



Gaia Science Alerts in Italy

Bologna, Catania, Napoli, Teramo, ... Padova

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L'Italia in Gaia - Roma



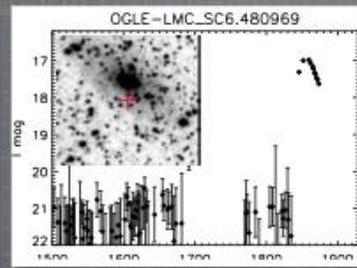
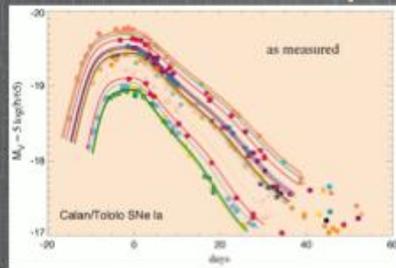


What are the Gaia Science Alerts?

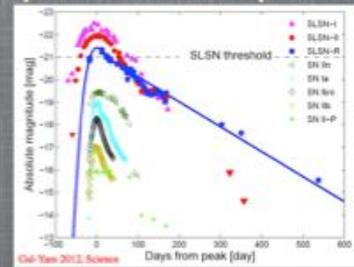
- **Detected events whose value is lost if not immediately alerted and followed-up**
- Sampling: about **70** observations per object over 5 years (grouped in pairs)
- Daily data transmissions of **anomalous** and **transient** events from the whole sky
- Issued usually within **12-48h** after observation
- Limiting magnitude: ~20mag
- Anomalies detected and classified on **1-2** Gaia data points (photometry and low-res spectroscopy)

SCIENTIFIC OPPORTUNITIES

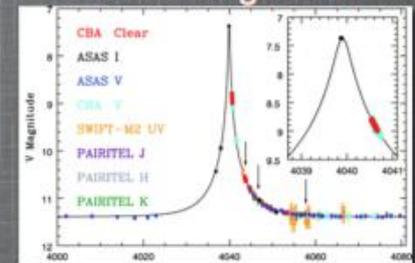
Supernovae



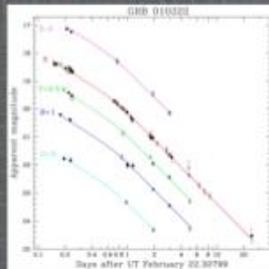
Super-luminous Supernovae



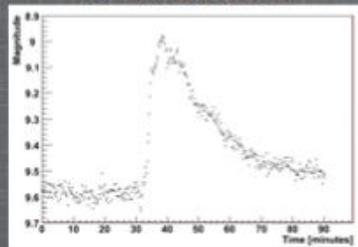
Microensing events



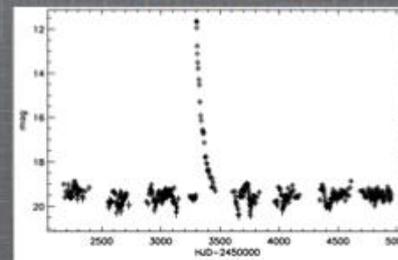
GRBs optical counterparts



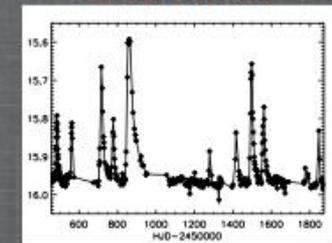
M-dwarf flares



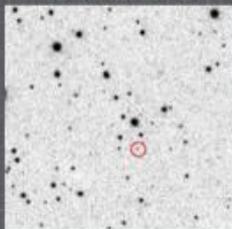
Classical novae



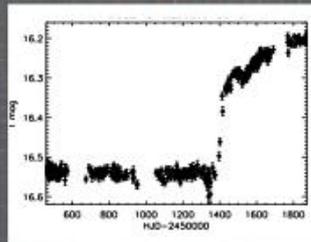
Dwarf novae



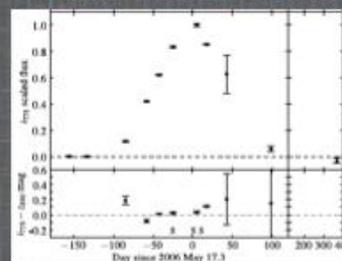
Asteroids



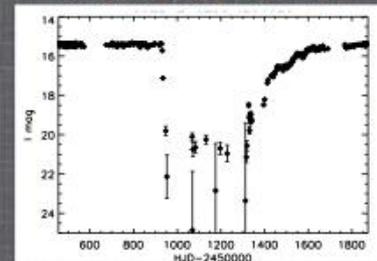
Be stars



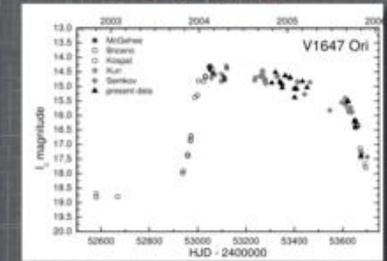
NEW THINGS??



