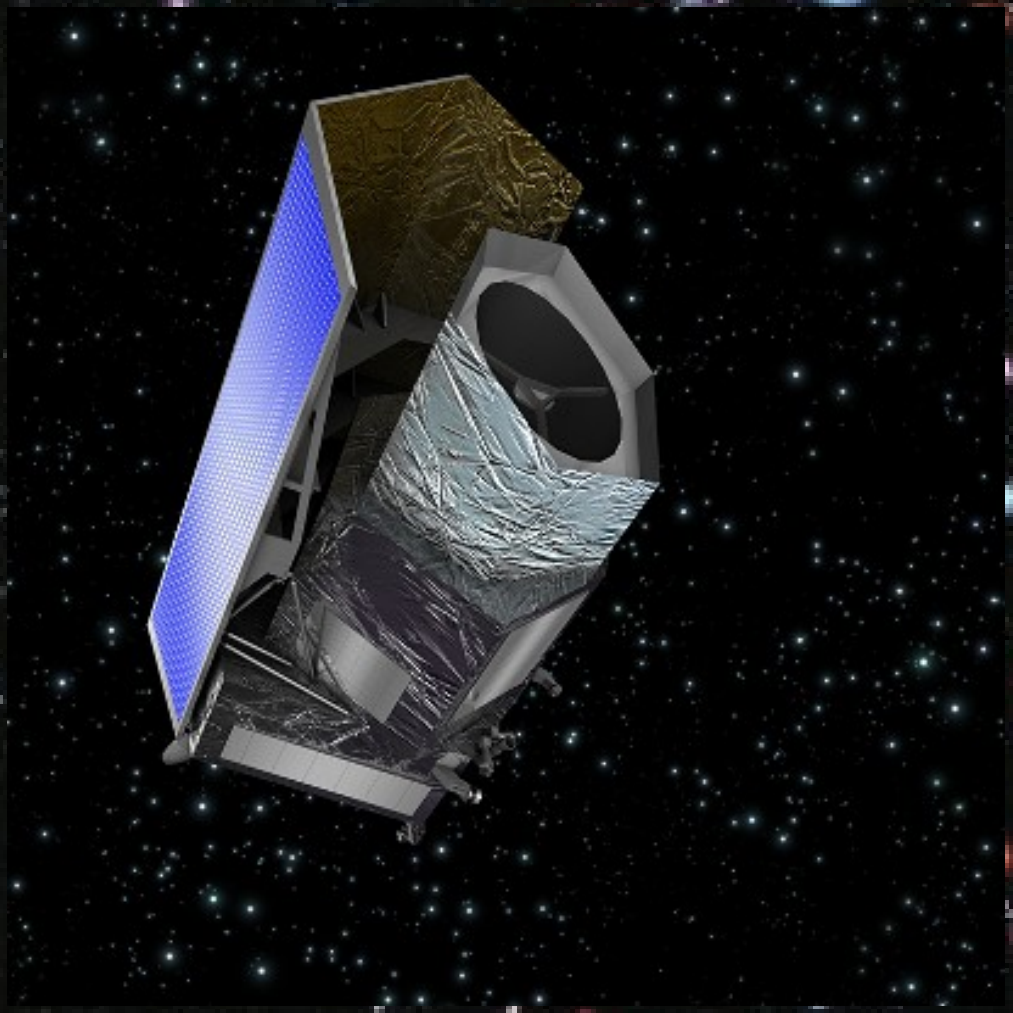
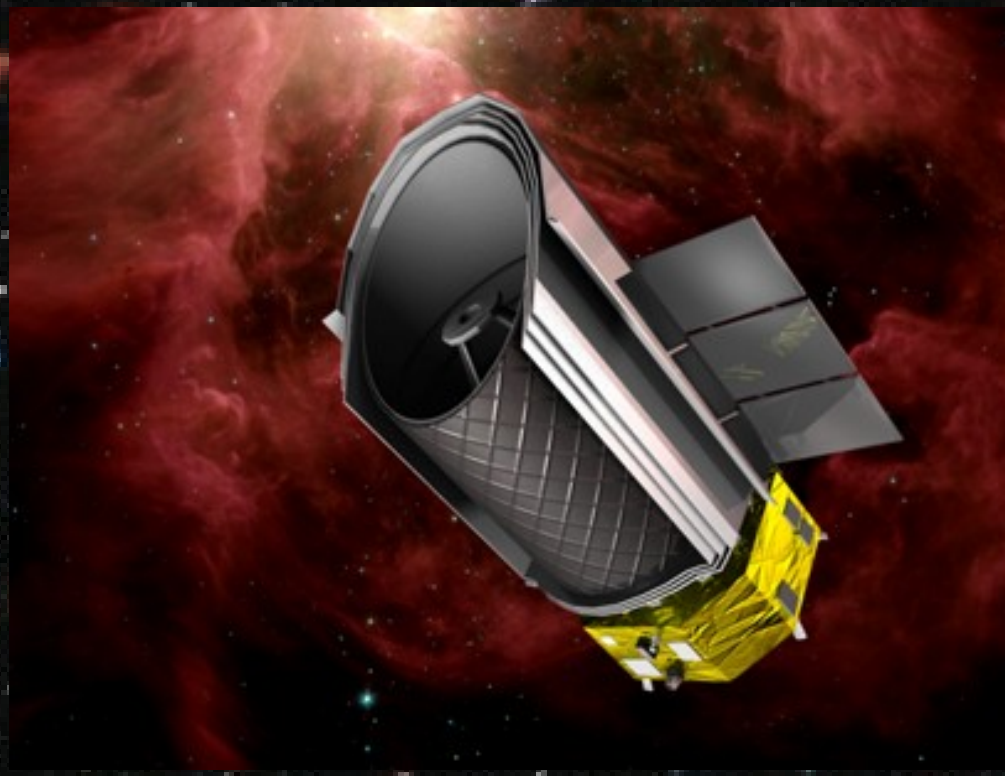
SPICA and Euclid synergies on galaxy evolution





Andrea Cimatti

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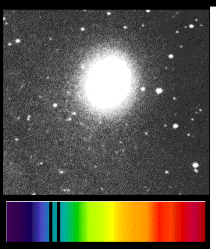
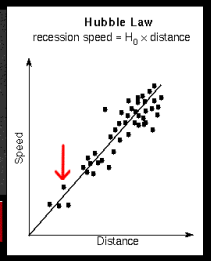
"Workshop nazionale SPICA" – INAF, Roma, 7-8 February 2013

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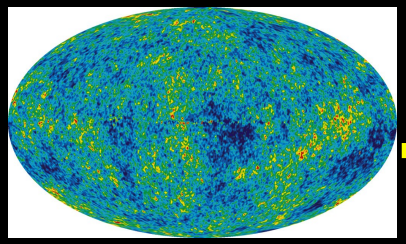
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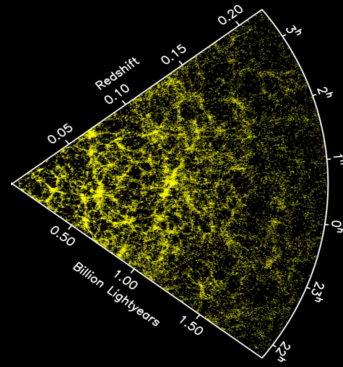

