provide the ESRs with a powerful set of techniques, essential if they decide to transfer their academic knowledge to the commercial setting.

- a) **Managing complex systems, enterprise and entrepreneurial skills**: (Barcelona) [5-day] Topics: introduction to formal project management techniques such as Agile programming, waterfall methods, the Unified Process. Human resource management, project planning, financial control, risk management, scientific project control. IPR, and how patents, licensing rights are managed. The ESRs will receive specific enterprise training. One day will be devoted to team-work skills.
- b) **Diversity and Public Engagement Training** (Leiden, NL) [5-day] Topics: public engagement with research, practical skills on engagement with different audiences (including policy-makers), practical development of a public engagement project about Gaia. Training in social innovation, applying scientific knowledge to tackle social issues, gender and diversity training, contribute to the UN's Sustainable Development Goals.
- c) **Public Engagement events**. The main outputs of the network will be presented at the summer 2024 IAU GA with an event that will demonstrate the wonder of the **Gaia Map** of the Cosmos. This event will link schools in Europe to those in Southern Africa, to provide a unique link up between Gaia, Europe and Africa. Organised by NKUA, UCAM and SAAO/ IAU Office for Astronomy Development.

1.3.1.3 WP Thematic Workshops and Conferences

Workshops will address key WP specific issues, with ESRs from the WP attending. All will involve detail in-depth discussions on the topics, and include invited external expertise.

- a) **WP3: Galaxy Modelling** (London, UK): workshop topics: mass modelling, kinematic modelling, dynamical modelling, stellar population modelling and dust extinction modelling. Challenges in applying modelling techniques to reconstruct the structure of the Galaxy from a large volume of the complex observational data that Gaia will produce. Hands-on session for ESRs to apply some of the modelling techniques to the available Gaia real and model data.
- b) **WP3: The Galactic Centre** (Grenoble, FR): workshop topics: dynamical structure of the Galactic nucleus, search for observational relics of a sequential merger of multiple black holes to form the supermassive black hole at the centre, formation of open clusters at the Central Molecular Zone, the origin of X-ray point sources around the centre (e.g. symbiotic X-ray binaries), dust distribution. The challenges of near infrared astrometry in the crowded galactic centre will be addressed
- c) **WP4: The frontiers of stellar physics: comparing theory with observations** (INAF/Padua, IT). The workshop will address next decade challenges on stellar evolution and pulsation, through synergies between new observation technologies, advances in theory, and multi-dimensional modelling. The challenges and the opportunities posed by the on-going and near future spectroscopic, photometric and astrometric and asteroseismic surveys (Gaia next data releases, WEAVE, 4MOST, LSST, TESS, PLATO...) will be discussed
- d) **WP5: The Art of Astrometry and Computation** (Lund, SE): Building astrometric modelling and first global solutions of the Gaia mission, this workshop will give ESRs a deep insight into the astrometric and computational challenges of this and future missions with tutorials and hands-on simulations.
- e) **WP5: Gravitation and Astrometry** (Dresden, DE): The problem of relativistic modelling in astrometry both at the level of Gaia and beyond will be overviewed. Open problems will be formulated, and the prospects assessed. Applications of astrometry to test fundamental physical theories will be reviewed.
- f) **WP5: Technical challenges of space-based astronomy** (Cambridge, UK). Organised by UCAM/LUND/TUD, with involvement of ABUSDS, LEON, OHB, SPINW, TAS. Part of the NIR and sub- μ s road-mapping exercise, will consider the complexities of constructing, and using space-based telescopes. Cover successes and challenges in the delivery of the Gaia mission, and note issues in moving to a successor mission.
- g) **WP6: Final Conference**. 'At the Frontiers of Gaia: pushing boundaries, exploring NIR astrometry and breaking the μ s barrier'. This major conference (Athens, GR) will present all research carried out in MWGaiaDN, and keynote invited talks. Some sessions will be organised by the ESRs. The conference will present the WP5 Roadmap for next steps in astrometry.

1.3.1.4 Training at the host and partner institutes

Each ESR will benefit from the professional development and training courses available at their host institutes, all of which have a strong record of excellence in research and training. Each institute offers a comprehensive range of

training in complementary skills³². All will be encouraged to take appropriate courses, for instance in language skills, academic writing, effective research management, communication and presentation skills. Local training will also be delivered in topics such as grant preparation, appropriate at the national level. The DTC will monitor the level of local complementary training undertaken by each ESR, to ensure that minimum levels are reached.

ESRs on secondment to industrial or astronomical facility partners will receive local training in areas such as project management, finance control, use of IT in a commercial setting, and so forth.

1.3.1.5 Opportunities through the wider GREAT/MWGaia network

The network's ESRs will be encouraged to participate in relevant activities organised through the wider GREAT/MW-Gaia programme. Additional science workshops and exchanges will be funded through our MW-Gaia COST supported action.

1.3.2 Role of non-academic sector in the training programme

The industrial partners (both large and SME) bring considerable expertise and experience in a range of key areas: development of advanced space systems (ABUSDS, OHB, SPINW, TAS), advanced database technologies (INSYS), managing Big-Data (DAPC), developing high performance virtual reality environments (SUIL). They have a fundamental role in delivering the required complementary training to the network ESRs and play a significant role in the organisation of the network wide training aspects of MWGaiaDN. Their membership of the Consortium Supervisory Board (CSB) and the Doctoral Training Committee (DTC), ensures that they strongly influence the strategic development of the network to ensure that the training offered through the network is not only appropriate scientifically, but also has more general relevance in training future expertise able to contribute to industry. The focus here would be ensuring relevant technical skills to enable an ESR to enter into the knowledge economy, essential for ensuring European economic success. The industrial partners represent significant leaders in technologies of immediate use to the science of Gaia. All of the partners have existing links to one or more of the full beneficiary nodes of the network, and are working with ESA and the DPAC in the design and implementation of the processing and analysis system for Gaia. These links to the industrial partners will make their integration into the network that much quicker.

1.4 Quality of the supervision

1.4.1 Qualifications and supervision experience of supervisors

Each ESR will be enrolled in a postgraduate programme at their host node (ESR project descriptions can be found in **Table 3.1.d**), leading to the award of a postgraduate degree at the PhD level. All of the MWGaiaDN nodes are world-class research institutions, with established excellence in academic training. Each ESR will benefit from state-of-the-art research training delivered by working in their host institute, coupled to a rich network-wide training programme. Qualified expert academics, all with significant experience in supervision of PhD's, all leading research teams, and all leaders in the development and science of Gaia will supervise the ESRs.

Importantly each ESR will gain further benefit from the close and dynamic research networking offered through the MWGaiaDN, particularly through the science interactions within the WPs. All hosts offer a full range of complementary training in related skills, such as transferable skills, scientific writing and presentation skills, language and programming skills, etc. In addition, where a particular host institute may not have the complete range of in-house complementary skills training, the ESRs will be able to benefit from 'top-up' training offered via training from other nodes in the network. A number of the core and associate nodes offer specialised training programmes, through the DN these will be made available to all network ESRs. All ESRs will additionally be encouraged to participate in relevant nationally organised training events, e.g. the STFC PhD summer school in the UK.

The DTC will be responsible for network wide oversight of the training programme, and will review progress of each student against his or her personal career development plans. The supervision offered at all beneficiaries follows the MSCA guidelines on supervision³³.

Note: Information concerning the role and profile of beneficiary node staff can be found in the Participating Organisations tables. The lead supervisors at each beneficiary node have significant experience in student supervision, all having supervised multiple PhD and MSc level students at their host institutions. For instance, the MWGaiaDN coordinator (Walton) was previously coordinator of the FP7 GREAT Initial Training Network (grant 264895) and his PhD student from that project has recently been awarded a new ERC Starting Grant in the latest Horizon Europe ERC 2021 round.

³² E.g. transferable skills courses at LEID: <https://www.lumc.nl/res/att/14050700035257/Transferable-skills-courses> or the training courses offered at UCAM: <http://www.training.cam.ac.uk/> & researcher specific at <http://www.training.cam.ac.uk/theme?providerId=36644>

³³ MSCA guidelines on supervision: <https://op.europa.eu/en/publication-detail/-/publication/bb02d56e-9b3c-11eb-b85c-01aa75ed71a1/language-en>

1.4.2 *Quality of the joint supervision arrangements*

All ESRs will be enrolled in a PhD programme at their host institute. To support the training of the ESR, each will have a Supervisory Committee (SC) which will contain the primary host institute supervisor, one supervisor from the ESRs academic secondment host institute, and one from the industrial or technical facility secondment partner. The role of the SC will be to establish the ESR's Personal Career Development Plan (PCDP) and then review the ESR's training and development progress. The SC will meet with the ESR on a quarterly basis (or at the request of the ESR if needed more frequently), with the first meeting being shortly after the ESR joins (so before M10). Day to day supervision will rest with the primary supervisor together with the ESRs secondary supervisor when on secondment. All PCDPs will be held by the Doctoral Training committee (DTC), and each ESR SC will report to the DTC on a 6 monthly basis to enable overall monitoring of the Doctoral Training. Further details of progress monitoring and evaluation of the ESRs is described in **Sec. 3.2.5**.

2 Impact

2.1 Contribution to structuring doctoral training at the European level and to strengthening European innovation capacity

MWGaiaDN will enhance the innovation capacity across Europe, with our network and training supporting:

1. Open innovation, open science and open to the world EU research and innovation goals³⁴.
2. Research related to the ICT and Space sectors, identified by the EU³⁵ as key areas of industrial competences enhancing Europe's global competitiveness.

MWGaiaDN will contribute to the realization of an integrated European Research Area. It will:

- a) Structure European expertise in Galactic astronomy and the efficient handling of the associated huge data sets required to support key science programmes. The research programme will provide open access to its outputs, supporting open science, open to the world.
- b) Facilitate and provide a framework for the interaction between scientists and experts from the industrial sector and academia. Foreground generated in the network will support open innovation.
- c) Reinforce the existing European competitiveness in the exploitation of the Gaia data, and the continuation and enhancement of this competitiveness in the young generation of scientists.
- d) Prepare the participating institutes for future collaborative projects in this and related areas.
- e) Link the wider community with the team generating the Gaia data products: the GREAT/MW-Gaia network generally and MWGaiaDN specifically, provides the essential venue in which the community of researchers and engineers directly involved in the construction and operations of the Gaia data analysis system can interact with the wider European and World community of astronomers who will be involved in the scientific exploitation of Gaia.
- f) Foster collaboration between partners: a legacy of MWGaiaDN will be the enduring research collaborations and industry links developed by the partners as a result of this network. Looking ahead to future ESA European space missions³⁶ collaborations developed here (e.g., with NAOJ, TAS, OHB, LEON, ABUSDS) may be further developed in the development of major new ESA space missions.
- g) Train the ESRs with transferable skills. Leverage our industrial and specialist partners training expertise in areas such as research commercialisation, training in entrepreneurship, training in research facility operations, to increase the innovation potential of the network and its ESRs.
- h) Balance the needs of mobility and research interaction with the needs of the climate. We will optimise the training programme to reduce travel where possible (e.g., co-organisation of some network meetings, enabling remote participation via video link). Where travel is required, participants will be encouraged to use 'low carbon footprint' options, e.g., train instead of plane.

This DN programme will stimulate a vibrant European astronomy research community, at the forefront of the analysis and interpretation of the Gaia data. This will **make Europe attractive to scientists from abroad**, including US astronomers who have no comparable space astrometry project planned, as confirmed in their recent US decadal survey.

Our network builds upon our active MW-Gaia COST action, through the training of a new cohort of ESRs, in specific research topics focussed on maximising the scientific exploitation of Gaia, and building the scientific (and to a lesser extent, the technical case) for the next generation European astrometry mission. The COST Action, by its nature, does not finance people, rather it supports the organisation of training events and short-term exchange visits. Thus, there are strong synergies between COST and the DN, and indeed the impact and reach of MWGaiaDN will be

³⁴ see https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy_en

³⁵ see <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/leadership-enabling-and-industrial-technologies>

³⁶ see <https://www.cosmos.esa.int/web/voyage-2050> for planning for ESAs space programme from the mid 2030's

increased through the alignment of the two programmes (to the benefit of the ESRs, and the wider community engaged in the COST Action).

Gaia is a flagship European mission through the current decade and its data is unique in size and accuracy, the data is publicly available world-wide as soon as they are released. The GREAT/MW-Gaia network has a key role in ensuring European leadership of the scientific exploitation of the Gaia data. **The collaborative projects envisaged in MWGaiaDN will ensure maintenance of this leadership and drive our understanding of the cosmos.**

2.1.1 contribution of the non-academic sector to the doctoral training

MWGaiaDN links key partners in the Space and Information Technology sectors. These linkages provide a strong two-way exchange of expert knowledge:

- a) The ESRs benefit from gaining a meaningful degree of exposure to industry and commerce. All ESRs will have training secondments to the leading industrial partners (or in some cases major technical facilities), offering them insight into the application of their research in generating products and services.
- b) The industrial partners benefit by their close interaction with the world's leading scientific groups of the DN. Their exposure to the scientific use cases will be invaluable to the industrial partners in furthering the development of their technologies.

The ESRs will have access to training across a range of topics that will improve their data science skills. They will also gain an understanding of the role of research outside of the academic setting.

Training examples that will be carried out at the non-academic partners include:

- i. With ABUSDS, OHB, LEON, TAS to define scientific drivers for the next generation of space astrometry.
- ii. With INSYS, DAPC, where use of advanced database systems will be stretched when using them to support large scale analysis of multi-million object sub samples.

Most ESRs will have a secondment visit of between 2 to 4 months to an industrial partner where they will receive technical training related to their specific research project. These are outlined in the ESR project specifications in Tab. **3.1.d**. The industrial partners bring expertise topics ranging from the development of immersion VR applied to data exploration (SUIL), to optical design considerations for future astrometry missions (ABUSDS, OHB, TAS), to detector choices for future near-IR astrometry missions (LEON), to advanced high performance database systems (INSYS), to asteroid-relative optical navigation (SPINW), to data and complex data processing pipelines design (DAPC). The ESRs will experience the working environment in industry, and have the chance to contrast the difference between work processes in academia and commerce. ESRs will be seconded to our Astronomical Facility partners (NAOJ, SAAO, DIRAC), gaining training in design of space systems (NAOJ), observational programmes (SAAO) and data analysis techniques (DIRAC).

Many aspects of the industrial and network wide training will support enhancing the ESRs technical skills in the data science arena. These are highly transferable skills relevant for future careers outside of astronomy or indeed cross domain research, e.g., astronomical image analysis expertise is being used in a high impact cancer research programme investigating breast cancer treatment pathways³⁷.

The non-academic partners bring essential training to the development of the ESRs, their participation increasing the level of inter-sectoral collaboration across the network. The active participation of the industrial partners in the development of the ESR research programme (e.g., through their involvement in the ESR's Supervisory Committee (SC) and input the PCDP for each ESR - see Sec. **1.3.2**) will help shape the nature of the ESR's research, which will be a good means to enhance knowledge transfer within an ESR project and across ESR projects. Coupled with the mobility aspects of the training, this will enhance the ESR skills relevant to careers outside of the academic sector.

The unique combination of skills and partners in this network, blending the very best science groups in Europe, the leading science development and support teams in Gaia/DPAC, together with leading IT and Space sector industrial partners, will ensure enduring partnership, delivering better science for Europe and the World.

2.1.2 Developing sustainable elements of doctoral programmes

The MWGaiaDN training programme strongly aligns with the **seven principles for innovative doctoral training**³⁸. The research topic for each ESR will be of the highest scientific quality, carried out at research intensive institutes. Each host institute will offer an excellent working environment. The training offered will have interdisciplinary options, both through options offered by the host institute training programmes, and through exposure to the network secondments within the network. Each ESR will have meaningful exposure to industry, and other employment opportunities, through secondments to the network's industrial and astronomical observatory partners. There will be opportunities for international networking, through secondments, participation at network workshops and training events, and attendance at scientific conferences, across Europe and further afield (e.g., USA, South Africa). The **ESR training is quality assured**, through network and host institute processes (see Sec **1.3.2**).

