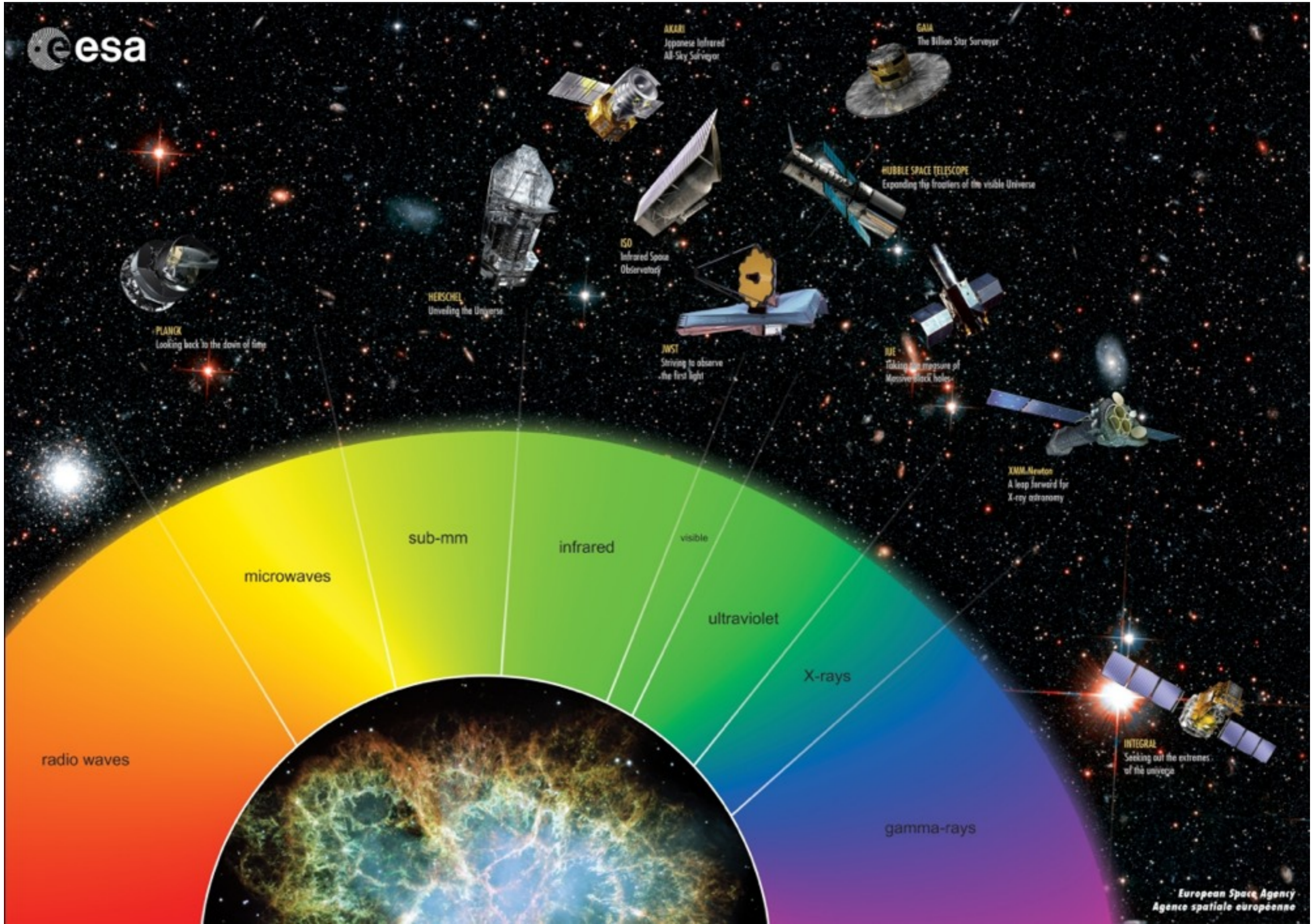