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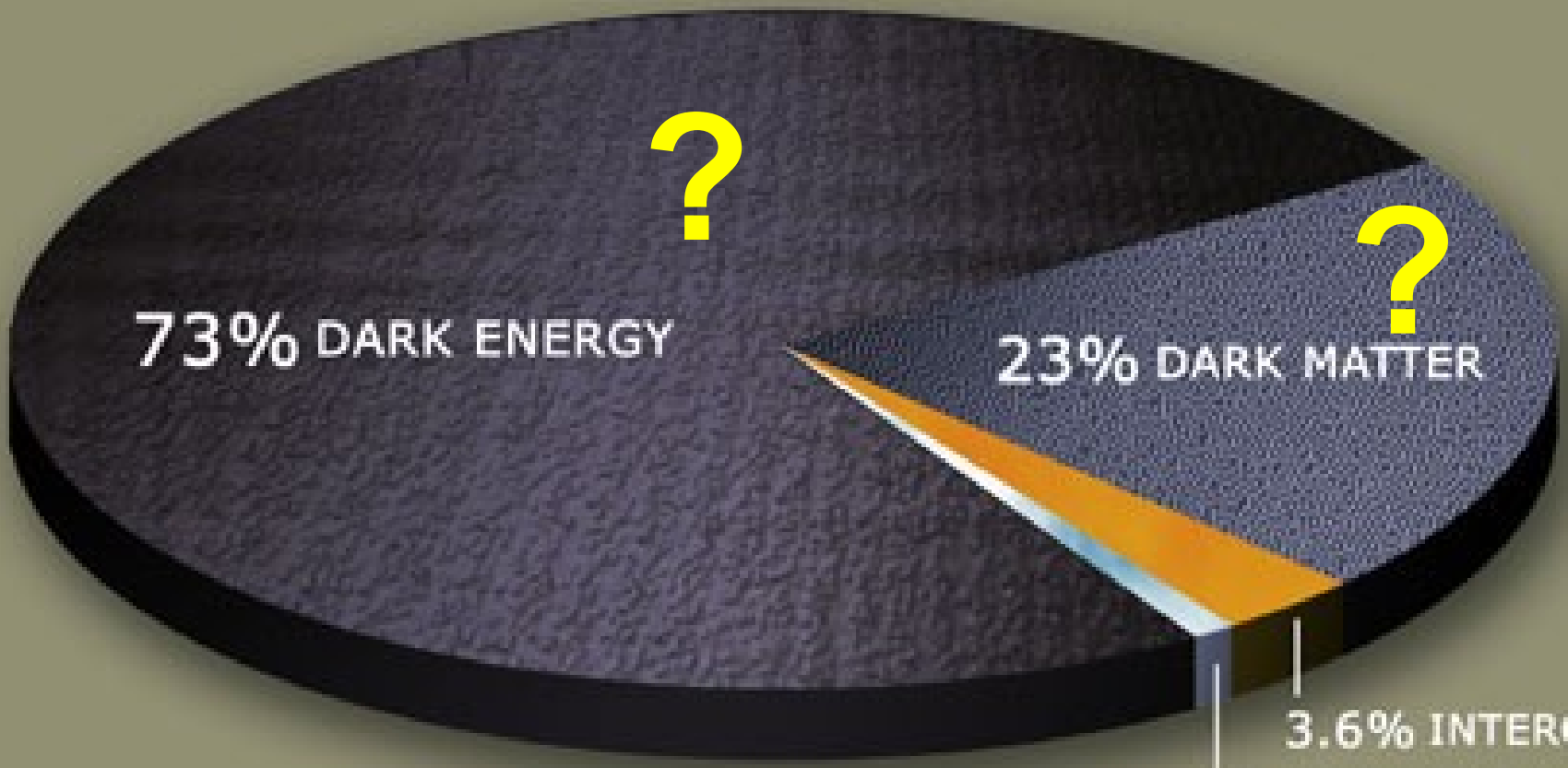
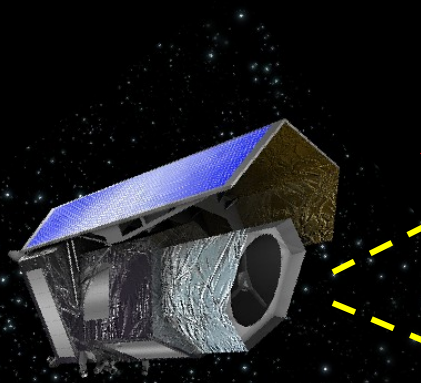
All observational cosmology tests agree: ~96% of the Universe is dark



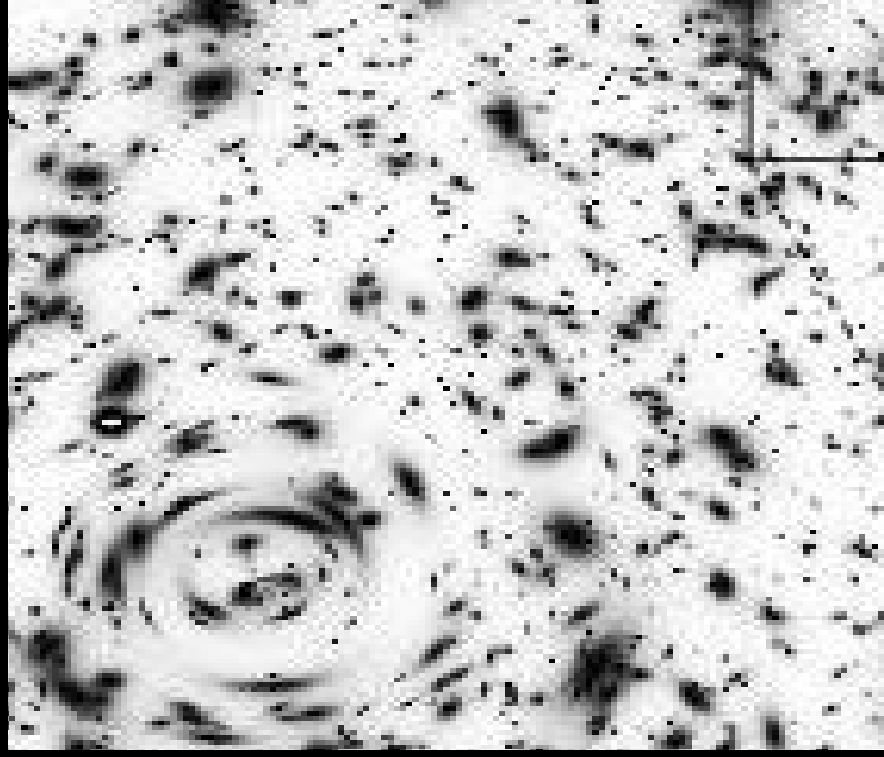
$$\Omega_{DM} + \Omega_{baryon} + \Omega_{\Lambda} = 1$$