³⁷ Walton leads the image analysis group of the [Cancer Research UK's Grand Challenge](https://www.cruk.cam.ac.uk/research-groups/imaxt-laboratory) project: [Imaging and Molecular Annotation of Xenografts and Tumours](https://www.cruk.cam.ac.uk/research-groups/imaxt-laboratory) (IMAXT) - see <https://www.cruk.cam.ac.uk/research-groups/imaxt-laboratory>

³⁸ See the [Salzburg II Recommendations](#) & [Principles for Innovative Doctoral Training](#)

MWGaiaDN will have impact in furthering the development and spreading of best practice in wider European collaborative research training programmes. Through links with our related MW-Gaia COST Action, it will be possible to **align best practice** in the delivery of the MW-Gaia COST Action exchange visits, e.g., MWGaiaDN training events will be co-organised with participation of the COST Action (i.e., the Public Engagement and Communication event). At the national level, best practices will be used by our participants in designing their personal, departmental or institutional training programmes. MWGaiaDN will leave a long-term imprint on the participating organizations through the establishment of joint courses and curricula that will continue to be very useful long after the end of this project. Lecture notes and other training material will be made openly available so that departments throughout Europe can benefit from them in their education.

The extreme breadth of Gaia's scientific scope has a **lasting beneficial effect** on the participating institutes, which the DN will help to bring about through its involvement of researchers from many different sub-disciplines of astronomy. For example, cosmologists are brought together with stellar dynamicists, with astronomers working on stellar abundances and astronomers searching for exoplanets. In contrast to other astronomical observing facilities with a broad range of astronomical applications (e.g., HST, VLT), where the different fields of research independently collect and analyze their specific data, all fields of research on Gaia will use the very same observed data set. This unique characteristic of Gaia will greatly reinforce the mutual understanding of the different sub-disciplines.

MWGaiaDN is an initiative of our long running Gaia GREAT/MW-Gaia network, which been active in supporting the development of expertise related to the Gaia mission, since 2009. Our currently running MW-Gaia COST action will overlap with the first year of MWGaiaDN. We anticipate that this **training, networking, and collaboration will continue** on after MWGaiaDN ends, where we will propose a follow-on COST Action from November 2024. The impact of MWGaiaDN will be ensured through continued networking, recognising that Gaia and the astrophysical research that it enables continues through to the end of this decade, and that there will need to be the strong community links to support the development of missions post Gaia in the 2030's.

2.2 Credibility of the measures to enhance the career perspectives and employability of researchers and contribution to their skills development

The network will deliver a cohort of excellent new researchers, who will be well placed to either form a future generation of scientific leaders in astronomy, or in applying their innovative skills in industry, commerce, the public sector, etc. The training programme strongly aligns with the priorities set out in the Europe 2020 Flagship Initiative – Agenda for new skills and jobs³⁹, providing the ESRs with the mix of skills and competencies needed to compete in Europe's job market.

MWGaiaDN will deliver the highest quality **research training** in this key area of astrophysics, utilising the state-of-the-art Gaia data, delivered by the key experts in the field. The network will take place during the period when the most complex and scientifically rich Gaia data will be published. The network timing is ideal for the recruited researchers to continue their careers within the large and expanding scientific community exploiting the Gaia mission data. The ESRs will gain unique expertise, in key astrophysics topic areas, with skills in cutting edge data science technologies, not readily available elsewhere, that will be much in demand in the coming decade. The projects undertaken by the ESRs will generate significant science returns in the form of high impact publications, of benefit to their future academic careers.

MWGaiaDN **transferable skills** training in project management, efficient team work, distributed computing, handling 'big data' and advanced data analysis techniques will make these young researchers attractive to the industry sector as well, should they choose to continue their careers outside of academia. The ESRs will be especially well equipped for areas requiring analytic and data science expertise, such as finance, IT, aerospace, defence, or in data analysis in for instance the life sciences sector. **Employment opportunities** may open for the ESRs at one of the network partners.

Many of the science programmes exploiting Gaia data require multi-institute collaborations; the ESRs will gain experience in these, the ability to work in distributed teams, being a valuable skill in many work situations. The ESRs will gain significant **networking skills** through their interactions across the network, through the secondments and exposure to a range of organisations, through participation in network workshops and other training events. These will be useful networking opportunities, helping each ESR build up their network of contacts, valuable in the next steps of their career. The ESRs will also have gained the ability to work in differing environments (sectorial, geographically, etc) which will also enhance their entrepreneurial opportunities. The ESRs will participate in a range of **public engagement training and activities** which will ensure that they are equipped with the communication skills required to succeed in their future careers. Their exposure to the transnational **mobility** aspects of the network,

³⁹ see <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0682:FIN:en:PDF>

including secondments and attendance at training events will ensure that they benefit from exposure to the range of cultures (working, organisational, social) across Europe⁴⁰.

MWGaiaDN will not only have a positive impact for its ESRs but also for a significant number of PhD students at the network institutes, and wider. We envisage many of the Doctoral Training events to have the capacity to involve external PhD students, and with the material from each event made available, it will be possible to re-use in many cases. This will be especially important in supporting continuing training more widely across Europe, and further afield, e.g. USA, South Africa and Japan. The training will impact the training experience of astronomy PhD students across Europe and wider.

2.3 Suitability and quality of the measures to maximise expected outcomes and impacts, as set out in the dissemination and exploitation plan, including communication activities

2.3.1 Plan for the dissemination and exploitation activities, including communication activities

MWGaiaDN will generate a wide range of outputs, of value scientifically, technically, managerially. It will be of interest to a wide range of audiences, from specialist science groups, more generally across research boundaries, to industry, to the wider public. All materials will be published through the appropriate channels: peer review journals, technical journals. Software will be made available through the MWGaiaDN website and we will participate in the EU Open Data pilot initiative. Blogs and Twitter feeds will disseminate new results.

Research papers will be published by the ESRs through high impact journals, primarily, Nature, Nature Astronomy, and Astronomy & Astrophysics. Technical papers will be presented at relevant conferences such as the SPIE Astronomical Telescopes track and proceedings. Our research papers will always be published as open access papers. Development of the technical Astrometry roadmap exercise will continue within the ESA Voyage 2050 programme. It is expected that each ESR will have 3 to 5 peer reviewed papers published or in review at the point of gaining their PhD. The PCDP for each ESR will give a target figure for these publications, together with estimated conference/meetings to be attended. This will be reviewed each year by the Training Committee.

The ESRs will attend all network wide schools and conferences (e.g., those organised within WP2 and WP6). They will also attend workshops organised within their WPs (e.g., WP3). The network will ensure ESR participation in the organisation of these events, with participation from the ESR cohort on the final network conference. ESRs will be encouraged to attend relevant externally organised workshops and conferences to enable them to present their research to the wider community.

MWGaiaDN will participate in the Horizon Europe Open Data Pilot, the concept of open access science is well established in the astrophysics research community, openness encourages discovery.

The networks Public Engagement and Impact Committee (PEIC, see Sec 3.2.1) will be responsible for developing measures to maximise the innovation potential of MWGaiaDN. It will define a set of quantifiable targets for measuring the effectiveness of dissemination, exploitation, communication and public engagement activities (e.g., monitoring number of website visits, twitter feed followers, citations of network publications, etc), and track these through the life of the network. Statistics as to network meeting attendance will be gathered. Evaluation surveys will be carried out after each event, with feedback from these helping improve future events. Impact of events will be monitored, e.g., tracking publications resulting from ideas or partnerships initiated at network meetings.

MWGaiaDN will implement a high-profile effective communication strategy, the plan being published as part of the Network Plan (within D1.1). The ESRs will be involved in communication and public engagement at all levels, from planning, to delivery, to reporting and evaluation of the effectiveness of the actions. WP6 is constituted to organise and deliver the DN's Communications. Evaluation of the public engagement programme will be the responsibility of the PEIC (see Sec 3.1.5 below).

Scientific outreach will be facilitated via MWGaiaDN participation at major astronomical society meetings. There will be a presence at each of the annual meetings of the European Astronomical Society. These week-long meetings are usually held end June of each year at a major astronomical centre. The GREAT network has participated at each EAS Annual meeting since 2012, organising meetings and science symposia. The DN's ESRs will thus be able to present, to a large European science audience, their current research results.

The International Astronomical Union's General Assembly (IAU GA) is held every three years and is the premier astronomy science meeting, typically with several thousand attendees. The DN will host an outreach exhibition stand at the IAU GA (D6.2), which is to be held in Cape Town, August 2024, updating on MWGaiaDN activities.

In order to demonstrate the wonder of Gaia and its mission to Map the MW, the DN will organise a live 'Gaia Map' link up with schools in Europe and Africa. This will be modelled on the successful 'Gaia Live in Schools' event that

⁴⁰ The transnational training delivered by MWGaiaDN in key areas of data science, highly relevant both to academia and important segments of European industry and commerce, strongly supports the Europe 2020 Flagship Initiative – Youth on the Move (see http://europa.eu/youthonthemove/docs/communication/youth-on-the-move_EN.pdf)

took place soon after the launch of Gaia⁴¹. The event (**D6.3**) will be held after the release of the major Gaia DR3 astrometric catalogues (which provide detailed distances to a billion stars in our MW – and hence the 3-D map of the Galaxy). At each school participating (target age of pupils being 12 yrs, thus starting secondary school children), an ESR (with additional PhD students from the DN's research teams) will provide demonstrations of science around Gaia in a practical and hands on manner. The session will include a live slot linking all schools to the Gaia team at ESA, where the school pupils get the opportunity to ask questions to the scientists 'running' this space satellite. Schools in southern Africa will also be involved, with the participation and organisation of our SAAO partner organisation (through the IAU Office of Astronomy Development). This event will be unique, inspiring and provide a lasting legacy of reusable materials.

During the network, News items will be published of the main network outputs and activities, with items specifically generated for varying end users (e.g., industry, policy makers, public engagement). The network will organise some specific workshops of relevance to industry. Policy makers will be invited to the network wide conferences. The DN will participate in relevant EU organised events. All presentations will acknowledge funding from the EU through the Horizon Europe MCSA programme.

The DN's website and associated social media feeds will play an important role in facilitating internal project networking and collaboration. It will consist of static pages to publish final reports, and also contain a wiki to allow for group interactions. Collaborative document creation (e.g., Dropbox, used for the creation of this proposal!) will also be used. MWGaiaDN will be present on social networking sites such as Twitter for the purposes of wider outreach. The ESRs will be tasked with ensuring that the project twitter feed is active, and that network meetings are adequately 'tweeted' out to the community.

Each network beneficiary and partner will also communicate and publicize the network's activities within their organisations, and at national levels. This will increase the visibility of the network.

2.3.2 Strategy for the management of intellectual property, foreseen protection measures

MWGaiaDN will produce new scientific advances in understanding in Astronomy and Astrophysics. These will be published as peer reviewed papers (**D3.3, D4.3, D5.4**) made accessible through open access repositories and journals. The network is focused on cutting edge astrophysical research increasing our understanding of the MW, and this supports the development of the case for next generation astrometry. Technical development is not envisaged, and hence directly patentable outputs are unlikely to result. However, it is anticipated that some techniques developed; especially in computational and analysis techniques may have wider applicability. For instance, techniques in the analysis of astronomical images can be applied to other domain data (e.g., remote sensing data, medical image data). ESRs that develop new techniques which may be exploited will be trained with the tools required to, for instance, patent the technique. Dissemination of results will consider implications for protecting the intellectual property⁴². In the case that patents will be filed, detailed and extensive peer review publication will occur later. The Collaboration Agreement will govern the use of Foreground IP by the network partners and cover the ownership and exploitation of such IP. The publication policy (within **D1.1**) will provide information on the routes for publication, which include publication via patent.

The key 'Toward near NIR-band sub- μ s astrometry' roadmap white paper, developed through the network, and finalised as deliverable **D5.3**, will be published as an open source document. It will be valuable to the community, decision makers and industry, providing input into science priority definition for future space astrometry (and related) missions, and the technical issues to be addressed.

The CA (Sec **3.1.5**) will govern the relationship and responsibilities of the partners of the network. Importantly this agreement will also define the intellectual property rights (IPR) and ownership of results pertaining to network activities. The guiding principle for the network is that all 'foreground' generated as a result of activity of the network will be released through open source channels such as GitHub and the EOSC portal⁴³ (for software) and Zenodo (for documents). Additionally, it is expected that all partners will provide access to their 'background' necessary to support the training activities of the network. The case of jointly owned results is explicitly defined in the CA. All node leaders have experience in management and policies concerning IPR and can draw on institutional IPR expertise in their Technology Transfer Offices, e.g., Cambridge Enterprise.

2.4 The magnitude and importance of the project's contribution to the expected scientific, societal and economic impacts (project's pathways towards impact)

2.4.1 Expected scientific impact(s)

MWGaiaDN will push the analysis of Gaia data to the limits, leading to feedback to DPAC on areas of improvement for DR4/DR5 and providing better quantified requirements on future space astrometry missions and future

⁴¹ See <http://blogs.esa.int/gaia/2014/04/04/gaia-live-in-school-inspiring-the-next-generation-of-european-space-scientists/> - this event linked over 2000 pupils in 34 schools across 10 European countries with Gaia scientists.

⁴² Advice will be sought from e.g. Cambridge Enterprise see <https://www.enterprise.cam.ac.uk/>

⁴³ See <https://eos-portal.eu/>

complementary photometric/spectroscopic surveys. The Milky Way will be understood at a deeper level, directly measuring galaxy hierarchical formation models through measuring changes in the MW disk orientation (**ESR2**), and how our MW formed through discovery of MW substructures as evidence of accreted galaxies (**ESR5**). The link from structure to stars will have a step change improvement, with the impact of binarity in determinations of the star formation rate being assessed (**ESR8**). Confrontation of stellar evolutionary models with Gaia observational data will provide ideas for and insights into improvements needed, such as in the role of magnetic fields on evolution (**ESR3**) or late-stage stellar modelling of AGB stars (**ESR9**) or reveals stars most likely to host solar type planet system architectures (**UCAM PhD**). A range of new analysis techniques for big data will emerge, for instance in optimised techniques to visualise the large Gaia datasets (**ESR1**). Relativistic astrometry modelling (**ESR7**) will reach new levels of accuracy, informs future developments needed for nano-arcsec missions. The celestial coordinate system will be established, with improvements to the lists of AGN anchoring that system (**ESR6**, **ESR10**). Study of galactic central regions will inform the plans for the JASMINE mission (**UCL PhD**). Finally, the DN will deliver a key study (**ESR4**) of how Gaia and a future GaiaNIR mission will finally reveal all components at play in the MW ecosystem, to allow the link between Galaxy dynamics and the link to star formation to be deciphered. This is truly a key question in our understanding of the cosmos, at large scales, and in our search for life in nearby stars.

MWGaiaDN will then make a significant and direct contribution to our study of the MW as an ecosystem, already identified as a key priority for future missions (e.g., the ESA Voyage 2050 assessment). The unique combination of expertise in galactic structure, stellar astrophysics, fundamental astrophysics, computational and advanced machine learning techniques, ensures a unified picture will emerge of the MW at all scales. The ESR cohort will be a vital core of human potential to drive forward the emerging plans to drive astrometry powered science into the next decade.