R Coronae Borealis



FU Orionis



Alert dissemination

- Publication of Alerts to the entire community: no proprietary data.

- VOEvent - machine-readable format, can be displayed in e.g. Google Sky

- Skyalert.org - will host both alerts and follow-up data

The screenshot shows the Skyalert.org website. At the top is a navigation bar with the SkyAlert logo, the text "Skyalert.org", and links for "Browse Event Streams", "Browse SkyAlert Feeds", and "my Feeds and Alerts". Below the navigation bar is a "Recent Events" section. It contains a legend with colored squares for CRTS, CRTS3, CSS_NEO, CRTS2, Fermi, and CRTSCircular. The main area is a timeline plot showing event occurrences as colored dots and bars. The x-axis is labeled "Time since now (2010/11/02 6:20 PDT)" and has markers for month, 2w, week, 4d, 3d, 2d, day, 12h, 4h, 2h, hour, and 0.0. Below the plot are three buttons: "Browse Event Streams", "Browse SkyAlert Feeds", and "my Feeds and Alerts". To the right of the "Recent Events" section is an "About SkyAlert" section with a paragraph of text and a list of links.

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[Browse Event Streams](#) | [Browse SkyAlert Feeds](#) | [my Feeds and Alerts](#) Log in [here](#), or register [here](#).

Recent Events

In the picture below, time is measured with "right now" at the right. Ages of recent events -- the last 200 received -- are shown by stream. Click on an event to bring up a new window with detailed portfolio.

- CRTS
- CRTS3
- CSS_NEO
- CRTS2
- Fermi
- CRTSCircular

month 2w week 4d 3d 2d day 12h 4h 2h hour 0.0
<-- Time since now (2010/11/02 6:20 PDT)

[Browse Event Streams](#) [Browse SkyAlert Feeds](#) [my Feeds and Alerts](#)

About SkyAlert

SkyAlert collects and distributes astronomical **events** in near-real time. Each event belongs to a **stream** of events that come from a common source, with a common vocabulary of parameters for each event. You can browse event streams and the events themselves, at the links below. You can set up "alerts" which decide which events you find interesting, that comes with an **Atom feed** of those that pass the selection. You get only the events you want -- no more, no less.

- [SkyAlert News](#)
- [Feeds of interesting astronomical events](#)
- [Browse event streams](#) that skyalert is monitoring
- [Recent events](#) as a table
- Recent events with [WorldWide Telescope](#)
- Recent events [Facebook page](#)
- Recent events with [Twitter](#)
- [Build a custom feed](#)
- [Get email when an interesting event occurs](#)
- [Get SkyAlert events on your iPhone](#)
- [Authoring your own event stream](#)
- *SkyAlert: Real-time Astronomy for You and Your Robots, (pdf)*
- Contact us at help@skyalert.org



GSA organization

Gaia-FUN-TO (Gaia Follow-Up for Transient Objects, analogy to Gaia-FUN-SSO)

Aim: extraction of science from GSA

3 meetings (2010 Cam, 2011 Cam, 2012 Bo)

White books

Involved in the Alert Verification Phase

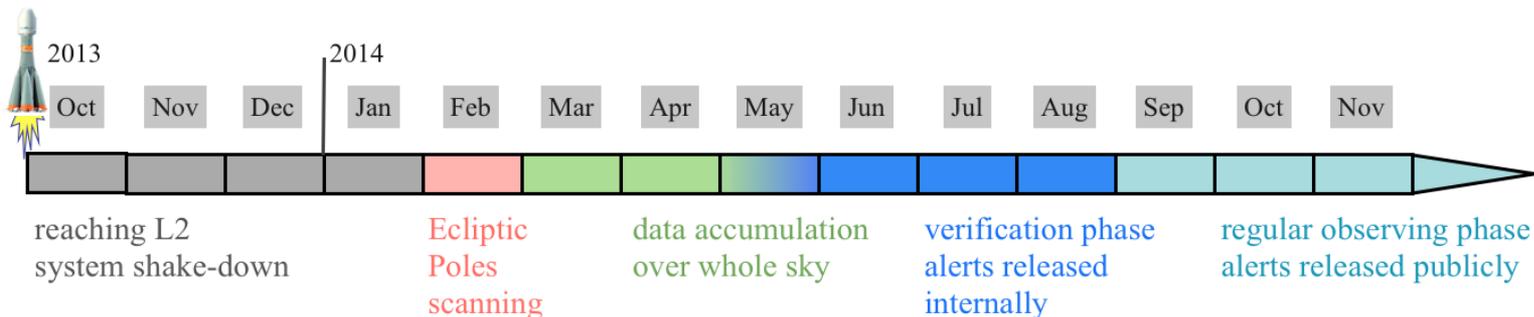


Science Alerts Verification Phase (SAVP)