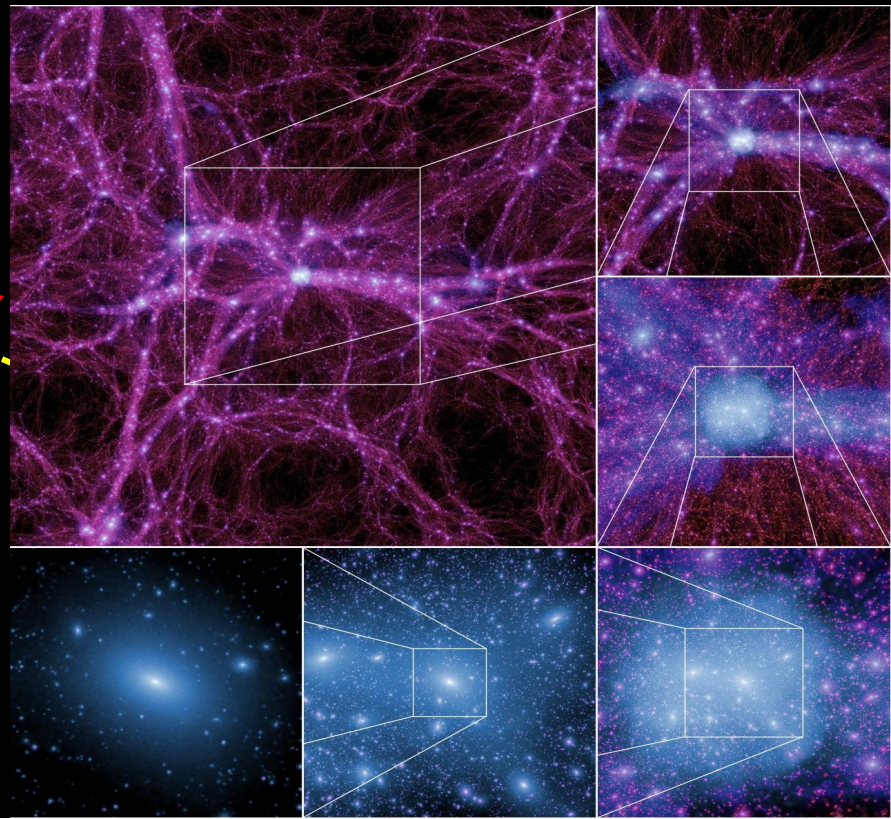
Euclid

- **ESA** *Cosmic Vision 2015-2025* M-class Mission
- 2008-2011: Assessment + Definition Phases
- **2012 : final adoption in June**
- Launch in 2020



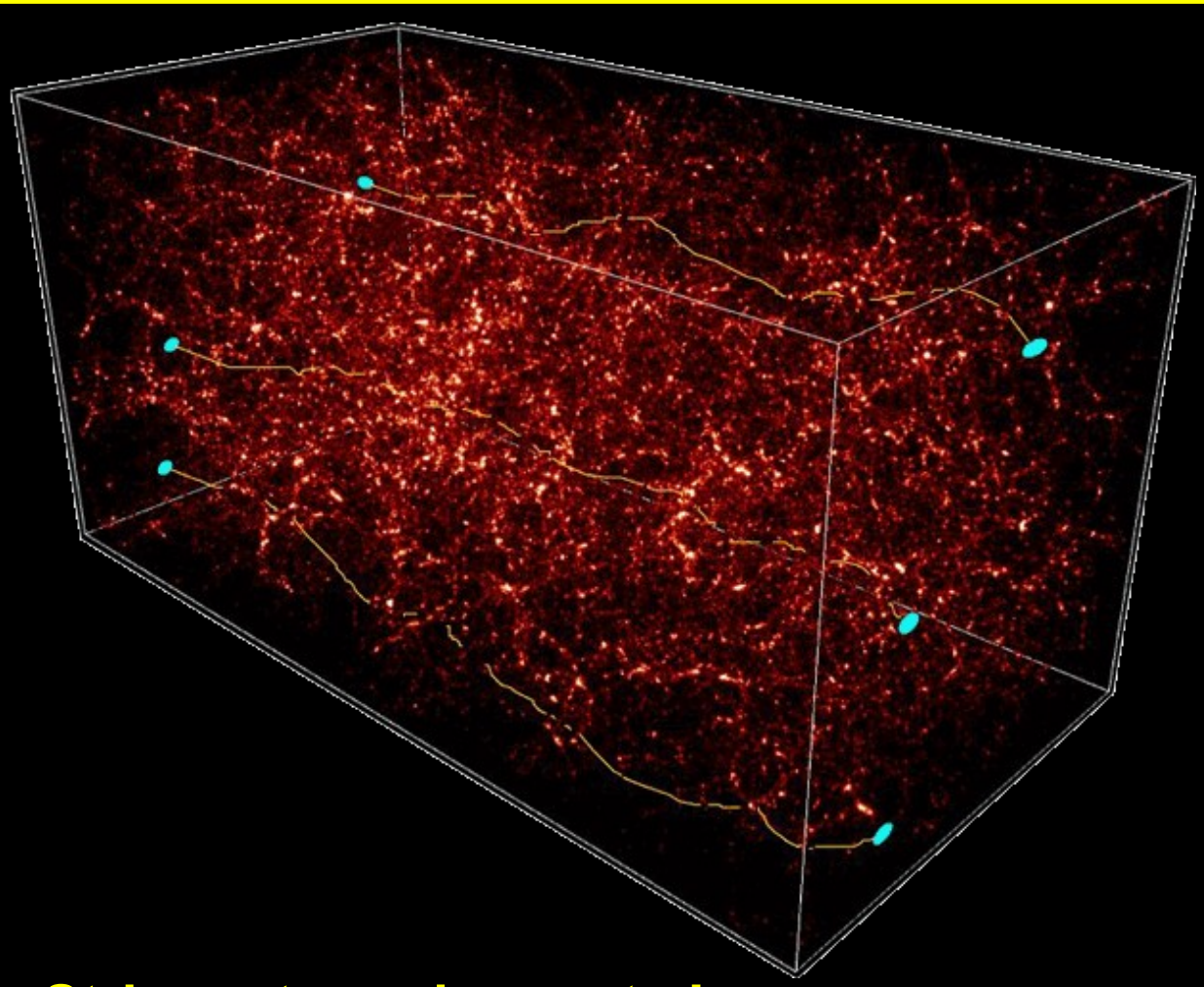
Visible (+ NIR) imaging
Weak gravitational lensing
Near-infrared spectroscopy
Large scale structure