MWGaiaDN: Truly impactful

2.4.2 *Expected economic/technological impact(s)*

MWGaiaDN will position European industry for the next step in a large European led space astrometry mission. It will equip a new generation of young researchers with the skills needed by increasingly complex challenges to industry (technological, data analysis, etc). It will provide inspiration for a younger generation through exposure to Gaia and its science. The high impact network will deliver a cohort of adaptable researchers, highly employable, who will be well placed to contribute to both the academic and knowledge-based economy in Europe.

2.4.3 *Expected societal impact(s)*

MWGaiaDN will impact on society through its outreach activities, inspiring students in the study of space science, not only in Europe, but also in the developing world. Our research will be made accessible for use in Schools (e.g., Cambridge's AstroEast project working with schools in the local region. In the longer term, in humankind's ambition to send probes and people to explore the cosmos, MWGaiaDN will provide a better understanding of how to map the route to nearby worlds with its celestial reference frame, and study of stellar systems of interest for habitation!

3. Quality and Efficiency of the Implementation

MWGaiaDN will create **Excellent** science exploiting the current state of the art Gaia mission (through WP3, WP4, WP5); it will **Extend** the techniques for NIR and sub- μ s astrometry (through WP5); it will **Enhance** the skills of the next generation of scientists (through WP2, WP6) and it will **Effect** the next revolution in European led astronomy through leadership in astrometric-based science (through WP5).

The network will commence 1 February 2023 and run for 48 months. All 10 ESRs will be recruited over spring/summer 2023 and commence their 36 months of ESR training from ~Sep/Oct 2023. All will complete their PhD projects within four years⁴⁴, with the first thesis by ~Oct 2026.

3.1 Quality and effectiveness of the work plan, assessment of risks and appropriateness of the effort assigned to work packages

3.1.4 *Fellow's individual projects, including secondment plan*

The ESR projects are linked in addressing the ecosystem of the MW, from stars to structure to the definition of the celestial reference frame and the MW's place within it. Together the MWGaiaDN delivers a highly focused research programme with all projects linked through the common Gaia linked thread.

Table 3.1 d also contains the descriptions of the PhD projects to be carried out by research fellows at UCAM and UCL. These two fellows will be funded from the UK and will not be MSCA fellows and will not be funded through MWGaiaDN. Otherwise, the UCAM and UCL fellows will participate normally in the network activities and thereby enhance the science output from the network as a whole.

Table 3.1 d Individual Research Projects

⁴⁴ Length of PhD programme depends on the local institute doctoral programme. Typically 3.5 to 4 years duration with the additional months institute funded

Fellow ESR1	Host institution UB	PhD enrolment (Y: UB)	Start date Month 8	Duration 36 months	Deliverables D4.1, 4.2, 4.3, 4.4, 5.3
Project Title: WP4: The joint star-formation, migration, and habitability history of the Galactic disc					
Objectives: The PhD candidate will develop a framework that allows better determination of the Galactic star-formation history and the stellar mixing rate as a function of time and position in the Galactic disc from basic observations of stellar age, metallicity, and kinematics, accounting also for non-diffusive stellar mixing. We can take advantage of two things: larger samples because of Gaia and the ongoing/future spectroscopic surveys (like WEAVE and 4MOST), and novel determination of ages accounting for possible unresolved binaries (also a task for the ESR; benchmarked by asteroseismic observations from Kepler, CoRoT, K2, TESS, and eventually PLATO). The influence of stellar migration on the Galactic Habitable Zone is a completely unexplored and exciting terrain connecting Galactic Astrophysics to exoplanet research. This project has strong links to WP3.					
Expected Results: Using the more precise migration models obtained in the first part of the project, the PhD candidate will characterise the time evolution of the habitable-planet hosting star population around and beyond the solar vicinity. This type of study will also benefit from sophisticated comparisons to state-of-the-art cosmological Milky Way models, especially for modeling the statistical influence of cosmic radiation on potential planet host stars and for determining the occurrence rate of accreted exoplanets.					
Planned secondment(s): UGA: (M25-26: Babusiaux) Star Formation analysis. LEID: (M29-30: Brown) Stellar binarity analysis. UCAM: (M33-24: Walton) Exoplanet host variations					
Fellow ESR2	Host institution LEID	PhD enrolment (Y: LEID)	Start date Month 8	Duration 36 months	Deliverables D3.1, 3.2, 3.3, 5.4
Project Title: WP3: The tilting rate of the MW disk					
Objectives: Hierarchical structure formation models for the MW predict that the dark matter halo tumbles at a typical rate of a few tens of $\mu\text{s}/\text{yr}$, which suggests that the MW disk orientation may also vary in time. Modelling by Earp et al. (2019) showed that the tilting rate of the disc is well correlated with the gas inflow rate, and that the warp provides a good indication of the direction of the tilt. Interactions with satellite galaxies such as the LMC may lead to a rotation of the angular momentum vector of the disk population. It has been estimated (Perryman et al 2014) that the time varying MW disk orientation should be measurable in the Gaia data, provided the reference frame defined through quasars observed by Gaia is inertial to sufficient accuracy. This ESR project is aimed at researching how to make this measurement in practice from the Gaia data. A successful measurement of the time variation of the MW disk angular momentum vector would provide insights into the accretion history and dynamical state of the MW as well as the ongoing interactions with massive satellite galaxies such as the LMC and the Sagittarius dwarf galaxy. It is not guaranteed that the time variation of the MW disk orientation can be measured, one of the problems being that it may not be possible to define ‘the disk’ uniquely in terms of a fundamental plane. However, even an estimate of the upper limit on the orientation variation would lead to insights into the questions above and in addition provide valuable information on how the measurement is affected by systematic errors in the Gaia astrometry and reference frame. This in turn would provide guidance on the future requirements on high accuracy astrometry and reference frames.					
Expected Results: Methods for determining the time variation of the angular momentum vector of the MW disk; new insights into the definition of the disk, new knowledge on the MW accretion history and on the interactions with satellite galaxies; insights into Gaia astrometry and reference frame systematic errors; accuracy requirements on future astrometric surveys.					
Planned secondment(s): TUD (Klioner, M15-16): Training on astrometric reference frames, precision / accuracy Gaia reference frame. UB (Romero-Gómez, M20-23): MW & satellite galaxy modelling in cosmological context. INSYS (M32-33 Salvador) IRIS data platform {Industrial secondments are noted in bold/underline}					
Fellow ESR3	Host institution INAF (Padova)	PhD enrolment (Y: UNIPD)	Start date Month 8	Duration 36 months	Deliverables D4.1, 4.2, 4.3, 5.4
Project Title: WP4: [Young clusters: kinematics, stellar evolution & modelling]					
Objectives: Gaia’s precise parallaxes, proper motions, and photometry, combined with the ground-based spectroscopic programs (e.g. (such as APOGEE, Gaia-ESO Survey, WEAVE) and deep photometric surveys (PAN-STARRS, LSST) that have been or will be set-up to complement the Gaia data will provide datasets that will lead to a better understanding of stellar models. The ESR will use the kinematics of nearby clusters in the range than 100–7000 Myr and large star-forming complexes in order to select members. In young objects this will allow to define the interplay between internal kinematics and stellar evolution in the early stages of cluster life. Chemical abundances of s-process elements (Ba, Y, La) and Li in clusters from 150 Mys to 7 Gyr will be used to set constraints on stellar models. Namely, absorption lines of s-process elements are extremely sensitive to the stellar chromospheric activity, therefore monitoring the abundance variation of these elements as a function of activity indexes will provide key information on how magnetic fields influence the formation of lines in stellar spectra. Furthermore, Li abundances in giants and subgiants and when possible, in main sequence and pre-main sequence stars are sensitive to mixing processes. The ESR will study the variation of these elements with cluster ages and compare the results with stellar models. The work will be done first with Gaia DR3 and already available spectroscopic surveys. At later times, WEAVE radial velocities and chemical abundances will provide a homogenous data base of about 300 clusters. The ESR will develop machine learning and/or clustering algorithms to analyze fully automatically the big data samples represented by the stellar spectra. The collaboration with DAPCOM will train the ESR to enter the realm of big data, learning the necessary skills to perform this task. As contribution to WP5 activity, the ESR will explore the future astrometric and photometric requirements for studying young clusters under different physical conditions (gas density, metallicity...), either in the external regions of the disk and/or in external galaxies such as the Magellanic Clouds and local group galaxies. LSST data reaching $g=24$ mag already in single exposures will further enlarge the horizon where the analysis will be possible down to the low mass stellar regime. The use of near-infrared LSST bands will make it possible to observe objects in moderate to high extinction regions inaccessible to Gaia.					
Expected results: The project will allow us to improve our knowledge of stellar models, in particular concerning mixing processes in stellar interiors and magnetic fields. The analysis of clusters in different evolutionary phases will result in a better definition of the					

stellar content down to the low mass and M dwarf regime for nearby clusters (1–2 kpc using Gaia data and possibly up to the outer disk with LSST). In turn, this will lead to isochrone improvement. Ultimately this will result in better determination of star cluster age and properties. Astrometric requirements to extend the science case to Local Group Galaxies will be derived.

Planned secondment(s): **DAPC**, Julbe, M09-10, clustering algorithm, big data training. **UGA**, Babusiaux, M12: interstellar extinction maps. **LEID**, Brown M15-16, internal kinematics of young star forming regions.

Fellow	Host institution	PhD enrolment	Start date	Duration	Deliverables
ESR4	LUND	(Y: LUND)	Month 8	36 months	D5.1, 5.2, 5.3, 5.4

Project Title: WP5: Probing the Galaxy with Visible-NIR Astrometry and Gravitational Waves

Objectives: The era of multi-messenger astronomy has arrived and is crucial to fully understand the Galaxy's formation and evolution. Gaia has just entered its extended mission period while a deeper survey, LSST, is close to first light and future astrometry missions such as small-JASMINE and GaiaNIR will extend the wavelength range to the NIR giving distances and dynamical information in important obscured regions, such as the Galactic centre and spiral arms. The LISA mission will add another spectrum to this puzzle and the gravitational wave radiation from double white dwarf binaries will overlap with the visible and NIR astrometric detections of the same objects but will also extend the positional measurements throughout the Galaxy giving a more complete picture. Now is a good time to take stock of what these enormous projects will provide and how they overlap to improve our understanding of the Galaxy as a whole.

This project will have two connected aims. The first aim is to assess the impact on our understanding of the Galaxy by adding future Visible-NIR astrometric observations to the existing Gaia catalogue. LSST observations will go deeper than Gaia and many of the stars observed by small-JASMINE and GaiaNIR will be new NIR objects while in the case of objects already measured by Gaia the astrometric accuracy will be improved, especially the proper motions. The Galaxia code (Sharma, et al. 2011) will be used to generate, using an N-body sampling scheme, synthetic surveys of the MW with and without the new observations - this was recently used to provide a mock stellar catalogue for Gaia-DR2 (Rybizki, et al. 2018) and to provide number counts for the GaiaNIR Voyage2050 proposal (Hobbs, et al. 2019). The resulting synthetic catalogues can be used to understand how to identify structures in the Galaxy, how to determine the all-sky distribution of different stellar families and how to identify substructure in the Halo. Importantly this will show the advantages of combining the data from different missions and will feed directly into the science proposal for the upcoming GaiaNIR mission. The second aim is to investigate the sources of gravitational waves that will be observed by astrometry missions (Gaia, LSST, small-JASMINE and GaiaNIR) and by the upcoming LISA mission which is a very different kind of instrument. This will be used to construct a comprehensive source list with associate errors (basically a Galactic map) of potential electromagnetic sources which can also be observed by LISA in the next decade (see Korol, et al. 2017 for early work). This study should be done both with the real Gaia data to develop a realistic all-sky map of gravitational wave sources for LISA and with synthetic data from Galaxia to make predictions when including future astrometry missions in the coming decades.

Expected Results: An assessment of the benefits of including data from the different astrometric missions considering their respective accuracies. Detailed predictions of the science return achieved by shifting astrometry into the NIR. A realistic all-sky catalogue of Gaia and LSST electromagnetic sources of gravitational waves for LISA. A prediction of future LISA observations beyond those of the realistic all-sky catalogue. Demonstration of synergies between Gaia, LSST, small-JASMINE, GaiaNIR, and LISA.

Planned secondment(s): **DIRAC**, Connolly, M12-13 about big data and ground-based astrometry. **NAOJ**, N. Gouda, M14-15 small-JASMINE and relative astrometry. **TAS**, Herbert-Guest, M24-25, investigate performance implications of Gaia NIR design.

Fellow	Host institution	PhD enrolment	Start date	Duration	Deliverables
ESR5	UB	(Y: UB)	Month 8	36 months	D3.1, 3.2, 3.3, 5.4

Project Title: WP3: Revealing weak substructures in the MW

Objectives: Precise astrometry of Gaia DR2/EDR3 has allowed the detection of many structures in the MW from clusters and star forming regions to moving groups and stellar streams, some of them known and many previously unnoticed. The data has also permitted to rule out some of the groups previously claimed. In parallel, the kinematic studies carried out so far have revealed the rich complexities of the thin and thick disks as well as the halo, due to non-equilibrium states motivated by mergers. Additional information, especially ages and chemical composition, will act as a valuable signature to understand the nature of the groups detected and put them in the context of the MW formation and evolution. The ESR will extend existing all-sky data mining clustering methodologies to the third Gaia Data Release by including its new data products (information from low and high-resolution spectra like extinction and chemical composition) and complementary measurements based on ground surveys (WEAVE, OCCASO, APOGEE, LAMOST, MIRADAS, Pan-STARRS, JPLUS/JPAS, LSST, among others). The increase of the dimensionality of the clustering approach and the globally improved precision of Gaia DR3 will allow to identify tiny/weak structures unnoticed so far because of the domination of the field population. This will be applied to study the completeness of the current open clusters and ultra-faint dwarf galaxies samples, the process of clusters disruption by the identification of their tidal tails and extended coronas, the identification of hidden subpopulations of specific types of stars like white dwarfs (to identify the very cold ones constraining the age of the populations they belong to) or RR-Lyrae (tracing substructures in distant halo streams, ultra-faint dwarf galaxies, the Galactic bar). The UB group is deeply involved in the development of such algorithms as done for Gaia DR2/EDR3 and in some ground based spectroscopic surveys like OCCASO, WEAVE and MIRADAS. The UB group also has well established collaborations with the JPLUS/JPAS and APOGEE teams and the future 4MOST project.

Expected Results: Multi-dimensional methods to identify groups of stars in areas where the stellar field population dominates. Application of these methods to analyze the full sky with Gaia EDR3, DR3 and complementary data. The successful applications and the limitations of the methods and data will be identified and will constitute inputs for the WP5 roadmap. Analysis of the detected structures in the context of the MW formation and evolution. Methods and results will be disseminated through peer reviewed papers.