Only period during which data are NOT public

- To validate and set-up the processing pipeline (detection, classification, detection thresholds, ..)
[Potential alerts are 1000s/day]
- To be started as soon as sufficient sky has been covered

launch
29 September 2013



Lukasz Wyrzykowski, 04.02.2013



SAVP

Makes use of

- Network of mid-size telescopes
- Centralized data repository (IoA)
- *ad hoc* SW (IoA)

Telescope requirements:

- multi-band photometric capabilities with moderate astrometric capabilities
=and/or
low-, mid-res spectroscopy for the classification
- both hemispheres, east and west
- flexible scheduling (ToO) → ideal robotized/automated telescopes
- unified/standardized observational output,

Large number of European groups/telescopes

Still To Be formalized via a MoU (weeks ?)



Italian involvement in Gaia-FUN-TO and SAVP

Opportunity for :

- (1) better understanding of the Gaia alerts stream
- (2) preparation and readiness of the observatory/people for GSA exploitation

Aim: scientific exploitation of GSA (throughout the mission) from the beginning

Italian telescopes:

- (TNG/NOT mini-XShooter)
- mid-size telescopes

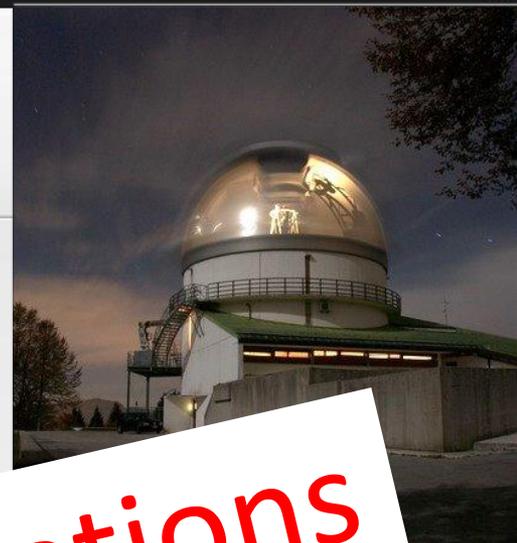
Other telescopes :

- NTT/PESSTO (we !!)
- 1.2m, Belgian Mercatore, La Palma
- 1.2m, Swiss Euler, La Silla
- 1.5m, Danish, La Silla
- several more



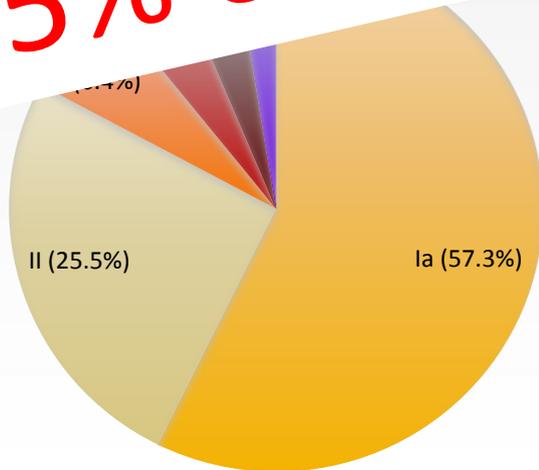
Asiago New Operation Model

- **no night assistance/support**
- simplification in operations (AFOSC/EHELLE, Peltier, ..)
- improved safety controls
- **remotization** (currently from the Asiago main site)
- few, large, **self-funded** programs (SNe, Exo-Transits, ...)