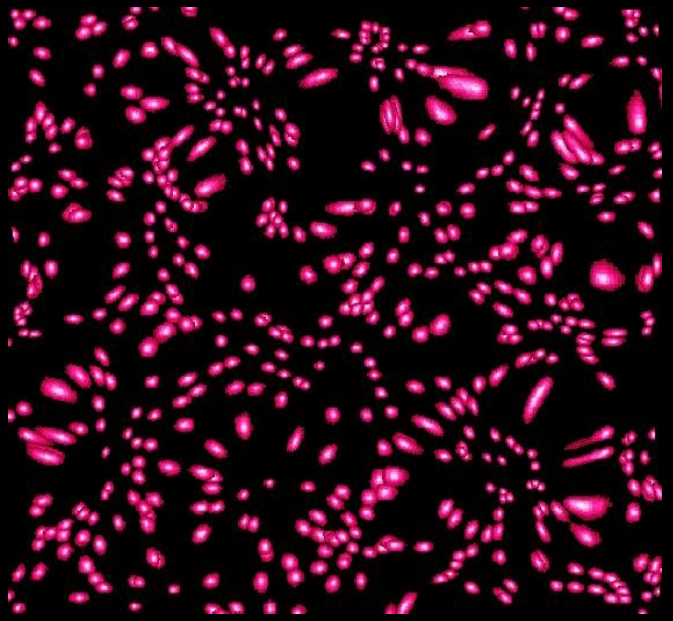


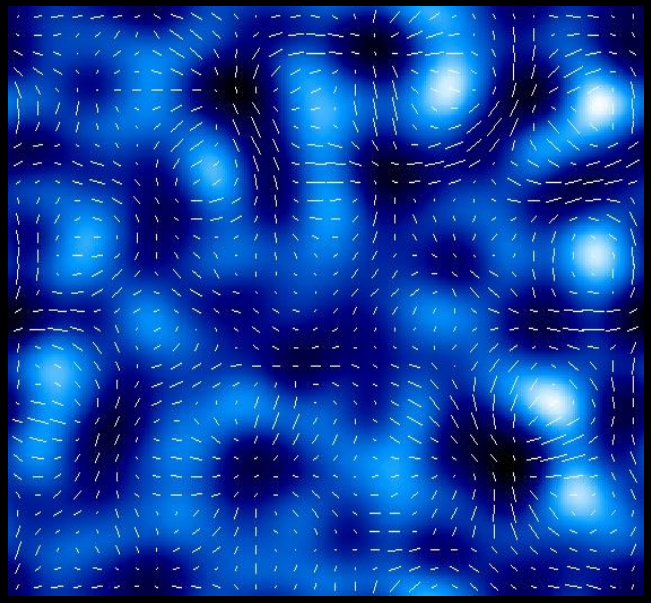


Expected accuracy improvent over current:
- >300x (Dark Energy EoS)
- >30x (Modified Gravity)

Probe 1 : Weak Gravitational Lensing





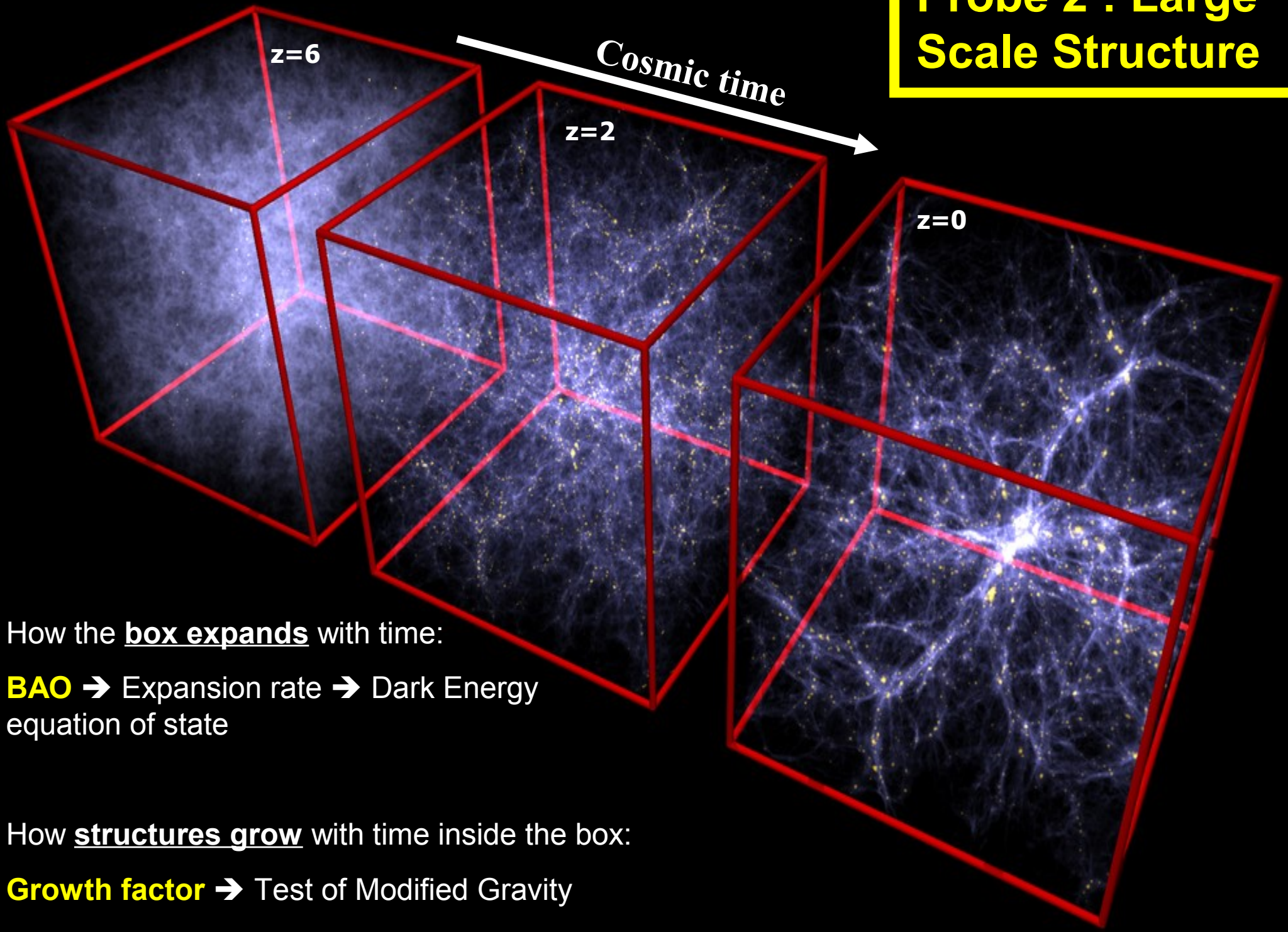


Stringent requirements !