Planned secondment(s): **UGA**, Carine Babusiaux, M15-M17: interstellar extinction and its inclusion in the clustering algorithm; **LUND**, Hobbs, M22-24: systematics, statistical treatment of Gaia data. **INSYS** (M32-33 Salvador) IRIS data platform / Cache DB

Fellow	Host institution	PhD enrolment	Start date	Duration	Deliverables
ESR6	UC	(Y: UC)	Month 8	36 months	D5.1, 5.2, 5.3, 5.4

Project Title: WP5: AGN and the ICRF with Gaia					
<p>Objectives: The main goal of Gaia mission is to obtain the best ever multi-parameter map of the MW, in order to make progress in our knowledge of the Galaxy and also of its evolution. Besides the detection of galactic bodies, Gaia has also the capability of detecting point-like or even limited extended extragalactic sources. Among the latter are Active Galactic Nuclei (AGNs; a class that includes the QSO, Quasar, BL Lacs, Seyferts, etc), extremely bright and commonly variable cosmological objects that harbour in their centre super massive black holes (SMBH). Even though Gaia is a relatively shallow mission it has nevertheless been very successful in detecting this class of objects, with more than 1 600 000 AGNs having been reported so far. Why is the investigation in AGNs important? (a) <i>Per se</i>, as they are among the most extreme emitters in the Universe, being multi-wavelength and multi-messenger objects, so a relevant laboratory to investigate matter at extreme conditions. (b) But also, as a tool to understand the formation and evolution of the AGN host galaxies. Different studies have shown that there is a strong correlation between SMBH and host galaxy properties, suggesting a common formation and evolution process. Even if several models predict that merging is a fundamental process, there are still many unknowns, that can only be partially solved by analysing many systems at different stages of the merging process. Gaia astrometry is key in the identification of putative close binary systems. (c) These are the cosmic sources that define the International Celestial Reference Frame (ICRF) in the optical and the best candidates for the alignment between the optical and radio realizations of the ICRF should be identified.</p>					
<p>Expected Results: The research project proposed here aims at exploring Gaia data with the following main objectives: (1) To identify new AGNs via a multi-parameter space analysis; (2) To characterise (variability, SED, luminosity functions, etc) in a statistical way the population of Gaia AGNs, taking advantage of the fact that Gaia is an all-sky mission, and so provides a (mostly unbiased) flux limit sample. We will be in the best position to select the best Gaia AGNs for reference frame alignment; (3) Identify binary systems. These systems have been reported in Gaia data, but no systematic follow up has been performed. Confirmed binary systems can have an impact on constraining models that predict merging as a fundamental process of SMBH growth, and so the ESR project will partially develop theoretical modelling, to improve estimates on quantities like time scales of merger processes.</p>					
<p>Planned secondment(s): UB, Luri, M14-15, supervised and unsupervised techniques for source classification; LEID, Brown, M21-23, sources of reference frame systematics & catalogue mining; SPINW, Hormigo M26-27, ICRF & space navigation reqs.</p>					
Fellow ESR7	Host institution TUD	PhD enrolment (Y: TUD)	Start date Month 8	Duration 36 months	Deliverables D5.1, 5.2, 5.3, 5.4
Project Title: WP5: Relativistic challenges of sub-μs astrometry					
<p>Objectives: Astrometric observations of μs and sub-μs accuracies require very careful modelling in the framework of general relativity. A relativistic astrometric model can be formulated efficiently and with a high accuracy only for some simplified models of gravitating matter. In practice it is virtually impossible to consider all relativistic effects of a realistic Solar System exceeding some level in magnitude below about 1 μs. This is related both to some unsolved theoretical problems and to the practical impossibility of accounting for all minor bodies that could potentially produce sufficiently large astrometric signatures. Small relativistic effects coming from non-sphericity of the gravitational fields of Solar System's bodies as well as from their translational and rotational motions are also very difficult and computationally expensive to compute. Gravitational fields generated outside Solar system – gravitational waves from unknown sources and unmodeled microlensing effects – can also create systematic effects in the observational data. Another aspect is avoidable systematic errors in the data and parameters used in the model: e.g., errors in the Solar System and spacecraft ephemerides, limited accuracy of the masses of gravitating bodies, etc. For all these reasons, in the case of future sub-μs astrometric projects the feasibility and usefulness of the usual approach that the relativistic model should be about an order of magnitude more accurate than the final accuracy is no longer obvious. It is now important to investigate the size and character of systematic errors in the solutions when certain relativistic effects are missing in the model. This will first be investigated for the Gaia accuracies. The deficiencies of the model will be introduced and special Gaia-like astrometric solutions will be simulated. A detailed analysis of the errors of the resulting solutions, both at the level of global-scale statistics and at the level of individual, most affected objects, will demonstrate the real consequences of the model deficiencies. Secondly, an analogous study will be performed for a hypothetical astrometric mission with an accuracy of 10 nano-as (this level of accuracy can be expected from a combination of Gaia and GaiaNIR data). Several scenarios will be pursued: a global Gaia-like astrometric mission with higher accuracy, combination of Gaia and GaiaNIR as well as small-field astrometry. Detailed simulations of astrometric solutions will be performed using Gaia DPAC software AGISLab. Using the results from these numerical experiments, quantitative models for the influence of unaccounted effects will be formulated, to show which relativistic effects must be modelled to achieve sensible astrometric solution, and which effects, can be tolerated as acceptable additional noise.</p>					
<p>Expected Results: (1) Understanding of the content of a reasonable relativistic model for astrometry at the 10 nano-as level. (2) Characterization of the influence of unaccounted relativistic effects in the high-accuracy astrometric solutions. Both results will pave the way for relativistic data modelling for the future astrometric projects like GaiaNIR but will also be useful for the interpretation of the final Gaia results.</p>					
<p>Planned secondment(s): LUND, Hobbs, M20-21: learn additional details of the AGISLab software, GaiaNIR project and its combination with Gaia. UC, Anton, M30-31: learn about statistical properties of the QSO's. ABUSDS, D'Arrigo, M40-41: learn about self-calibration methods of space-based astrometric instruments.</p>					
Fellow ESR8	Host institution UGA	PhD enrolment (Y: UGA)	Start date Month 8	Duration 36 months	Deliverables D3.1, 3.2, 3.3, 5.4
Project Title: WP3: Deriving the MW IMF and SFR from high-accuracy astrometry					
<p>Objectives: The accuracy of the Gaia DR2 and EDR3 HR-diagrams and associated kinematics led to a number of studies on the local properties of the Star Formation History (SFR) and of the Initial Mass Function (IMF), both galactic properties being highly degenerate. Gaia DR3, by providing diverse information about stellar multiplicity will allow to fully revisit our understanding of the Gaia HR-diagram. However, the properties and limitations of the astrometric, photometric, and spectroscopic observations and data reduction will have to be considered to recover the de-biased multiplicity frequency. Separating the statistically different galactic populations through their kinematics, we aim to study the variation of the binarity fraction and of the IMF with galactic population, age, and formation history.</p>					
<p>Expected Results: bias-corrected multiplicity information over the Gaia HR-diagram for different galactic populations. Enhancement of existing simulation and statistical analysis tools to consider potential differences in the multiplicity and the IMF of different</p>					

galactic populations. Constraints and discussion on the global IMF and SFR of the MW. Expected improvements for the low mass part of the IMF from GaiaNIR.					
Planned secondment(s): LEID, Brown, M10-12: learn how to reconstruct the selection functions affecting the astrometric, photometric and spectroscopic data. OBSPM, Arenou, M14-16: learn the stellar multiplicity processing and validation selections that affected the DR3 content and the way forward to reconstruct the multiplicity frequency. NAOJ, Gouda M22-23, small JASMINE astrometry implications for near-IR populations in and towards the galactic centre.					
Fellow	Host institution	PhD enrolment	Start date	Duration	Deliverables
ESR9	NKUA	(Y: NKUA)	Month 8	36 months	D4.1, 4.2, 4.3, 5.4
Project Title: WP4: Testing the model predictions for the Asymptotic Giant Branch phase (specifically for carbon stars) using star clusters in the Milky Way and the Magellanic Clouds					
Objectives: Precise astrometry from Gaia DR2/EDR3 has resulted in the detection of several new star clusters in the MW Galaxy. For many clusters HR diagrams and membership probabilities have been published from DR2 and EDR3 data. In this ESR project we aim to analyze the Gaia DR3 data of all intermediate age and old (open) star clusters (previously known or newly discovered), that can potentially host carbon stars. HR diagrams will be constructed for the cluster members using Gaia DR3 magnitudes and colours, and ages derived based on state-of-the-art stellar isochrones. The second step is to associate Carbon Stars (CS) to star clusters. For this purpose, we will utilize all available bibliographic sources and multiwavelength data archives, as well as Gaia-ESO-Survey results on carbon-rich stars, in conjunction with parallaxes and proper motions provide by Gaia DR3. We will also search (using Gaia DR3 data) for Mira variables associated with the clusters. Mira variables are AGB stars that can be used as distance indicators. Inter-calibrations with other distance indicators associated with the clusters will be explored. Comparison of the ages and metallicities of the clusters (when metallicities are not known, follow-up spectroscopy will be attempted) that host carbon stars to model predictions, will help constrain the window of masses and metal abundances where the CS phenomenon occurs. Comparison with current stellar model predictions is expected to lead to their refinement and a better understanding of the third dredge up in stellar interiors. As a secondary objective, stellar multiplicity will also be searched for among the cluster members, and its effect on the AGB evolution explored. The project will be extended to lower metallicities to cover the full parameter space using star clusters in the Magellanic Clouds. The methodology followed in that case will leverage on Gaia data, as well as on other surveys (including VMC, 2MASS etc).					
Expected Results: The main result is a significant improvement of our understanding of the AGB evolutionary stage, and especially of the third dredge-up. As a by-product, we will provide a full analysis of intermediate age and old star clusters in the MW, and any Mira variables that they may contain. Mira variables can constitute a viable alternative to other distance indicators.					
Planned secondment(s): DAPC, Julbe, M14-15, big data and data integration training; INAF: M 17-19 - stellar evolution modelling/star clusters, supervisor Vallenari (Padova)					
Fellow	Host institution	PhD enrolment	Start date	Duration	Deliverables
ESR10	TUD	(Y: TUD)	Month 8	36 months	D3.1, 3.2, 3.3, 5.4
Project Title: WP5: Astrometric characterization of QSOs and the stability of the Gaia-CRF					
Objectives: Quasi-stellar objects (QSO) play several important roles in Gaia. Besides allowing for certain scientific results (e.g., the measurement of the acceleration of the Solar system), QSOs are used to fix the orientation and the rotational state of motion (the “spin”) of the resulting Gaia catalogue. On the other hand, the true parallaxes, and proper motions of the QSOs are statistically zero (apparent proper motions due to time-dependent sources structure could exist for some sources) and can be used to trace systematic errors of Gaia astrometry all over the sky. All these tasks require a possibly cleanest and possibly largest sample. The challenge is to identify genuine QSOs in the Gaia data. The approach developed for Gaia Celestial Reference Frame 3 (Gaia-CRF3) uses crossmatches with external QSO/AGN catalogues and subsequent two-stage astrometric filtering. This resulted in about 1.6 million QSOs in Gaia EDR3. Gaia DR3 contains the first results from the various pipelines for astrophysical source classification in Gaia. Those results were also used in a similar astrometric filtering and additional 300000 QSOs were identified. Given the development of both astronomical instrumentation and machine-learning methods of source classifications one should expect a great number of new QSO catalogues in the coming years. Also, Gaia will substantially improve its own astrophysical classification. A total of 3-4 million quasars is suspected in the final Gaia data. The cross-matches and the astrometric filtering should be further refined. One important topic here is to introduce source structure index characterizing the astrometric quality of the QSOs, so that subsets of Gaia-CRF with better quality and stability can be identified. This should be attempted based on the already available parameters of the Gaia astrometric solutions. Another aspect is to identify and characterize all expected sources of systematic proper motions in the Gaia astrometric data for the QSOs. Those systematic proper motions, when uncorrected or corrected only with a certain accuracy, disturb the Gaia positions of the QSOs at a future epoch. Those effects must be carefully considered e.g., when combining Gaia and Gaia-NIR results.					
Expected Results: (1) A source structure index for Gaia QSOs defined from Gaia own astrometry and allowing one to select more stable subsamples of the Gaia-CRF. (2) Characterization of the systematic proper motions of QSOs in the Gaia astrometry. An optimal way to combine the Gaia-CRF astrometry with the future Gaia-NIR results for the QSOs.					
Planned secondment(s): LEID, Brown, M20-21: learn about the characterisation of the QSOs in the crowded areas. UC, Anton, M27-28: exchange about the methods to study the Gaia data for QSO candidates and the statistical analysis of those data. LUND, Hobbs, M34-35: learn additional details of the GaiaNIR project and its expected combination with Gaia.					

Fellow	Host institution	PhD enrolment	Start date	Duration	Deliverables
UCAM PhD*	UCAM	(Y: UCAM)	Month 9	36 months	D4.1, 4.2, 4.3, 4.4, 5.3
Project Title: WP4: Exoplanet Host Star Characterisation with Gaia and Spectroscopy					

Objectives: In preparation for PLATO, WEAVE and Gaia have an important role in building up a detailed knowledge of the bright star sample that will be targeted by ESA's PLATO. Detailed chemical analysis studies of exoplanet host stars have been used to infer that low metallicity stars that host exoplanets have an overabundance of alpha-elements. Precise chemical determinations of the host stars of exoplanets can potentially be used to statistically infer the makeup of their orbiting planets (terrestrial-like, gas-dwarf planets or gas giant planets). However, recent studies are revealing a range of subtle and sometimes conflicting results and trends (e.g. lack of clear correlations between stellar metallicity and planetary residual metallicity that would be predicted from Giant planet formation models). Currently a comprehensive study in twilight time survey of bright exoplanet host stars using the WEAVE multi-object spectrograph (science observations commence 2022) is being defined. These observations will provide detailed, high precision, chemical (covering a range of elements sampling the main nucleosynthesis pathways) characterization of the stars to be observed with PLATO. Gaia data will be used to establish the host star within their local (10pc) environment, to additionally study the correlations between host stars and their nearby neighbour star chemo-dynamical properties with their exoplanet systems. Pilot studies will be carried out initially against known star/exoplanet systems being discovered by TESS. The high precision abundances (to better than 0.1 dex) obtained will be important in understanding star-planet environmental effects. The ESR project will involve definition and implementation of the WEAVE twilight survey, investigation of contaminating sources (involving assessment of the Gaia release investigating close pairs, separations < 1 arcsec), comparison of exoplanet host star properties (chemo-dynamic) to their local neighbourhood.

Expected Results: Implementation of the WEAVE twilight survey. Catalogue of exoplanet host star high precision abundances. New insights into the relationship between host star chemistry and their exoplanet properties. New method for use of VR analysis environment and use in exploration of high dimensional data. Implications for bright star observations in the IR.

Planned secondment(s): SUIL (M15-16: Harris) {**Industrial secondments are noted in bold/underline**}: advanced virtual reality visualisation environments to explore multivariate data. **UNIPD**: (M25-26: Vallenari) use of Gaia for PLATO input catalogue selection and contaminant analysis. Identify nearby(10pc) stars to each exoplanet host star from Gaia parallax/ proper motion data. **OHR** (M30-31: Klebor) technical considerations for sub- μ s astrometry around bright stars.

Fellow	Host institution	PhD enrolment	Start date	Duration	Deliverables
UCL PhD*	UCL	(Y: UCL)	Month 8	36 months	D3.1, 3.2, 3.3, 3.4, 5.3

Project Title: WP 3: Revealing the dynamical structure of the Galactic centre

Objectives: The Galactic centre ($R < 1$ kpc) where is heavily obscured is a prime target for the future NIR astrometry missions, including JASMINE and GaiaNIR, based on the heritages of the current success of Gaia. The ESR will develop a Bayesian Made-to-Measure (M2M) tool (Hunt & Kawata 2014, MNRAS, 443, 2112; Bovy, Kawata, Hunt 2018, MNRAS, 473, 2288) to fit the Vista Variable in the Via Lactea (VVV) NIR photometry data, VVV astrometry data (VIRAC, Smith et al. 2018, MNRAS, 474, 1826), NIR spectroscopic data from SDSS/APOGEE and upcoming SDSS-V and VLT/MOONS data with a dynamical model with multiple stellar population. This will tell us the age distribution of stars in the nuclear stellar disk, which is a promising indicator for the formation time of the Galactic bar (Baba & Kawata 2020, MNRAS, 492, 4500), and will identify or reject the existence of the Ultra Light Dark Matter (ULDM, 10^{-23} – 10^{-18} eV) soliton core from the stellar dynamics constraints (Toguz, Kawata et al. arXiv:2106.02526). This work will be supported also by Ralph Schönrich (MSSL, UCL) and Jason Sanders (Physics & Astronomy, UCL), who are the world expert of dynamical model and the Galactic centre observational data. In addition, the ESR will develop the multidisciplinary skills by being involved in verification work of the TDI performance of Leonardo's APDs NIR detector within a wide collaboration of GaiaNIR:UK consortium, whose initial phase of study has been funded by UK Space Agency. We will verify the NIR TDI performance required for GaiaNIR precision astrometry for the Galactic centre crowded region with MSSL built "TDI simulator" with a cooled vacuum chamber and moving light sources.