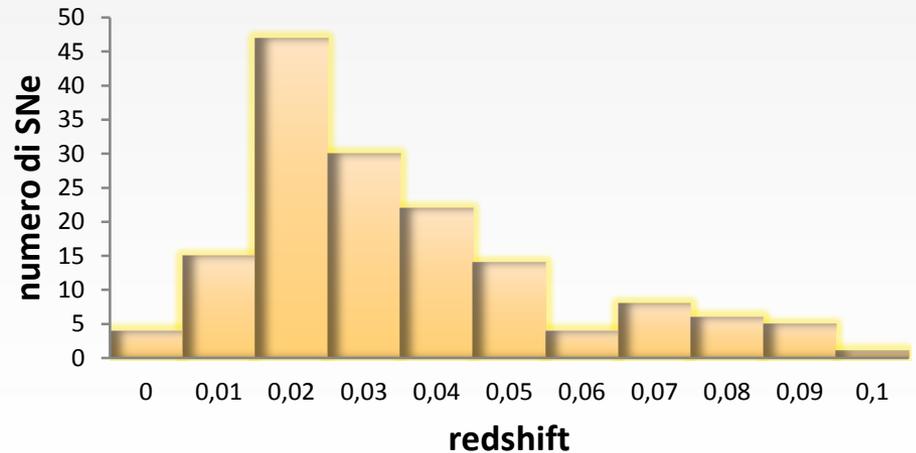


>25% of all SN classifications

Ic (2.5%)
distrib



Distribuzione in redshift





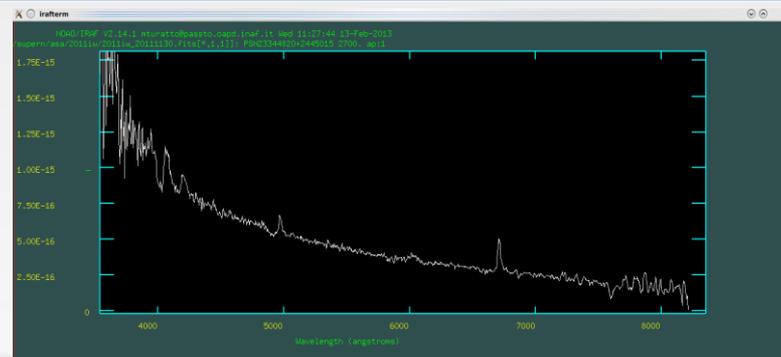
Gaia Alert system is highly heterogeneous
→ Test on data released via Skyalert (CRTS)

- Preliminary test (07/2011) in Loiano
- Coordination test of italian facilities with IoA (26-30/11/2011):

Pre-launch SAVP tests (IoA - INAF)

Science Results:

- Several targets observed ph+spec
- 1 SN classified, CBET 2941
- 1 SN classified as *second*



Le supernovae di Gaia

I telescopi Italiani coinvolti nel Gaia Science Alerts Follow-up Programme confermano 2 nuove supernovae. L'esperimento condotto ha visto per la prima volta i telescopi nazionali lavorare in sinergia fra loro.

di Gisella Clementini

08/12/2011 18:30

+ server & SW works, instruments are suitable, expertise in place
- vulnerable to strong competition (good!!)



A Science Case: Gaia SNe

perhaps the most appealing



Context:

- key interdisciplinary field (from stellar evolution to cosmology)
- large surveys era: PS1, PTF, LSQ, CRTS, SkyMapper, VST-Sudare, DES ... LSST
- spec-surveys: PESSTO, nearby SN Factory

Migration toward *proprietary* data (only exception is PESSTO)

Pros:

- Large number of objects
- Early discovery
- Often good photometric follow-up

- Unbiased =>> New discovery Space

Cons:

- Yes/Not
- Targets announced a posteriori
=> limited spec study



GAIA SNe (space, all-sky)

In 5yr (Cappellaro 2011, $g \sim 19$):

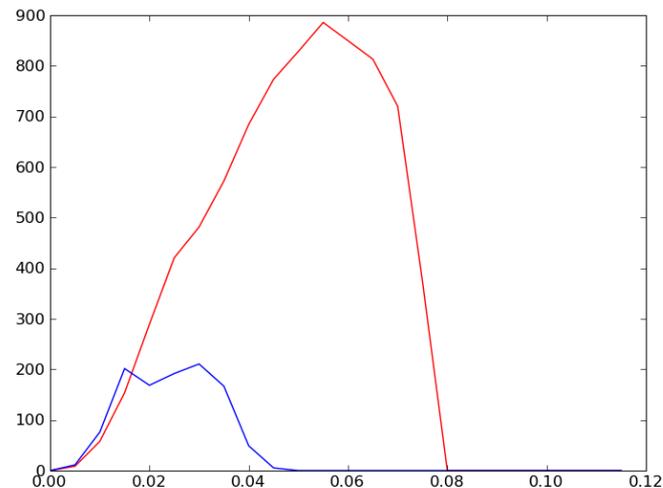
- 6300 SNe (87% Ia, 13% CC)
- 1800 SNe pre-max (95% Ia, 5% CC)
- 500 SNe < -5 d (97% Ia, 3% Ib/c)

Cons:

- significant fraction daytime objects => small interest
- variable/poor average cadence (many rediscoveries)
- ...

Pros:

- all sky (unbiased)
- deep, wide, available within 2 days
- the only public SN search of the next future





Conclusions

- Gaia Science Alerts are the first data released by Gaia
- Strong scientific interest on GSA in Europe and in Italy
- Facilities well suited for GSA **verification** and **exploitation**
- Expertise in place
- **Unique opportunity for Transients Science**