- ❑ **Tight control of systematics**
- ❑ **Very accurate measurement of galaxy shapes**
- ❑ **Very accurate photometric redshifts**
- ❑ **Very accurate knowledge of galaxy N(z)**

- ❑ **Map the 3D distribution of Dark Matter**
- ❑ Correlation between shapes of galaxy pairs as a function of angular separation and z (i.e. power spectrum of the “shear”)

Probe 2 : Large Scale Structure

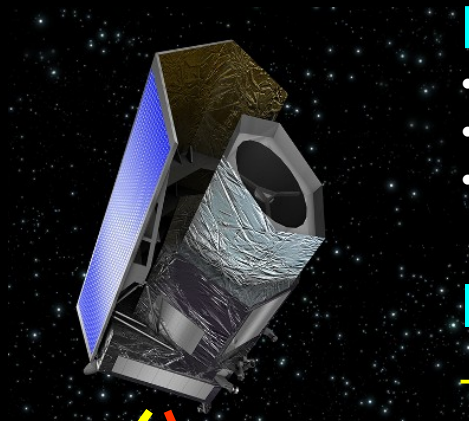


How the **box expands** with time:

BAO ➔ Expansion rate ➔ Dark Energy equation of state

How **structures grow** with time inside the box:

Growth factor ➔ Test of Modified Gravity



Mission elements

- L2 Orbit (Soyuz ST-2.1 B launcher)
- Launch in 2020. ~ 6-7 year mission
- Telescope: 1.2 m primary diameter (“step & stare” survey mode)

Instruments

– **VIS** : visible imaging: CCD mosaic, 0.5 deg², 0.1’’ pixels, 0.18’’ PSF, R+I+Z filter (0.55-0.92 μm), AB_{lim}=24.5

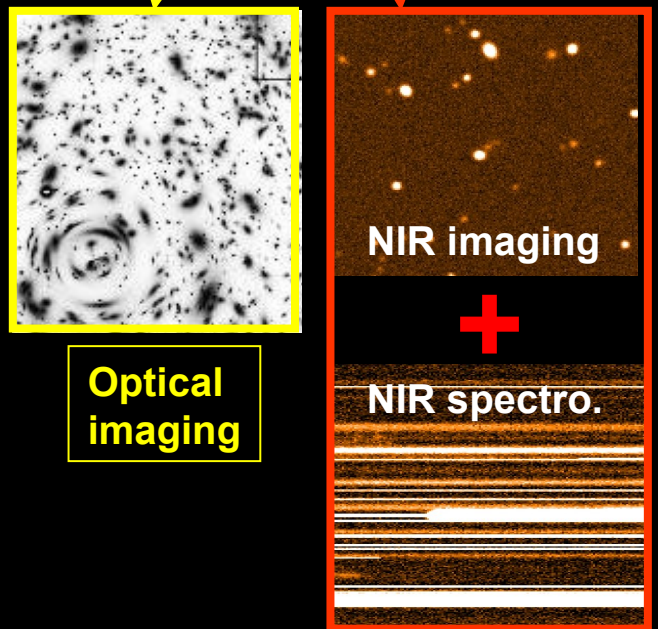
– **NISP**: 0.5 deg², 0.3’’ pixels, HgCdTe detectors