Expected Results: Identifying the formation epoch of the Galactic bar. Identifying or rejecting the existence of ULDM. Development of Bayesian M2M modelling technique for the future NIR astrometry data. Future NIR TDI detector verification.

Planned secondment(s): **UGA** Babusiaux, M10-M12 : Stellar population modelling; **UB**, Romero-Gómez, M25-M27, Inner Galaxy modelling; **LEON**, Barnes, M32-M35, NIR detector study.

* The UCAM and UCL PHDs are recruited by UK-based associated partners, they are not supported by EU funds, and will be supported by UK funds

3.1.5 Network organisation

The Consortium Supervisory Board (CSB) has overall responsibility for the delivery of the DN goals. The CSB will define the skills requirements for the ESRs such that the needs of both the academic and industrial partners are considered. It will ensure that scientific and technological training through the node based ESR research projects is supplemented with relevant complementary skills training, appropriate to the needs of each ESR. It will establish a set of best practice guidelines for the DN to ensure a uniformity of opportunity across the network in terms of training opportunities for each ESR, and monitoring and mentoring systems to measure ESR progress.

The budgeting process is strongly coupled to the activities of the ESRs with the budget being determined, in the main, according to a rigid formula. The CSB is responsible for the distribution of funds and **financial management** of the network. The individual host institutes⁴⁵ are responsible for their devolved budgets. The associate nodes will invoice the relevant full node for costs incurred in hosting an ESR on secondment. Associate node costs for network wide events will be invoiced against the coordinating node. All financial transactions will be subject to audit, according to the local audit practices of the full partners, and by the EC. Full documentation & receipts will be available to support claims. The CSB will ensure the **scientific and research integrity** of the network. The European Code of Conduct

⁴⁵ Fundació Bosch i Gimpera (FBG) manages the funds at UB: it is a third party of Universitat de Barcelona (UB). FBG was created and is controlled by UB, and has an authorisation to administer International funds on behalf of UB. According to the "Annotated General Grant Agreement", FBG falls under the specific case "Foundations, spin-off companies, etc., created in order to handle the administrative/financial tasks of the beneficiary", and it's in charge of the administrative and financial management of European projects at the UB. FBG does not perform scientific/technical work in the project.

for Research Integrity⁴⁶ will be followed. The CSB will set procedures for dealing with cases of scientific misconduct. When a case of misconduct is raised, the Research Coordination Committee will convene an ad-hoc panel to investigate the allegations and recommend action in a report to the CSB. The panel will be composed of senior network representatives (from institutes un-associated to any participants involved in the misconduct allegations). Based on network institution procedures handling misconduct⁴⁷.

The **Project Coordinator (PC)** will be the point of contact between the network and the European Commission (EC). The PC will manage the network budget, according to the principles laid down by the GSB and guidelines issued by the EC. The PC will be the main point of contact with external bodies. The PC will have overall executive responsibility for the project and will provide leadership, supported by the RCC (see below) for the scientific aspects of the project, and the **Project Office** in UCAM (with science/admin support staff⁴⁸) for the financial and legal areas of the project. The full role and tasks of the PC will be detailed in the Consortium Agreement.

The **Doctoral Training Committee (DTC)** will manage network training. The DTC, chaired by the lead of WP2, will consist of the DN WP Leaders, two Industrial partner representatives, one from the academic partner nodes and the PC. With full WP representation, the DTC will be able to align the network wide training with the individual WP science-based training. The DTC will have responsibility to ensure that there is equivalence of training opportunity for all ESRs irrespective of host location. The DTC will ensure that full risk monitoring and health and safety procedures are in place when EU project teams travel to non-EU based partners. The DTC will meet by telecon bi-monthly and face-to-face at least once per year at the annual network meetings. The **Research Coordination Committee (RCC)** will be chaired by the **PC** with membership from the **WP Leaders (WPL)**. It will have responsibility in managing the science and training interactions between the research nodes. The RCC will encourage and monitor the networking between the ESRs, and the quality of the science generated across the network. The RCC will be responsible for managing the investigation process into allegations of scientific misconduct. The **Public Engagement and Impact Committee (PEIC)**, chaired by the lead of WP6, will coordinate the engagement and communication activities of the network. It will monitor the effectiveness of these engagement activities. It will evaluate the networks impact and ensure that the innovation potential of the network is fully realised. The **Recruitment and Equal Opportunities Committee (REOC)** will coordinate the recruitment process and monitor and evaluate the DN's equal opportunities practices across the network. The **supervisor** and **SC** of each ESR will be responsible for the academic and pastoral care of their ESRs.

External expert advice will be taken from the consortium's **Science, Training & Innovation Advisory Panel (STIAP)**, to help ensure that the network's scientific, innovation and training goals are met. The STIAP will be composed of independent experts with a background in astronomy, innovation and training policy. It will also provide general advice on possible ethics and 'duty of care to the ESRs' issues.

3.1.6 *Joint governing structure: the MWGaiaDN Consortium Agreement*

In order to formalise the internal workings of the DN, a Consortium Agreement (CA) will be drawn up and agreed at the start of the programme⁴⁹. It will define the roles and responsibilities of the beneficiaries and partners of the network, the employment status of the recruited researchers, and the supervision arrangements, including qualifications of supervisors. It will also lay out the management of Intellectual Property Rights within the consortium. The CA will be essential in underpinning the structure of the DN, supplementing the formal contract with the European Commission. The CA will set out the decision-making powers of the network and will detail how potential conflicts and disputes will be resolved. In general disputes will be resolved at the lowest possible level. Initially issues will be handled within the node, or within the WP. Escalation will be to the Supervisory Board. Failing that, recourse to the legal provisions in the CA will occur.

3.1.7 *Joint admission, selection, supervision, monitoring and assessment procedures:* [not applicable]

3.1.8 *Supervisory board*

The **CSB** is the top-level board governing the overall management of the DN programme. The Project Coordinator (PC) will chair the CSB. Each beneficiary partner and associate partner will have one representative on the CSB, with **two ESR CSB members** (one male, one female for gender balance) to represent the *student voice*. Full meetings of the CSB will occur once per year at the annual full project meeting. Additional full meetings will be held as required, face-to-face or by tele/videocon.

⁴⁶ See https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf

⁴⁷ e.g. the University of Cambridge's policy of misconduct at <https://www.research-integrity.admin.cam.ac.uk/research-misconduct>

⁴⁸ A project administrative assistant will be employed to assist the PC concerning administrative and legal tasks related to the operation of the network. All beneficiaries will contribute a share (40%) of their management and indirect costs budget to UCAM, jointly sharing the funding of this position and cost of the management of the project as a whole. This will be formalized in the consortium agreement.

⁴⁹ The CA will be modelled on the DESCAs Horizon 2020 Model Consortium Agreement (<http://www.DESCA-2020.eu>)

3.1.9 Recruitment strategy

The recruitment and selection policy for the DN will conform to the principles of the European Code of Conduct for the Recruitment of Researchers. There will be a centralised recruitment exercise for the network. The recruitment procedure will place an emphasis on individual excellence. However, the principles of *equal opportunity* and *gender balance* will be stressed. Selection of the ESRs at the full nodes will be carried out conforming to local procedures, but with a member of the DTC on each selection panel to ensure an equivalence in selection procedures, and aid in bringing a balance in terms of network hires. Members of the selection panels will have training according to their local institute norms. Recruitment will begin when the network has been approved and the Grant Agreement implemented. All posts will be advertised at once, through a range of media, including the EU Euraxess site and national and international⁵⁰ job sites. Whilst applicants will apply to a specific host beneficiary, suitable candidates will be made aware of opportunities across the network. With a Aug 2022 network start, ESRs will be typically interviewed from then until December 2022, with all starting Sep-Dec 2022 depending on host institute.

3.1.10 Progress monitoring and evaluation of individual projects

Each ESR will have a personal career development plan (PCDP) against which they will be able to track their progress. Their host node will provide the primary supervisor for that ESR, whilst a secondary mentor will be allocated based at a partner node. The ESR supervisor will work with the ESR in drawing up their PCDP and provide regular monitoring and guidance to their ESR. The PCDPs will be reviewed annually to allow for regular formal monitoring of the progress of the ESRs. This will ensure that the ESR is able to progress; any issues or problems can be identified and corrected at an early stage. Each ESR will be able to make full use of the career development support offered through their host institutions and they will be able to call for support through the DN. Career development information will be collated in WP2 and best practice for use by all ESRs across the network; this resource will be of value to the host nodes. All ESRs will be enrolled in PhD programmes at the host institutes. Some PhDs will complete in the 36-month period of the ESR. However, for those institutes with PhD's running for longer than 36 months (e.g., Netherlands), local arrangements will be put into place to ensure that the ESR continues to be registered and supported for the 4th year of the PhD.

3.1.11 Quality and Risk management

The risk register will be maintained by the Project Coordinator and reviewed by the DTC and reported upon to the annual meeting of the CSB. Table 3.2a presents the implementation risks. This will be updated at the first meeting of the DTC. A yearly checkpoint will allow for alterations of the programme to reflect possible alterations required, tailored to the progress of each individual ESR.

Before any MWGaiaDN researcher visit or secondment to one of our non-EU partner organisations, a risk assessment will be carried out conforming to the norms of the ESR's beneficiary host institute. This would include arranging for suitable insurance cover, health and safety information, and contact points for emergencies.

The MWGaiaDN'S STIAP (see Sec. 3.1.5) will have a remit to provide general advice on any specific 'Care of Duty' or ethical issues that may arise during the network.

3.1.12 Gender aspects

The recruitment procedure will prioritise the excellence of the individual. However, the principles of *equal opportunity* and *gender balance* will be stressed. Recruitment of the ESR positions will include advertising to reach under-represented groups, for instance via the IAU working group 'Women in Astronomy'. The ESR training programme will include a specific training element on gender issues during the Transferable Skills school. Decision-making within the network will take account of gender, will seek to increase diversity and in particular gender diversity, throughout the network activities. For instance, seven of the fifteen (47%) of the DN's primary ESR supervisors are women, and the network will aim to achieve at least 40% female membership of the DTC and other committees of the network. The research programmes will consider the needs of women (and men).

3.1.13 Environmental aspects in light of the MSCA Green Charter

MWGaiaDN will adhere to the MSCA Green Charter where consistent with the network's science driven excellence. Measure to reduce the environmental impact of the research programme will be implemented. At the researcher-level, network meetings will be organised such that participants will be able to attend in person or remotely using videoconferencing tools⁵¹. This will help minimise unnecessary travel. Where travel is essential, low carbon forms of transport will be used, for instance the train rather than the plane, public transport rather than car. Institutionally all ESRs will be given guidance in minimising the environmental impact of their research activities. MWGaiaDN will aim to reduce the environmental impact of its research at every opportunity.

⁵⁰ e.g. <http://www.ast.cam.ac.uk/admissions/phd> and <https://jobregister.aas.org/>

⁵¹ As a result of the Covid-19 pandemic all MWGaiaDN partners have made additional investments in their video conferencing capabilities to support remote participation in meetings.

3.2 Quality, capacity and role of each participant, including hosting arrangements and extent to which the consortium as a whole brings together the necessary

3.2.1 Appropriateness of the infrastructure and capacity of each participating organisation

Each beneficiary and partner have the appropriate research and training infrastructure in place to carry out the tasks assigned to them in the network. The beneficiary nodes are all world-class research institutions⁵² with the required research infrastructure (research and administrative) to support the activities of the ESR projects and the training. The network beneficiaries will provide an excellent environment for the ESRs. Relocation advice will be offered through the local institute offices, and EURAXESS Services for relocation. Many of our research institutes have the 'HR Excellence in Research' accreditation. UCAM has the Athena SWAN Silver mark. UCAM has significant experience in leading DNs. The key expertise and facilities at each beneficiary node are listed in Sec. 5.

3.2.2 Consortium composition and exploitation of participating organisations' complementarities

All MWGaiaDN beneficiaries and partner organisations are fully committed to the research and training programme, with the contributions of all partners given in terms of their organisation and participation of workshops and training events (see Sec. 1.2.1), hosting ESRs during their individual projects (see Sec. 3.1.4) and as described in the partner organisation letters of commitment (see Sec. 5). We note that the network is reasonably large with some 23 organisations participating. The management structure (Sec 3.2.1) is configured to ensure that the network interactions proceed in an effective manner. In particular the network subcommittees and the supervisory board will review progress on a regular basis. Our DN network leadership are experienced in managing large networks. Walton (UCAM) has coordinated a previous ITN, and currently chairs the MW-Gaia COST Action. Brown (LEID) is Chair of the Gaia Data Processing and Analysis Consortium, whilst Vallenari (INAF-Padova) is its deputy chair. Jordi is grant holder for the MW-Gaia COST Action. The network participants have had a range of earlier partnerships and interactions. Together this expert experience will ensure effective interactions across the network, and delivery of the ESR projects.

The network brings together experts in Gaia and related astronomy, together with partners with expertise in related industry. There are strong synergies between the partners, and through the network significant research and training will be delivered which would not be possible at a national level. All ESR research projects involve secondments and exchanges with multiple partners, academic and industry or technical facilities, across the network, which provides access to the relevant world leading expertise. The network will both create new links between the participating groups and strengthen existing links.

Close interactions between the network participants will be established and maintained through: active involvement in the various schools/conferences of the DN; the Gaia data processing and analysis activities involved in many of the ESR projects; direct collaboration between the different DN project teams via telecons, document exchange (common papers), and ESR and partner exchange visits.

Jointly authored papers involving several ESRs and participants will result from many of the ESR projects. Each ESR will have a secondary thesis mentor, located in a collaborating network institute.

The network will deliver added value, in linking partners with complementary skills. The majority of the network beneficiary groups are already involved in the delivery of Gaia data to the community through the DPAC⁵³. All beneficiary groups are active in the MW-Gaia COST Action. MWGaiaDN WP leads also have leadership roles in the matching COST Action working group structure. The industrial partners have either been involved in research or technical partnerships with individual or groups of academic groups. INSYS were a partner in the earlier GREAT-ITN. ABUSDS were the prime contractor of Gaia. SUIL works closely with the UCAM group in a medical project (see Sec 2.1.1). The academic partner organisations have and do work in partnership with the academic beneficiary nodes. All are involved in the MW-Gaia COST Action. The beneficiaries and partners bring the range of skills and expertise required to deliver a high impact DN, with a cohort of excellently trained ESRs resulting.

The network links partners with a range of complementary skills, with the individual ESR projects fully exploiting these synergies. The UCAM ESR1 will exploit the new virtual reality environments developed by SUIL, to enable improved visualisation and analysis of the complex multivariate chemical and dynamical information on exoplanet host stars. ESR2 at LEID will benefit from local expertise in Gaia data, and will learn from the visit to UB how to compare observational data with the latest high-resolution theoretical Galactic structure models. ESR4 at LUND will benefit from local expertise in precision astrometry from Gaia. The visit to ABUSDS will provide additional insights into the implications in possible spacecraft instrumentation designs if extending observations into the infrared. The industrial partners will participate in all workshops at some level, taking a key role in the WP2 big data and WP5 technical challenges workshop. This will expose all the ESRs to valuable knowledge in transferring their science knowledge to the commercial sector. Participation of the industrial partners in the WP5 science road-mapping

⁵² Several of the network institutes are 'world top 100' universities QS World University Rankings 2020: UCAM (7th), LUND (92nd)

⁵³ see DPAC at <https://www.cosmos.esa.int/web/gaia/dpac/consortium>

exercise, will demonstrate how the assessment of science priorities can scope and define future technical directions, which in turn will be implemented in the industrial sector.