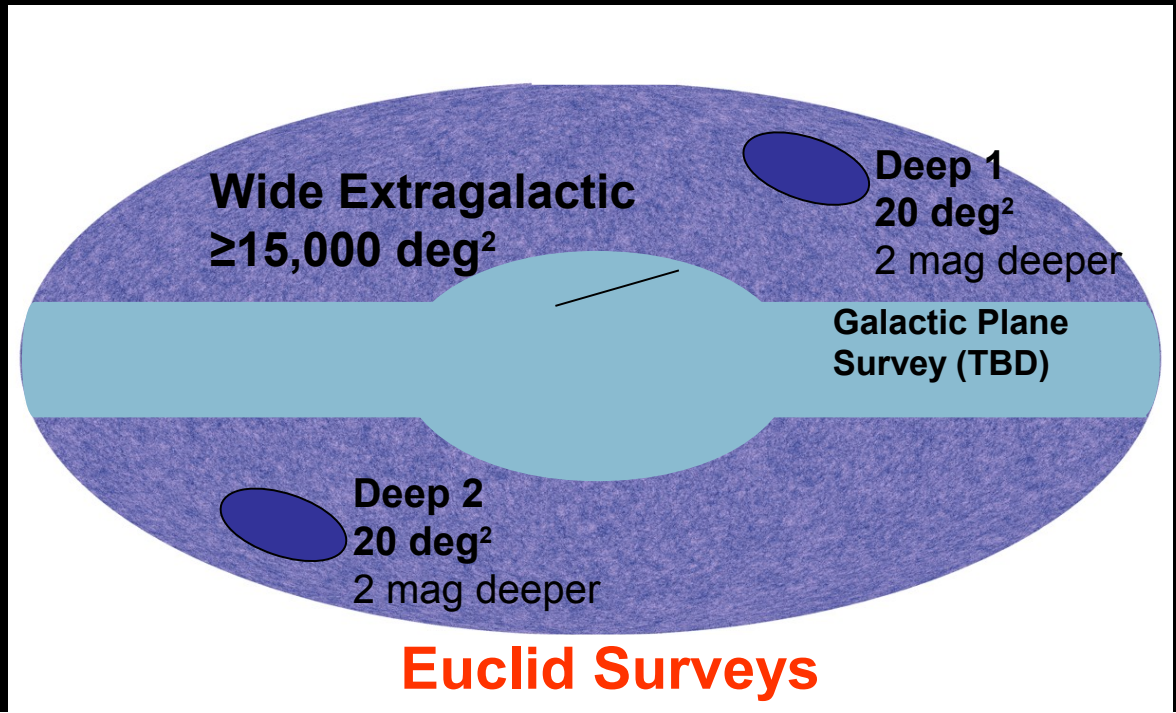
➢ Imaging: Y, J, H bands to AB=24

} **2 billion galaxies**

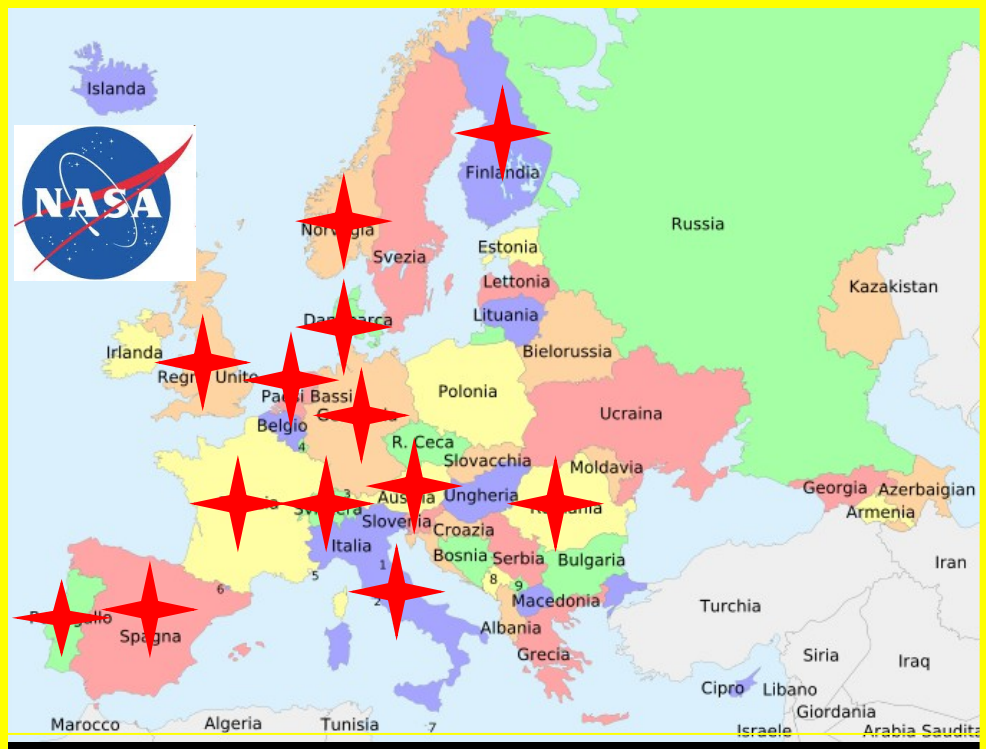
➢ Slitless spectra: 1.1–2 μm, R~300, F>3x10^{-16} ergs cm^{-2} s^{-1}, m_{cont}(H)<19 (AB), 0.7<z(Hα)<2 → **50+ million galaxy spectra/redshifts**

+ Ground-based optical imaging for photo-z (Pan-STARRS, DES, KiDS, LSST…)





The Euclid Consortium and Italian Participation



Euclid Consortium

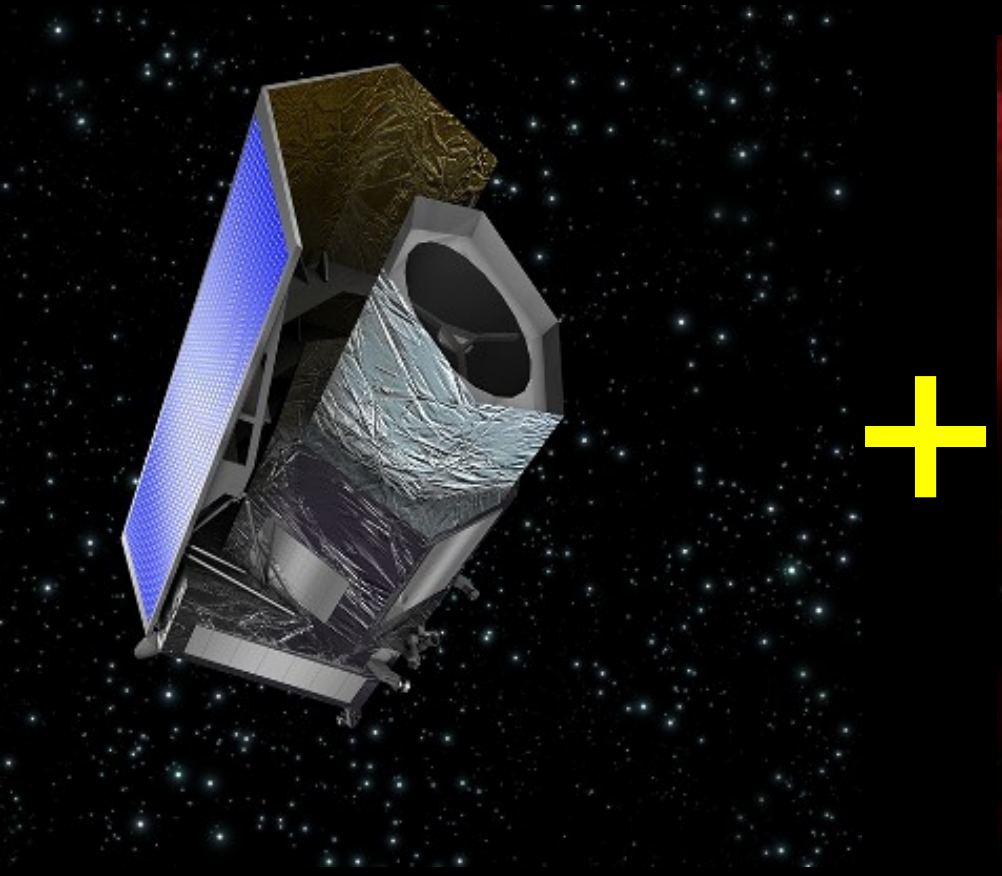
- 13 countries, ~ 900 people
- Lead: Chair (Y. Mellier - IAP France) + EC Board
- France, Italy & UK are the major contributors
- 2 Italians in the Board (A. Cimatti & R. Scaramella)

"Euclid-Italy" Team

- **~120+ members**
- Main financial support from **ASI**, partly from **MIUR** (PRIN)

- **Universities** : Bologna, Milano, Napoli, Padova, Roma1, Roma2, Roma3, SISSA (Trieste), SNS (Pisa), Trieste