Partners such as LUND, TUD, NAOJ bring leading experts in astrometry (e.g., Hobbs, Lindegren, Klioner, Gouda). UCAM, LEID, DIRAC, UB bring experts in data and statistics (e.g., Brown, Jordi, Ivezić, Walton), whilst others such as CU, NKUA bring experts in astrophysical objects (e.g., Anton, Hatzidimitriou). Together with the experts from industry, both large space (e.g., TAS, OHB, ABUSDS) and IT (e.g., INSYS) and other more specialised SMEs (e.g., DAPC, SPINW, SUIL), the ESRs will be able to work on projects furthering our understanding of the MW (exploiting the exquisite data from Gaia). Crucially they will be able to drive the definition of the roadmap essential for the development of the next generation of space astrometry missions, leading to innovation possibilities for both science and industry in Europe.

The beneficiaries/partners, located across all parts of Europe represent key groups who will push the boundaries of exploiting Gaia. The ESRs will gain vital cross science, cross domain experience required to play a leading part in moving this area of astrometry to the next level in the coming decades.

3.2.3 Commitment of beneficiaries and associated partners to the programme

All ESRs will carry out secondments at other network institutes during the course of their individual research projects, with each visiting an industrial or major technical/facility partner. Full details of secondments (host, duration and timing) are given in **Tab. 3.1.d** with a summary in **Tab. 1.2.a**. Many will have one of their secondments at an institute outside of Europe. The secondments will provide exposure to a variety of research, technical and industrial facility. Thus, some will be to smaller research university groups, others will be to larger research organisations, to national research facilities (e.g. NAOJ), or to industry, large (e.g. ABUSDS, OHB) and small (SUIL). This breadth of exposure will provide the ESRs with experience with learning and growing in a wide range of international, interdisciplinary and intersectoral research environments. In addition, this will provide valuable exposure to potential future employers of the ESRs.

All beneficiaries are fully committed to the network, and each has already agreed a distribution of their institution funds to support the DN network project office. Each of the partner organisations, both academic and industrial, provide a full letter of commitment, which are attached in Sec. 5. These highlight the wide range of interactions, which will occur, and how each of the partner organisations will add significant value to the network. Each beneficiary and partner will sign the Collaboration Agreement. All partners will host ESR secondments (see **Tab 1.2a** and ESR project descriptions in **Tab 3.1.d**), offer training, participate in the research projects and network training events.

MWGaiaDN brings together a unique and world-class combination of research groups across Europe linked with key global partners: coupled to strongly complementary industrial groups participating at the highest level. This will ensure world class training to deliver a new cohort of ESRs able to exploit the opportunities from Gaia, drive innovation in the 2020's, and ensure continued leadership of European science and industry in this fundamentally important area of space science.

Specialism	Tasks	Organisations (Industry, Facility, Academic)
Space satellite design	WP5: technical challenges	ABUSDS, OHB, SPINW, TAS, NAOJ
Near infrared detector design	WP5: technical challenges	LEON
Commercialisation	WP5: knowledge transfer	UCAM (Cambridge Enterprise)
Big-Data databases	WP3: massive data database use WP5: technical challenges	DIRAC, INSYS
Big-Data applications	WP3, WP4: application integration	DAPC, DIRAC, INSYS
Ground based imaging expertise	WP3: Data mining, astro-statistics	DAPC, DIRAC, INSYS
Ground based spectroscopy	WP4: integrated spectroscopy observations	SAAO
Simulations	WP3: Galaxy modelling WP5 stellar models	UB, UCL
Public Engagement and Communications	WP6: Outreach, links with schools	SAAO, NKUA, UB, LEID
Visualisation and VR	WP3, WP4: data visualisation	SUIL
Project Management	WP2: ESR transferable skills training	ABUSDS, OHB, TAS

3.2.4 Funding of non-associated third countries

As at the time of Grant Agreement Preparation, following communication 25/04/2022 from the REA, the United Kingdom's association to Horizon Europe is not expected to apply at the time of planned signature of the grant agreement for your proposal. Legal entities established in the United Kingdom in the proposal are therefore not eligible for funding and cannot be beneficiaries. UCAM and UCL transferred from beneficiary partners to associate partners. They will participate in MWGaiaDN with finance provided through full matching UK support^{54 55} with

⁵⁴ <https://www.gov.uk/government/publications/horizon-europe-guarantee-open-letter-to-the-uk-research-and-development-sector>

⁵⁵ <https://www.ukri.org/wp-content/uploads/2021/12/UKRI-Horizon-Europe-Guarantee-Guidance-May22-update.pdf>

both UCAM and UCL contributing a UK funded PhD research fellow to the doctoral network, and delivering the WP6 lead (UCAM) and other non-management deliverables and tasks as noted in this Description of the action.

The UCAM and UCL doctoral fellows will carry out the individual projects foreseen in the original proposal. The UCAM PhD project being in WP4 titled: "Exoplanet Host Star Characterisation with Gaia and Spectroscopy" (with secondments foreseen to SUIL, UNIPD and OHB). The UCL PhD project being in WP3 titled: "Revealing the dynamical structure of the Galactic centre" (with secondments foreseen to UGA, UB and LEON). In addition, UCAM and UCL will fulfil their role in acting as secondment hosts to the EU funded beneficiary fellows as noted in section 3.1.4.

4. Ethics

The project involves associate partners located in United Kingdom (UCAM, UCL, AIRBUS, TAS), United States (DIRAC), South Africa (SAAO) and Japan (NAOJ). The beneficiary research fellows will undertake exchange visits to the partners as specified in Section 3.1.4. Furthermore, risk assessments for travel from EU to non-EU countries will be made, with network policies set by the supervisory board (CSB) and monitored by the doctoral training committee (DTC - see Section 3.1.11).

No activity to be undertaken in these countries raises potential ethical issues, plans to use local resources, plans to import any material (other than data) from non-EU countries into the EU or from a non-EU country to another non-EU country, involves low and/or lower middle-income countries or puts the individuals taking part in it at risk

ANNEX 2

ESTIMATED BUDGET FOR THE ACTION

Estimated EU contribution									
Estimated eligible unit contributions (per budget category)									Maximum grant amount ¹
A. Contributions for recruited researchers					B. Institutional contributions		Total	h = a + b + c + d + e + f + g	
A.1 Living allowance	A.2 Mobility allowance	A.3 Family allowance	A.4 Long-term leave allowance	A.5 Special needs allowance	B.1 Research, training and networking contribution	B.2 Management and indirect contribution			
Forms of funding	Unit contribution ²	Unit contribution ²	Unit contribution ²	Unit contribution ²	Unit contribution ²	Unit contribution ²	Unit contribution ²	g	i
	a	b	c	d	e	f			
1 - ULEI	134 150.40	21 600.00	17 820.00	0.00	0.00	57 600.00	43 200.00	274 370.40	274 370.40
2 - INAF	119 217.60	21 600.00	17 820.00	0.00	0.00	57 600.00	43 200.00	259 437.60	259 437.60
3 - ULUND	153 489.60	21 600.00	17 820.00	0.00	0.00	57 600.00	43 200.00	293 709.60	293 709.60
4 - UB	223 502.40	43 200.00	35 640.00	0.00	0.00	115 200.00	86 400.00	503 942.40	503 942.40
5 - UC	103 183.20	21 600.00	17 820.00	0.00	0.00	57 600.00	43 200.00	243 403.20	243 403.20
6 - TUD	240 638.40	43 200.00	35 640.00	0.00	0.00	115 200.00	86 400.00	521 078.40	521 078.40
7 - UGA	142 473.60	21 600.00	17 820.00	0.00	0.00	57 600.00	43 200.00	282 693.60	282 693.60
8 - NKUA	99 878.40	21 600.00	17 820.00	0.00	0.00	57 600.00	43 200.00	240 098.40	240 098.40
9 - UNIPD									
10 - JASMINE-NAOJ									
11 - NRF									
12 - DIRAC									
13 - DAPCOM									
14 - INTERSYS									
15 - SPIN									
16 - SUIL									
17 - OHB									
18 - LEO-LTD									
19 - AIRBUSDS									
20 - CNRS									
21 - TAS-UK									
22 - UCL									
23 - UCAM									
Σ consortium	1 216 533.60	216 000.00	178 200.00	0.00	0.00	576 000.00	432 000.00	2 618 733.60	2 618 733.60

¹ The 'maximum grant amount' is the maximum grant amount fixed in the grant agreement (on the basis of the sum of the beneficiaries' estimated units).

² See Annex 2a 'Additional information on the estimated budget' for the details (units, amount per unit).

ANNEX 2a

ADDITIONAL INFORMATION ON UNIT COSTS AND CONTRIBUTIONS

HE MSCA Doctoral Networks/Post-doctoral Fellowships and HE ERA Fellowships¹

Contributions for recruited researchers — Living allowance

Type: unit contributions

Units: months spent by the researcher(s) on the research training activities (person-months)

Amount per unit*: see Annex 2

* Amount calculated as follows:

{the monthly living allowance for researchers in MSCA-PF/MSCA-DN and ERA Fellowship actions multiplied by country-specific correction coefficient of [OPTION by default: the country in which the researcher is recruited][OPTION for PF-Global Fellowships: the country where the associated partner hosting the researcher during the outgoing phase is located and the country in which the researcher is recruited (for the return phase and placements)]}

The monthly living allowance and the country-specific correction coefficients are set out in the Horizon Europe Work Programme (MSCA Work Programme part) in force at the time of the call:

- for the monthly living allowance:
 - PF and ERA Fellowships: EUR 5 080
 - DN: EUR 3 400
- for the country-specific correction coefficients: see Work Programme (available on the [Funding & Tenders Portal Reference Documents](#) page).

Contributions for recruited researchers — Mobility allowance

Type: unit contributions

Units: months spent by the researcher(s) on the research training activities (person-months)

Amount per unit²: see Annex 2

Contributions for recruited researchers — Family allowance

Type: unit contributions

Units: months spent by the researcher(s) on the research training activities (person-months)

Amount per unit³: see Annex 2

Contributions for recruited researchers — Long-term leave allowance

Type: unit contributions

Units: months spent by the researcher(s) on long-term leave (person-months)

¹ [Decision](#) of 16 March 2021 authorising the use of lump sum contributions and unit contributions for Marie Skłodowska-Curie actions under the Horizon Europe Programme.

² Same amount for all beneficiaries.
Amount for the mobility allowance set out in the Horizon Europe Work Programme (MSCA Work Programme part) in force at the time of the call (available on the [Funding & Tenders Portal Reference Documents](#) page).

³ Same amount for all beneficiaries.
Average based on the amount for the family allowance set out in the Horizon Europe Work Programme (MSCA Work Programme part) in force at the time of the call (75% of the number of units with family, 25% without).

Amount per unit*: see Annex 2

*Amount calculated as follows:

{long-term leave allowance (i.e. the sum of the applicable living allowance and mobility allowance)
multiplied by
percentage of long-term leave allowance incurred by the beneficiary (i.e. costs incurred by the beneficiary
divided by the long-term leave allowance)
multiplied by
number of months}

Contributions for recruited researchers — Special needs allowance

Type: unit contributions

Units: number of special needs units (per recruited researcher) that were needed for implementing the action (person-months)

Amount per unit*: see Annex 2

*Amount calculated as follows:

{requested special needs unit
multiplied by
(1/number of months)}

The pre-defined special needs units are: EUR 3 000, EUR 4 500, EUR 6 000, EUR 9 500, EUR 13 000, EUR 18 500, EUR 27 500, EUR 35 500, EUR 47 500 and EUR 60 000.

Institutional contributions — Research, training and networking contribution

Type: unit contributions

Units: months spent by the researcher(s) on the research training activities (person-months)

Amount per unit⁴: see Annex 2

Institutional contributions — Management and indirect contribution

Type: unit contributions

Units: months spent by the researcher(s) on the research training activities (person-months)

Amount per unit⁵: see Annex 2

HE MSCA Staff Exchanges⁶

Contributions for seconded staff — Top-up allowance

Type: unit contributions

Units: months spent by the seconded staff member(s) on the research and innovation activities (person-months)

Amount per unit⁷: see Annex 2

⁴ Same amount for all beneficiaries.
Amount for research, training and networking contribution set out in the Horizon Europe Work Programme (MSCA Work Programme part) in force at the time of the call (available on the [Funding & Tenders Portal Reference Documents](#) page).

⁵ Same amount for all beneficiaries.
Amount for management and indirect contribution set out in the Horizon Europe Work Programme (MSCA Work Programme part) in force at the time of the call (available on the [Funding & Tenders Portal Reference Documents](#) page).

⁶ [Decision](#) of 16 March 2021 authorising the use of lump sum contributions and unit contributions for Marie Skłodowska-Curie actions under the Horizon Europe Programme.

⁷ Same amount for all beneficiaries.
Amount for the top-up allowance set out in the Horizon Europe Work Programme (MSCA Work Programme part) in force at the time of the call (available on the [Funding & Tenders Portal Reference Documents](#) page).

Contributions for seconded staff — Special needs allowance

Type: unit contributions

Units: number of special needs units (per seconded staff member) that were needed for implementing the action (person-months)

Amount per unit*: see Annex 2

*Amount calculated as follows:
{requested special needs unit
multiplied by
(1/number of months)}

The pre-defined special needs units are: EUR 3 000, EUR 4 500, EUR 6 000, EUR 9 500, EUR 13 000, EUR 18 500, EUR 27 500, EUR 35 500, EUR 47 500 and EUR 60 000.

Institutional contributions — Research, training and networking contribution

Type: unit contributions

Units: months spent by the seconded staff member(s) on the research and innovation activities (person-months)

Amount per unit⁸: see Annex 2

Institutional contributions — Management and indirect contribution

Type: unit contributions

Units: months spent by the seconded staff member(s) on the research and innovation activities (person-months)

Amount per unit⁹: see Annex 2

HE MSCA COFUND¹⁰

COFUND contributions — COFUND allowance

Type: unit contributions

Units: months spent by the researchers on the research training activities (person-months)

Amount per unit¹¹: see Annex 2

COFUND contributions — Long-term leave allowance

Type: unit contributions

Units: months spent by the researcher(s) on long-term leave ('person-months')

Amount per unit*: see Annex 2

*Amount calculated as follows:
{long-term leave allowance (i.e. the applicable COFUND allowance)}

⁸ Same amount for all beneficiaries.
Amount for research, training and networking contribution set out in the Horizon Europe Work Programme (MSCA Work Programme part) in force at the time of the call (available on the [Funding & Tenders Portal Reference Documents](#) page).

⁹ Same amount for all beneficiaries.
Amount for management and indirect contribution set out in the Horizon Europe Work Programme (MSCA Work Programme part) in force at the time of the call (available on the [Funding & Tenders Portal Reference Documents](#) page).

¹⁰ [Decision](#) of 16 March 2021 authorising the use of lump sum contributions and unit contributions for Marie Skłodowska-Curie actions under the Horizon Europe Programme.

¹¹ Same amount for all beneficiaries.
Amount for the COFUND allowance set out in the Horizon Europe Work Programme (MSCA Work Programme part) in force at the time of the call (available on the [Funding & Tenders Portal Reference Documents](#) page).

multiplied by
percentage of long-term leave allowance incurred by the beneficiary (i.e. costs incurred by the beneficiary
divided by the long-term leave allowance)
multiplied by
number of months}

COFUND contributions — Special needs allowance

Type: unit contributions

Units: number of special needs units (per recruited researcher) that were needed for implementing the action ('person-months')

Amount per unit*: see Annex 2

*Amount calculated as follows:
{ requested special needs unit
multiplied by
(1/number of months)}

The pre-defined special needs units are: EUR 3 000, EUR 4 500, EUR 6 000, EUR 9 500, EUR 13 000, EUR 18 500, EUR 27 500, EUR 35 500, EUR 47 500 and EUR 60 000.

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ISTITUTO NAZIONALE DI ASTROFISICA (INAF), PIC 999868920, established in VIALE DEL PARCO MELLINI 84, ROMA 00136, Italy,

hereby agrees

to become beneficiary

in Agreement No 101072454 — MWGaiaDN ('the Agreement')

between UNIVERSITEIT LEIDEN (ULEI) and the European Research Executive Agency (REA) ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LUNDS UNIVERSITET (ULUND), PIC 999901318, established in Paradisgatan 5c, LUND 22100, Sweden,

hereby agrees

to become beneficiary

in Agreement No 101072454 — MWGaiaDN ('the Agreement')

between UNIVERSITEIT LEIDEN (ULEI) and the European Research Executive Agency (REA) ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSITAT DE BARCELONA (UB), PIC 999986387, established in GRAN VIA DE LES CORTS CATALANES 585, BARCELONA 08007, Spain,

hereby agrees

to become beneficiary

in Agreement No 101072454 — MWGaiaDN ('the Agreement')

between UNIVERSITEIT LEIDEN (ULEI) and the European Research Executive Agency (REA) ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSIDADE DE COIMBRA (UC), PIC 997826391, established in PACO DAS ESCOLAS, COIMBRA 3004-531, Portugal,

hereby agrees

to become beneficiary

in Agreement No 101072454 — MWGaiaDN ('the Agreement')

between UNIVERSITEIT LEIDEN (ULEI) and the European Research Executive Agency (REA) ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

TECHNISCHE UNIVERSITAET DRESDEN (TUD), PIC 999897729, established in HELMHOLTZSTRASSE 10, DRESDEN 01069, Germany,

hereby agrees

to become beneficiary

in Agreement No 101072454 — MWGaiaDN ('the Agreement')

between UNIVERSITEIT LEIDEN (ULEI) and the European Research Executive Agency (REA) ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSITE GRENOBLE ALPES (UGA), PIC 897379108, established in 621 AVENUE CENTRALE, GRENOBLE 38058, France,

hereby agrees

to become beneficiary

in Agreement No 101072454 — MWGaiaDN ('the Agreement')

between UNIVERSITEIT LEIDEN (ULEI) and the European Research Executive Agency (REA) ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON (NKUA), PIC 999643007,
established in 6 CHRISTOU LADA STR, ATHINA 10561, Greece,

hereby agrees

to become beneficiary

in Agreement No 101072454 — MWGaiaDN ('the Agreement')

between UNIVERSITEIT LEIDEN (ULEI) and the European Research Executive Agency (REA)
(‘EU executive agency’ or ‘granting authority’), under the powers delegated by the European
Commission (‘European Commission’),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement,
in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in
accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 4 HORIZON EUROPE MSCA UNIT MGA — MULTI + MONO

FINANCIAL STATEMENT FOR [PARTICIPANT NAME] FOR REPORTING PERIOD [NUMBER]

EU contribution									
Eligible unit contributions (per budget category)								Requested EU contribution	
[OPTION for all MSCA ToA except COFUND: A. . Contributions for [recruited researchers] [seconded staff members]][OPTION for COFUND: A. COFUND contributions]					[OPTION for all MSCA ToA except COFUND: B. Institutional contributions]		Total		
[OPTION for DN and PF: A.1 Living allowance]	[OPTION for DN and PF: A.2 Mobility allowance]	[OPTION for DN and PF: A.3 Family allowance]	[OPTION for all MSCA ToA except SE: A.4 Long-term leave allowance]	A.5 Special needs allowance	[B.1 Research, training and networking contribution]	[B.2 Management and indirect contribution]			
[OPTION for SE: A.1 Top - up allowance]	[OPTION for COFUND: A.1 COFUND allowance]								
Forms of funding	Unit contribution ¹	[Unit contribution ¹]	[Unit contribution ¹]	[Unit contribution ¹]	Unit contribution ¹	[Unit contribution ¹]	[Unit contribution ¹]	$h = a [+ b] [+ c] [+ d] + e [+ f] [+ g]$	i
	a	[b]	[c]	[d]	e	[f]	[g]		
XX – [short name beneficiary/affiliated entity]									

The beneficiary/affiliated entity hereby confirms that:

The information provided is complete, reliable and true.

The unit contributions declared are eligible (see Article 6).

The contributions can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 19, 20 and 25).

¹ See Annex 2a 'Additional information on the estimated budget' for the details (units, amount per unit).

ANNEX 5

SPECIFIC RULES

CONFIDENTIALITY AND SECURITY (— ARTICLE 13)

Sensitive information with security recommendation

Sensitive information with a security recommendation must comply with the additional requirements imposed by the granting authority.

Before starting the action tasks concerned, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task. The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary.

For requirements restricting disclosure or dissemination, the information must be handled in accordance with the recommendation and may be disclosed or disseminated only after written approval from the granting authority.

EU classified information

If EU classified information is used or generated by the action, it must be treated in accordance with the security classification guide (SCG) and security aspect letter (SAL) set out in Annex 1 and Decision 2015/444¹ and its implementing rules — until it is declassified.

Deliverables which contain EU classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving EU classified information may be subcontracted only with prior explicit written approval from the granting authority and only to entities established in an EU Member State or in a non-EU country with a security of information agreement with the EU (or an administrative arrangement with the Commission).

EU classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

ETHICS (— ARTICLE 14)

Ethics and research integrity

The beneficiaries must carry out the action in compliance with:

- ethical principles (including the highest standards of research integrity)

¹ Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

and

- applicable EU, international and national law, including the EU Charter of Fundamental Rights and the European Convention for the Protection of Human Rights and Fundamental Freedoms and its Supplementary Protocols.

No funding can be granted, within or outside the EU, for activities that are prohibited in all Member States. No funding can be granted in a Member State for an activity which is forbidden in that Member State.

The beneficiaries must pay particular attention to the principle of proportionality, the right to privacy, the right to the protection of personal data, the right to the physical and mental integrity of persons, the right to non-discrimination, the need to ensure protection of the environment and high levels of human health protection.

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

- aim at human cloning for reproductive purposes
- intend to modify the genetic heritage of human beings which could make such modifications heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed)
- intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer, or
- lead to the destruction of human embryos (for example, for obtaining stem cells).

Activities involving research on human embryos or human embryonic stem cells may be carried out only if:

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the granting authority.

In addition, the beneficiaries must respect the fundamental principle of research integrity — as set out in the European Code of Conduct for Research Integrity².

This implies compliance with the following principles:

- reliability in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources
- honesty in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way

² European Code of Conduct for Research Integrity of ALLEA (All European Academies).

- respect for colleagues, research participants, society, ecosystems, cultural heritage and the environment
- accountability for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

and means that beneficiaries must ensure that persons carrying out research tasks follow the good research practices including ensuring, where possible, openness, reproducibility and traceability and refrain from the research integrity violations described in the Code.

Activities raising ethical issues must comply with the additional requirements formulated by the ethics panels (including after checks, reviews or audits; see Article 25).

Before starting an action task raising ethical issues, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task, notably from any (national or local) ethics committee or other bodies such as data protection authorities.

The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary, which shows that the documents cover the action tasks in question and includes the conclusions of the committee or authority concerned (if any).

VALUES (— ARTICLE 14)

Gender mainstreaming

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action and, where applicable, in line with the gender equality plan. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS — ACCESS RIGHTS AND RIGHTS OF USE (— ARTICLE 16)

Definitions

Access rights — Rights to use results or background.

Dissemination — The public disclosure of the results by appropriate means, other than resulting from protecting or exploiting the results, including by scientific publications in any medium.

Exploit(ation) — The use of results in further research and innovation activities other than those covered by the action concerned, including among other things, commercial exploitation such as developing, creating, manufacturing and marketing a product or process, creating and providing a service, or in standardisation activities.

Fair and reasonable conditions — Appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

FAIR principles — ‘findability’, ‘accessibility’, ‘interoperability’ and ‘reusability’.

Open access — Online access to research outputs provided free of charge to the end-user.

Open science — An approach to the scientific process based on open cooperative work, tools and diffusing knowledge.

Research data management — The process within the research lifecycle that includes the organisation, storage, preservation, security, quality assurance, allocation of persistent identifiers (PIDs) and rules and procedures for sharing of data including licensing.

Research outputs — Results to which access can be given in the form of scientific publications, data or other engineered results and processes such as software, algorithms, protocols, models, workflows and electronic notebooks.

Scope of the obligations

For this section, references to ‘beneficiary’ or ‘beneficiaries’ do not include affiliated entities (if any).

Agreement on background

The beneficiaries must identify in a written agreement the background as needed for implementing the action or for exploiting its results.

Where the call conditions restrict control due to strategic interests reasons, background that is subject to control or other restrictions by a country (or entity from a country) which is not one of the eligible countries or target countries set out in the call conditions and that impact the exploitation of the results (i.e. would make the exploitation of the results subject to control or restrictions) must not be used and must be explicitly excluded from it in the agreement on background — unless otherwise agreed with the granting authority.

Ownership of results

Results are owned by the beneficiaries that generate them.

However, two or more beneficiaries own results jointly if:

- they have jointly generated them and
- it is not possible to:
 - establish the respective contribution of each beneficiary, or
 - separate them for the purpose of applying for, obtaining or maintaining their protection.

The joint owners must agree — in writing — on the allocation and terms of exercise of their joint ownership (**‘joint ownership agreement’**), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement or consortium agreement, each joint owner may grant non-exclusive licences to third parties to exploit the jointly-owned results (without any right to sub-license), if the other joint owners are given:

- at least 45 days advance notice and
- fair and reasonable compensation.

The joint owners may agree — in writing — to apply another regime than joint ownership.

If third parties (including employees and other personnel) may claim rights to the results, the beneficiary concerned must ensure that those rights can be exercised in a manner compatible with its obligations under the Agreement.

The beneficiaries must indicate the owner(s) of the results (results ownership list) in the final periodic report.

Protection of results

Beneficiaries which have received funding under the grant must adequately protect their results — for an appropriate period and with appropriate territorial coverage — if protection is possible and justified, taking into account all relevant considerations, including the prospects for commercial exploitation, the legitimate interests of the other beneficiaries and any other legitimate interests.

Exploitation of results

Beneficiaries which have received funding under the grant must — up to four years after the end of the action (see Data Sheet, Point 1) — use their best efforts to exploit their results directly or to have them exploited indirectly by another entity, in particular through transfer or licensing.

If, despite a beneficiary's best efforts, the results are not exploited within one year after the end of the action, the beneficiaries must (unless otherwise agreed in writing with the granting authority) use the Horizon Results Platform to find interested parties to exploit the results.

If results are incorporated in a standard, the beneficiaries must (unless otherwise agreed with the granting authority or unless it is impossible) ask the standardisation body to include the funding statement (see Article 17) in (information related to) the standard.

Additional exploitation obligations

Where the call conditions impose additional exploitation obligations (including obligations linked to the restriction of participation or control due to strategic assets, interests, autonomy or security reasons), the beneficiaries must comply with them — up to four years after the end of the action (see Data Sheet, Point 1).

Where the call conditions impose additional exploitation obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) grant for a limited period of time specified in the request, non-exclusive licences — under fair and reasonable conditions — to their results to legal entities that need the results to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at

fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Additional information obligation relating to standards

Where the call conditions impose additional information obligations relating to possible standardisation, the beneficiaries must — up to four years after the end of the action (see Data Sheet, Point 1) — inform the granting authority, if the results could reasonably be expected to contribute to European or international standards.

Transfer and licensing of results

Transfer of ownership

The beneficiaries may transfer ownership of their results, provided this does not affect compliance with their obligations under the Agreement.

The beneficiaries must ensure that their obligations under the Agreement regarding their results are passed on to the new owner and that this new owner has the obligation to pass them on in any subsequent transfer.

Moreover, they must inform the other beneficiaries with access rights of the transfer at least 45 days in advance (or less if agreed in writing), unless agreed otherwise in writing for specifically identified third parties including affiliated entities or unless impossible under the applicable law. This notification must include sufficient information on the new owner to enable the beneficiaries concerned to assess the effects on their access rights. The beneficiaries may object within 30 days of receiving notification (or less if agreed in writing), if they can show that the transfer would adversely affect their access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

Granting licences

The beneficiaries may grant licences to their results (or otherwise give the right to exploit them), including on an exclusive basis, provided this does not affect compliance with their obligations.

Exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights.

Granting authority right to object to transfers or licensing — Horizon Europe actions

Where the call conditions in Horizon Europe actions provide for the right to object to transfers or licensing, the granting authority may — up to four years after the end of the action (see Data Sheet, Point 1) — object to a transfer of ownership or the exclusive licensing of results, if:

- the beneficiaries which generated the results have received funding under the grant
- it is to a legal entity established in a non-EU country not associated with Horizon Europe, and

- the granting authority considers that the transfer or licence is not in line with EU interests.

Beneficiaries that intend to transfer ownership or grant an exclusive licence must formally notify the granting authority before the intended transfer or licensing takes place and:

- identify the specific results concerned
- describe in detail the new owner or licensee and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or licence on EU interests, in particular regarding competitiveness as well as consistency with ethical principles and security considerations.

The granting authority may request additional information.

If the granting authority decides to object to a transfer or exclusive licence, it must formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information it has requested).

No transfer or licensing may take place in the following cases:

- pending the granting authority decision, within the period set out above
- if the granting authority objects
- until the conditions are complied with, if the granting authority objection comes with conditions.

A beneficiary may formally notify a request to waive the right to object regarding intended transfers or grants to a specifically identified third party, if measures safeguarding EU interests are in place. If the granting authority agrees, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information requested).

Limitations to transfers and licensing due to strategic assets, interests, autonomy or security reasons of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security reasons, the beneficiaries may not transfer ownership of their results or grant licences to third parties which are established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless they have requested and received prior approval by the granting authority.

The request must:

- identify the specific results concerned
- describe in detail the new owner and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or license on the strategic assets, interests, autonomy or security of the EU and its Member States.

The granting authority may request additional information.

Access rights to results and background

Exercise of access rights — Waiving of access rights — No sub-licensing

Requests to exercise access rights and the waiver of access rights must be in writing.

Unless agreed otherwise in writing with the beneficiary granting access, access rights do not include the right to sub-license.

If a beneficiary is no longer involved in the action, this does not affect its obligations to grant access.

If a beneficiary defaults on its obligations, the beneficiaries may agree that that beneficiary no longer has access rights.

Access rights for implementing the action

The beneficiaries must grant each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

- informed the other beneficiaries that access to its background is subject to restrictions, or
- agreed with the other beneficiaries that access would not be on a royalty-free basis.

The beneficiaries must grant each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

Access rights for exploiting the results

The beneficiaries must grant each other access — under fair and reasonable conditions — to results needed for exploiting their results.

The beneficiaries must grant each other access — under fair and reasonable conditions — to background needed for exploiting their results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to restrictions.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for entities under the same control

Unless agreed otherwise in writing by the beneficiaries, access to results and, subject to the restrictions referred to above (if any), background must also be granted — under fair and reasonable conditions — to entities that:

- are established in an EU Member State or Horizon Europe associated country
- are under the direct or indirect control of another beneficiary, or under the same direct or indirect control as that beneficiary, or directly or indirectly controlling that beneficiary and

- need the access to exploit the results of that beneficiary.

Unless agreed otherwise in writing, such requests for access must be made by the entity directly to the beneficiary concerned.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for the granting authority, EU institutions, bodies, offices or agencies and national authorities to results for policy purposes — Horizon Europe actions

In Horizon Europe actions, the beneficiaries which have received funding under the grant must grant access to their results — on a royalty-free basis — to the granting authority, EU institutions, bodies, offices or agencies for developing, implementing and monitoring EU policies or programmes. Such access rights do not extend to beneficiaries' background.