- **INAF** : OABO, OABrera, OACT, OAA, OANA, OAPD, OARM, OATO, OATS, IASFBO, IASFMI, IAPS



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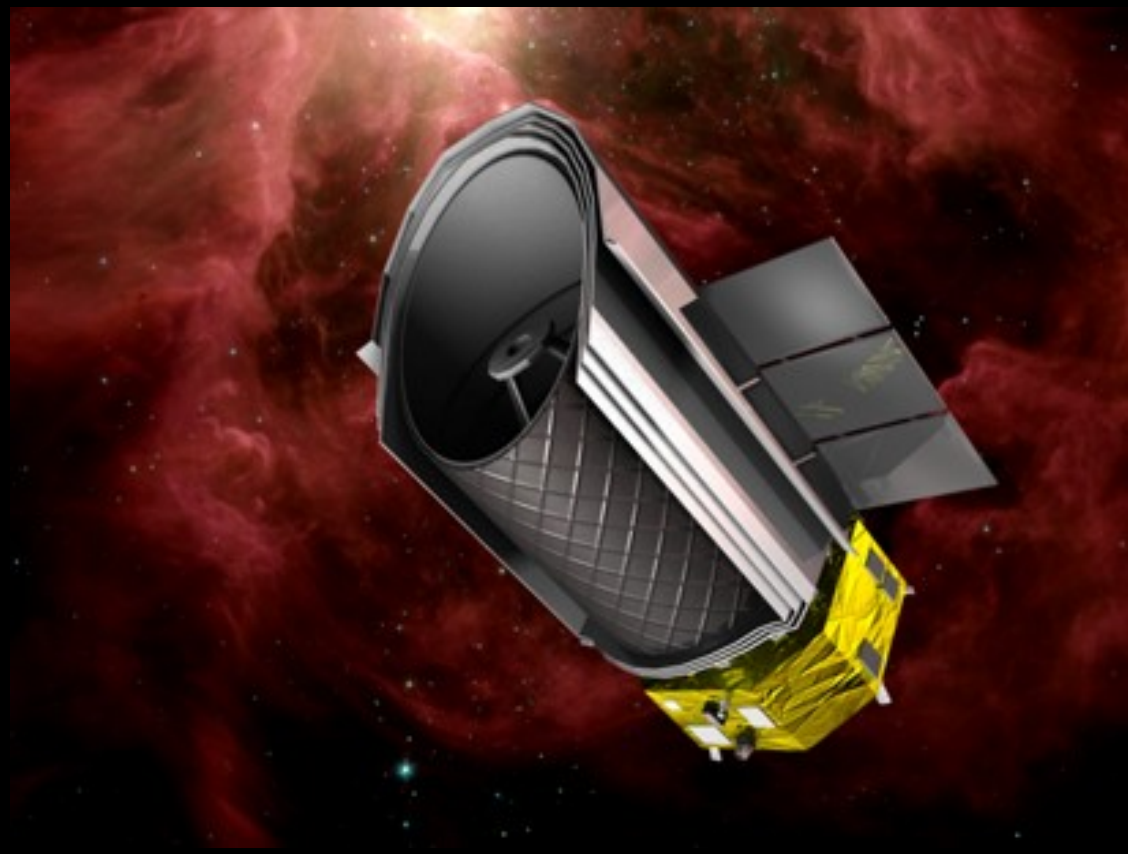
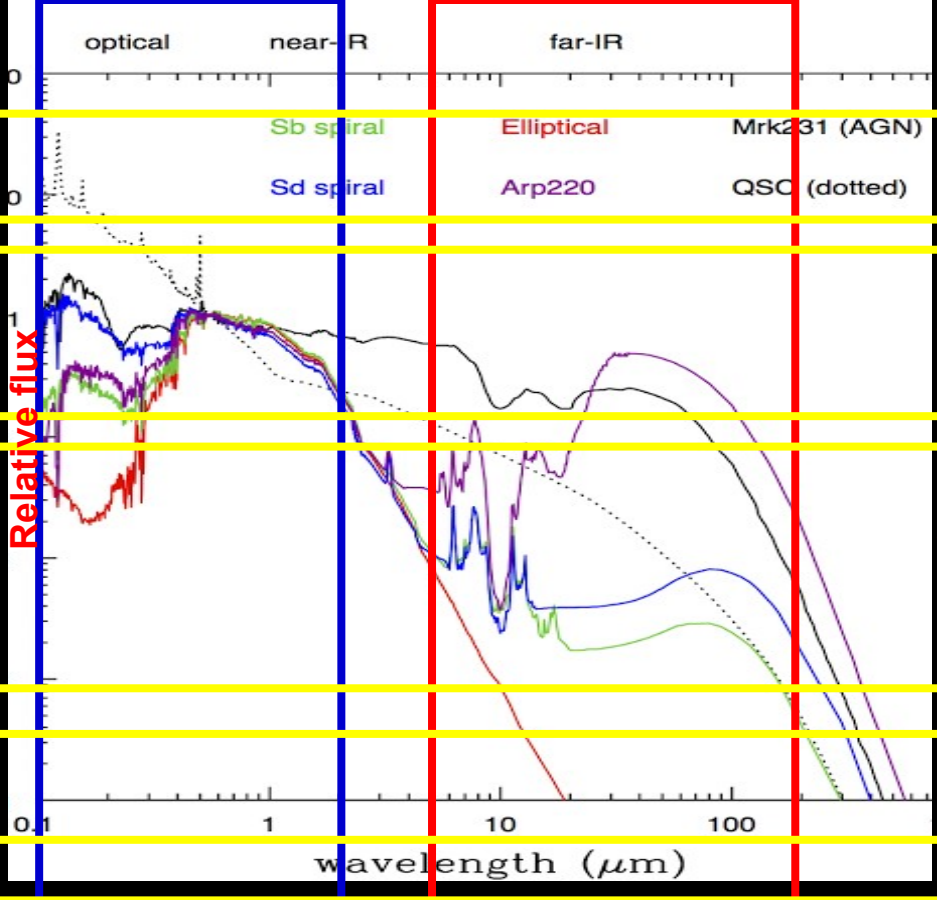
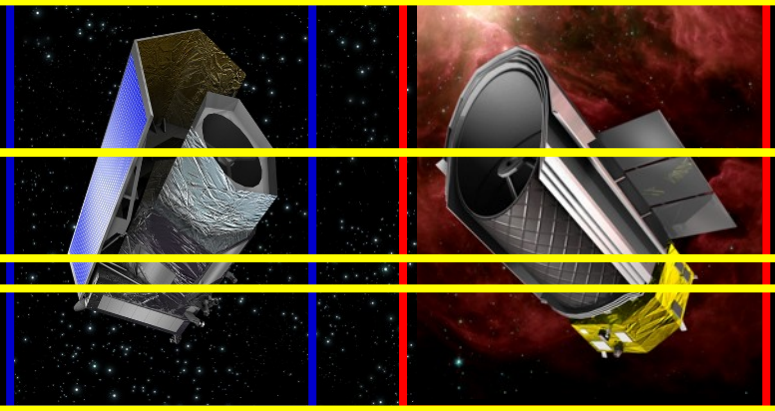


2020 (~6-7 years duration)

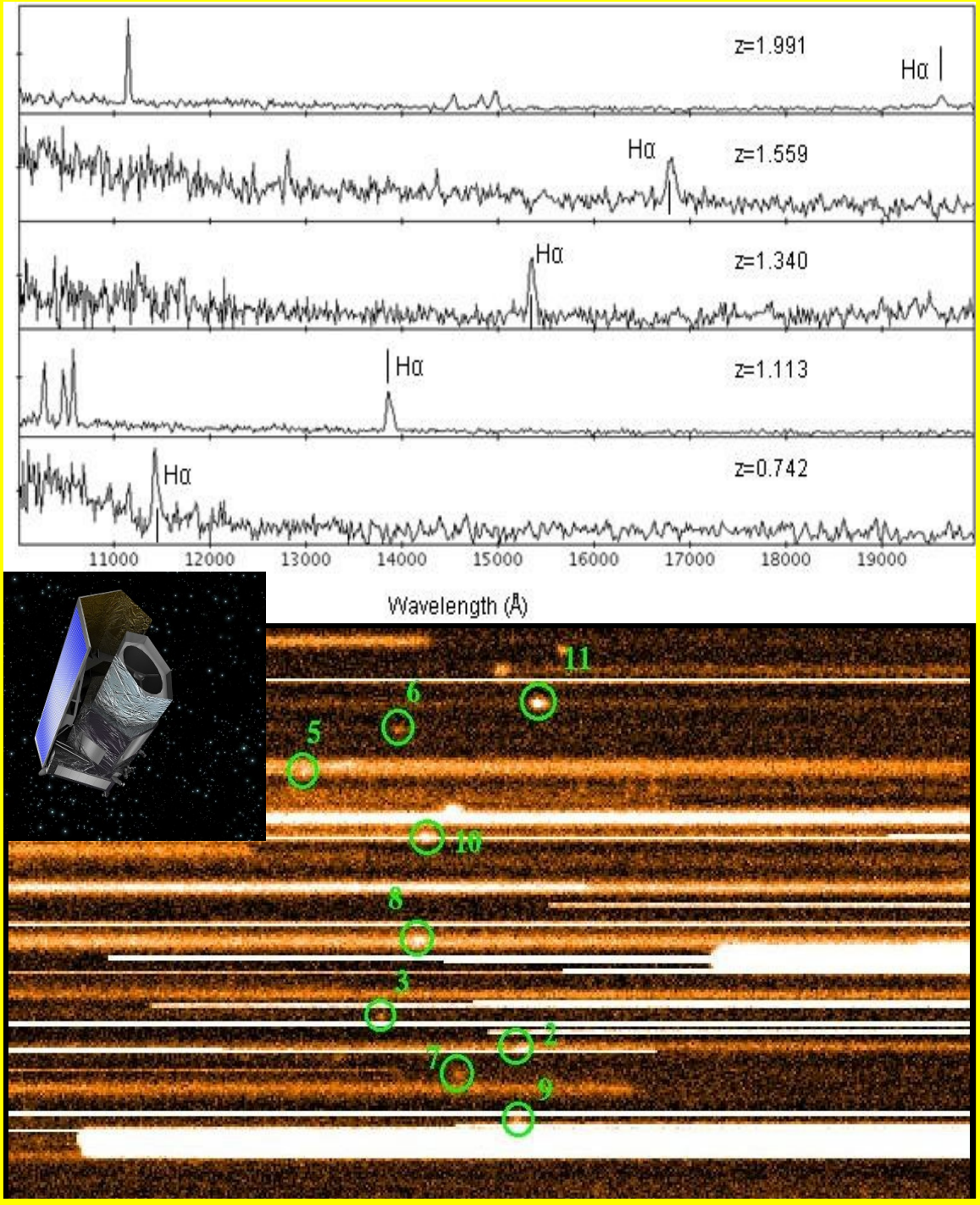
2022 (~3-5 years duration)

Euclid		SPICA
•Opt/NIR SEDs & spectra		•MIR/FIR SEDs & spectra
• 0.7< z-spec(Hα) < 2 • 0 < z-spec(others) < 9… • Very accurate z-phot		• 0< z-spec < 4+
• SFR(Hα) > 20,120 $M_\odot yr^{-1}$ @z=1, 2 in Wide Survey • SFR(Hα) > 3, 20 $M_\odot yr^{-1}$ @z=1, 2 in Deep Survey		• SFR>1,10 $M_\odot yr^{-1}$ @z=1, 2
• SED fitting (M*, ages, …)		• Accurate sSFR =SFR/M*
• Ionization diagnostics • Ionized gas metallicity		• Ionization diagnostics • Ionized gas metallicity
•Dust extinction (Hα/Hβ)		• Dust properties
• Moderately obscured objects		• Obscured objects

- Morphology
- LSS, environment
- Dark matter halos

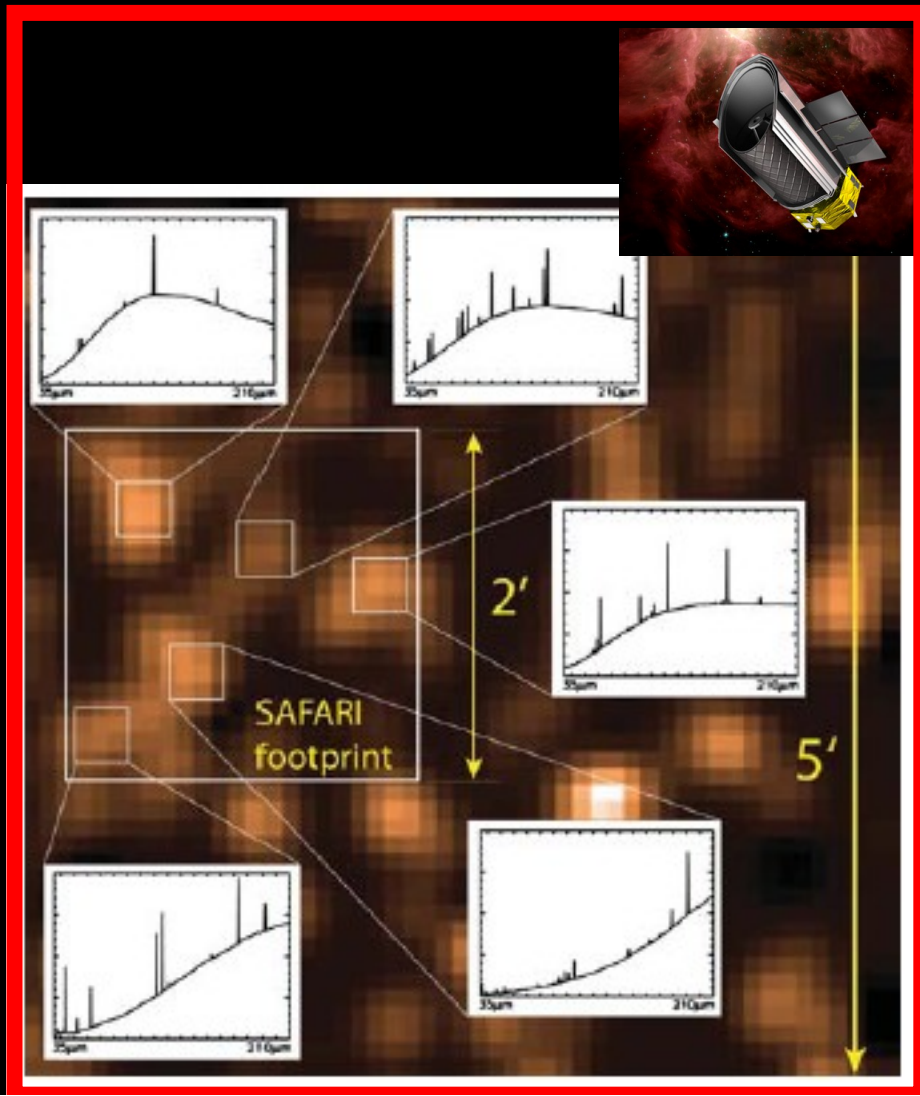
unique contribution of Euclid ⟶ crucial for SPICA !

Example of optimal Euclid – SPICA synergy



Euclid Deep Survey

~ 40 deg^2 (field coordinates TBD)



A bright future for Euclid + SPICA