Such access rights are limited to non-commercial and non-competitive use.

For actions under the cluster 'Civil Security for Society', such access rights also extend to national authorities of EU Member States for developing, implementing and monitoring their policies or programmes in this area. In this case, access is subject to a bilateral agreement to define specific conditions ensuring that:

- the access rights will be used only for the intended purpose and
- appropriate confidentiality obligations are in place.

Moreover, the requesting national authority or EU institution, body, office or agency (including the granting authority) must inform all other national authorities of such a request.

Additional access rights

Where the call conditions impose additional access rights, the beneficiaries must comply with them.

COMMUNICATION, DISSEMINATION, OPEN SCIENCE AND VISIBILITY (— ARTICLE 17)

Dissemination

Dissemination of results

The beneficiaries must disseminate their results as soon as feasible, in a publicly available format, subject to any restrictions due to the protection of intellectual property, security rules or legitimate interests.

A beneficiary that intends to disseminate its results must give at least 15 days advance notice to the other beneficiaries (unless agreed otherwise), together with sufficient information on the results it will disseminate.

Any other beneficiary may object within (unless agreed otherwise) 15 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the results may not be disseminated unless appropriate steps are taken to safeguard those interests.

Additional dissemination obligations

Where the call conditions impose additional dissemination obligations, the beneficiaries must also comply with those.

Open Science

Open science: open access to scientific publications

The beneficiaries must ensure open access to peer-reviewed scientific publications relating to their results. In particular, they must ensure that:

- at the latest at the time of publication, a machine-readable electronic copy of the published version or the final peer-reviewed manuscript accepted for publication, is deposited in a trusted repository for scientific publications
- immediate open access is provided to the deposited publication via the repository, under the latest available version of the Creative Commons Attribution International Public Licence (CC BY) or a licence with equivalent rights; for monographs and other long-text formats, the licence may exclude commercial uses and derivative works (e.g. CC BY-NC, CC BY-ND) and
- information is given via the repository about any research output or any other tools and instruments needed to validate the conclusions of the scientific publication.

Beneficiaries (or authors) must retain sufficient intellectual property rights to comply with the open access requirements.

Metadata of deposited publications must be open under a Creative Commons Public Domain Dedication (CC 0) or equivalent, in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: publication (author(s), title, date of publication, publication venue); Horizon Europe or Euratom funding; grant project name, acronym and number; licensing terms; persistent identifiers for the publication, the authors involved in the action and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for any research output or any other tools and instruments needed to validate the conclusions of the publication.

Open science: research data management

The beneficiaries must manage the digital research data generated in the action ('data') responsibly, in line with the FAIR principles and by taking all of the following actions:

- establish a data management plan ('DMP') (and regularly update it)
- as soon as possible and within the deadlines set out in the DMP, deposit the data in a trusted repository; if required in the call conditions, this repository must be federated in the EOSC in compliance with EOSC requirements
- as soon as possible and within the deadlines set out in the DMP, ensure open access — via the repository — to the deposited data, under the latest available version of the Creative Commons Attribution International Public License (CC BY) or Creative Commons Public Domain Dedication (CC 0) or a licence with equivalent rights,

following the principle ‘as open as possible as closed as necessary’, unless providing open access would in particular:

- be against the beneficiary’s legitimate interests, including regarding commercial exploitation, or
 - be contrary to any other constraints, in particular the EU competitive interests or the beneficiary’s obligations under this Agreement; if open access is not provided (to some or all data), this must be justified in the DMP
- provide information via the repository about any research output or any other tools and instruments needed to re-use or validate the data.

Metadata of deposited data must be open under a Creative Common Public Domain Dedication (CC 0) or equivalent (to the extent legitimate interests or constraints are safeguarded), in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: datasets (description, date of deposit, author(s), venue and embargo); Horizon Europe or Euratom funding; grant project name, acronym and number; licensing terms; persistent identifiers for the dataset, the authors involved in the action, and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for related publications and other research outputs.

Open science: additional practices

Where the call conditions impose additional obligations regarding open science practices, the beneficiaries must also comply with those.

Where the call conditions impose additional obligations regarding the validation of scientific publications, the beneficiaries must provide (digital or physical) access to data or other results needed for validation of the conclusions of scientific publications, to the extent that their legitimate interests or constraints are safeguarded (and unless they already provided the (open) access at publication).

Where the call conditions impose additional open science obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) immediately deposit any research output in a repository and provide open access to it under a CC BY licence, a Public Domain Dedication (CC 0) or equivalent. As an exception, if the access would be against the beneficiaries’ legitimate interests, the beneficiaries must grant non-exclusive licenses — under fair and reasonable conditions — to legal entities that need the research output to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Plan for the exploitation and dissemination of results including communication activities

Unless excluded by the call conditions, the beneficiaries must provide and regularly update a plan for the exploitation and dissemination of results including communication activities.

SPECIFIC RULES FOR CARRYING OUT THE ACTION (— ARTICLE 18)

Implementation in case of restrictions due to strategic assets, interests, autonomy or security of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security, the beneficiaries must ensure that none of the entities that participate as affiliated entities, associated partners, subcontractors or recipients of financial support to third parties are established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless otherwise agreed with the granting authority.

The beneficiaries must moreover ensure that any cooperation with entities established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) does not affect the strategic assets, interests, autonomy or security of the EU and its Member States.

Specific rules for MSCA actions

When implementing MSCA Doctoral Networks (DN), Postdoctoral Fellowships (PF) and COFUND actions, the beneficiaries must respect the following conditions:

- take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers³ and ensure that the researchers and all participants involved in the action are aware of them
- ensure that the researchers enjoy at the place of the implementation at least the same standards and working conditions as those applicable to local researchers holding a similar position
- ensure that the employment contract, other direct contract or fixed-amount-fellowship agreement (see Article 6) specifies:
 - the name of the supervisor(s) for the research training activities
 - the starting date and duration of the research training activities
 - the monthly support for the researcher under this Agreement (in euro and, if relevant, in the currency in which the remuneration is paid)
 - the obligation of the researcher to work exclusively for the action, unless part-time for professional reasons is allowed and has been approved (and for MSCA-DN and MSCA-PF: not to receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiary or other entities mentioned in Annex 1)
 - the working pattern of the researcher
 - the arrangements related to the intellectual property rights (during implementation of the action and afterwards), in particular full access — on

³ Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

- a royalty-free basis — for the researcher to background and results needed for their activities under the action
- the obligation of the researcher to inform as soon as possible about events or circumstances likely to affect the implementation of the action or the compliance with requirements under the Agreement (see Article 19)
- the obligation of the researcher to maintain confidentiality (see Article 13)
- the obligation of the researcher to ensure the visibility of EU funding in communications or publications and in applications for the protection of results (see Articles 17)
- where set out in the call conditions, the obligation of the researcher to carry out a mandatory return period of 12 months
- assist the researchers in the administrative procedures related to the recruitment
- inform the researchers about:
 - the description, conditions, location and timetable for the implementation of the research training activities
 - the rights and obligations toward the researchers under this Agreement
 - the obligation of the researchers to complete and submit — at the end of the research training activities — the evaluation questionnaire and — two years later — follow-up questionnaire provided by the granting authority
- ensure full access — on a royalty-free basis — for the researchers to background and results needed for their activities under the action
- ensure that the researchers do not have to bear any costs for the implementation of the action as described in Annex 1
- provide training and the necessary means for implementing the action (or ensure that such training and means are provided by other participants in the action)
- ensure that the researchers are adequately supervised and receive appropriate career guidance
- ensure that personalised career development plans are established, support their implementation and update in view of the needs of the researchers
- ensure an appropriate exposure to the non-academic sector (if applicable)
- respect the maximum limit for secondments set out in the call conditions
- respect the conditions for the outgoing and return phases set out in the call conditions (if any)
- ensure that the researchers are informed that they are ‘Marie Skłodowska-Curie fellows’
- for MSCA-DN and MSCA-COFUND:

- advertise and publish vacancies internationally, including on the web-sites requested by the granting authority, indicating the gross salary (not including employer's social contributions) to be offered to the researcher
- recruit the researchers, following an open, transparent, merit-based, impartial and equitable recruitment procedure (for postdoctoral programmes in MSCA-COFUND: with regular selection rounds and international peer review), on the basis of:
 - their scientific skills and the relevance of their research experience
 - the impact of the proposed training on the researcher's career
 - a fair gender representation (by promoting genuine equal access opportunities throughout the recruitment process)

The selection committees must bring together diverse expertise, have an adequate gender balance and include members from different countries and with relevant experience to assess the candidates.

- ensure that no conflict of interest exists in or arises from the recruitment
- for MSCA-DN and MSCA-PF:
 - ensure that the researchers do not receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiaries (or other entities mentioned in Annex 1)
 - host the researchers at their premises (or at the premises of other participants in the action)
- for MSCA-COFUND where doctoral or post-doctoral programmes are implemented as financial support to third parties through implementing partners:
 - ensure that the implementing partners comply with the same standards and procedures for implementing the research training activities, including the recruitment and working conditions for researchers, the specific rules for MSCA-COFUND actions and the specific rules on ethics and research integrity set out in Annex 5
 - implement effective monitoring and oversight arrangements towards the implementing partners, covering all aspects relating to the action
 - ensure effective and reliable reporting by the implementing partners, covering the activities implemented, information on indicators, as well as the legality and regularity of the expenditure claimed
 - ensure that the implementing partners provide that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the final recipients.

When implementing Horizon Europe MSCA Staff Exchanges (MSCA-SE), the beneficiaries must respect the following conditions:

- take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers⁴ and ensure that the seconded staff and all participants involved in the action are aware of them
- ensure that the seconded staff enjoys at the place of the implementation at least the same standards and working conditions as those applicable to local staff holding a similar position
- assist the seconded staff with the administrative procedures related to their secondment
- inform the seconded staff about:
 - the description, conditions, location and timetable for the implementation of the secondment
 - the rights and obligations of the beneficiary toward the seconded staff under this Agreement
 - the obligation of the seconded staff to complete and submit — at the end of the secondment — the evaluation questionnaire and — two years later — the follow-up questionnaire provided by the granting authority
 - the arrangements related to the intellectual property rights between the beneficiary and the seconded staff (during the secondment and afterwards), in particular full access — on a royalty-free basis — for the staff to background and results needed for their activities under the action
 - the obligation of the seconded staff to maintain confidentiality (see Article 13)
 - the obligation of the seconded staff to ensure the visibility of EU funding in communications or publications and in applications for the protection of results (see Article 17)
- ensure that the seconded staff do not have to bear any costs for the implementation of the action as described in Annex 1
- provide training and the necessary means for implementing the action (or ensure that such training and means are provided by other participants in the action)
- ensure that the seconded staff are adequately mentored
- ensure that the rights and obligations of the seconded staff remain unchanged during the secondment
- ensure full access — on a royalty-free basis — for the staff to background and results needed for their activities under the action

⁴ Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

- if appropriate, ensure that seconded staff are reintegrated after the secondment
- ensure that the seconded staff are covered by an adequate medical insurance scheme
- ensure that the seconded staff have the relevant expertise for the action
- use the top-up allowance (see Article 6) to contribute to the subsistence, accommodation and travel of the seconded staff.

Specific rules for ERA Fellowship actions

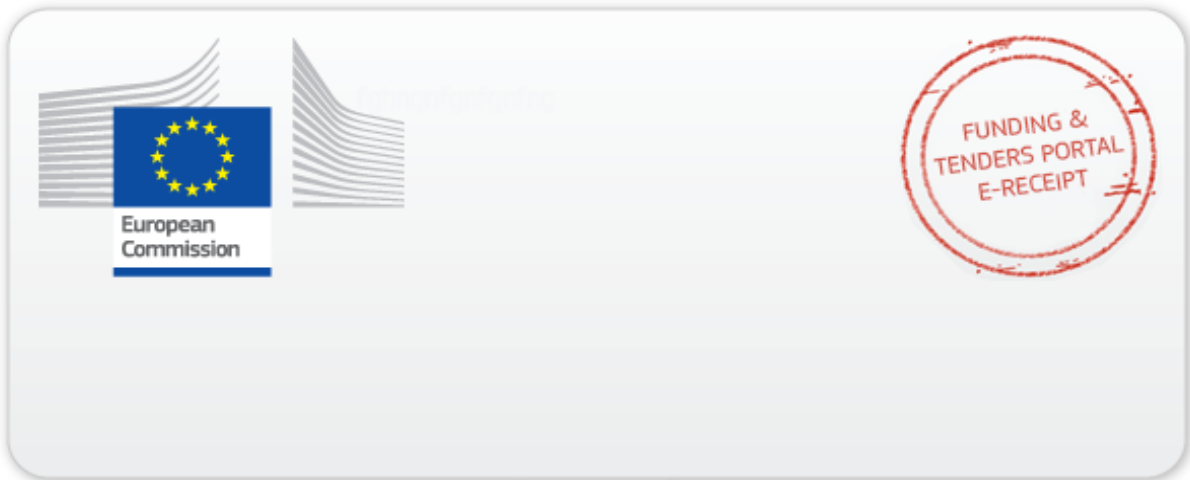
When implementing ERA Fellowships, the beneficiaries must respect the following conditions:

- take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers⁵ and ensure that the researchers and all participants involved in the action are aware of them
- ensure that the researchers enjoy at the place of the implementation at least the same standards and working conditions as those applicable to local researchers holding a similar position
- ensure that the employment contract, other direct contract or fixed-amount-fellowship agreement (see Article 6) specifies:
 - the name of the supervisor(s) for the research training activities
 - the starting date and duration of the research training activities
 - the monthly support for the researcher under this Agreement (in euro and, if relevant, in the currency in which the remuneration is paid)
 - the obligation of the researcher to work exclusively for the action, unless part-time for professional reasons is allowed and has been approved (and not to receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiary or other entities mentioned in Annex 1)
 - the working pattern of the researcher
 - the arrangements related to the intellectual property rights (during implementation of the action and afterwards), in particular full access — on a royalty-free basis — for the researcher to background and results needed for their activities under the action

⁵ Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

- the obligation of the researcher to inform as soon as possible about events or circumstances likely to affect the implementation of the action or the compliance with requirements under the Agreement (see Article 19)
- the obligation of the researcher to maintain confidentiality (see Article 13)
- the obligation of the researcher to ensure the visibility of EU funding in communications or publications and in applications for the protection of results (see Articles 17)
- where set out in the call conditions, the obligation of the researcher to carry out a mandatory return period of 12 months
- assist the researchers in the administrative procedures related to the recruitment
- inform the researchers about:
 - the description, conditions, location and timetable for the implementation of the research training activities
 - the rights and obligations toward the researchers under this Agreement
 - the obligation of the researchers to complete and submit — at the end of the research training activities — the evaluation questionnaire and — two years later — follow-up questionnaire provided by the granting authority
- ensure full access — on a royalty-free basis — for the researchers to background and results needed for their activities under the action
- ensure that the researchers do not have to bear any costs for the implementation of the action as described in Annex 1
- provide training and the necessary means for implementing the action (or ensure that such training and means are provided by other participants in the action)
- ensure that the researchers are adequately supervised and receive appropriate career guidance
- ensure that personalised career development plans are established, support their implementation and update in view of the needs of the researchers
- ensure an appropriate exposure to the non-academic sector (if applicable)
- respect the maximum limit for secondments set out in the call conditions
- respect the conditions for the outgoing and return phases set out in the call conditions (if any)
- ensure that the researchers are informed that they are ‘ERA fellows’
- ensure that the researchers do not receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiaries (or other entities mentioned in Annex 1)

- host the researchers at their premises (or at the premises of other participants in the action)



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