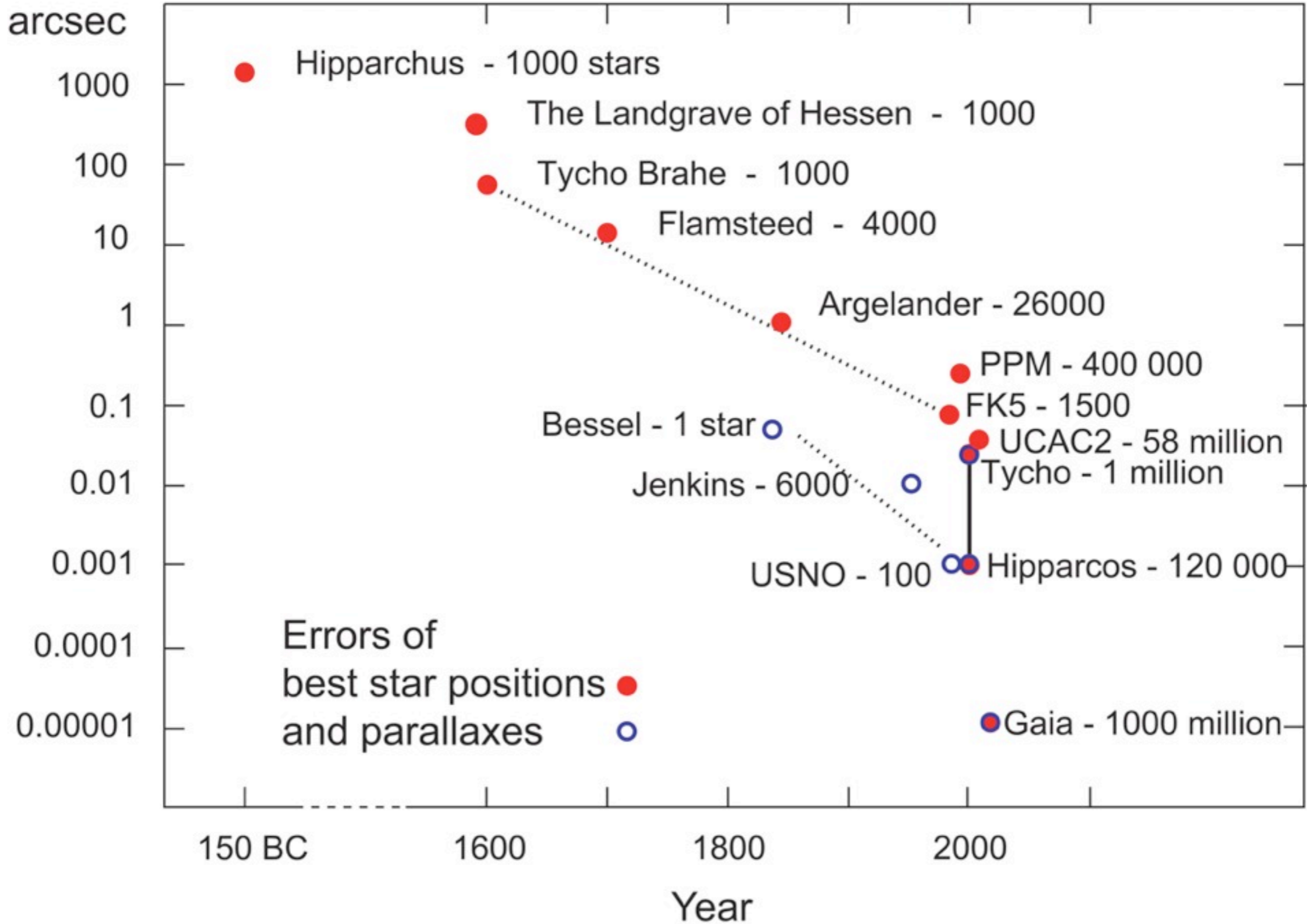
Science Alerts from GAIA

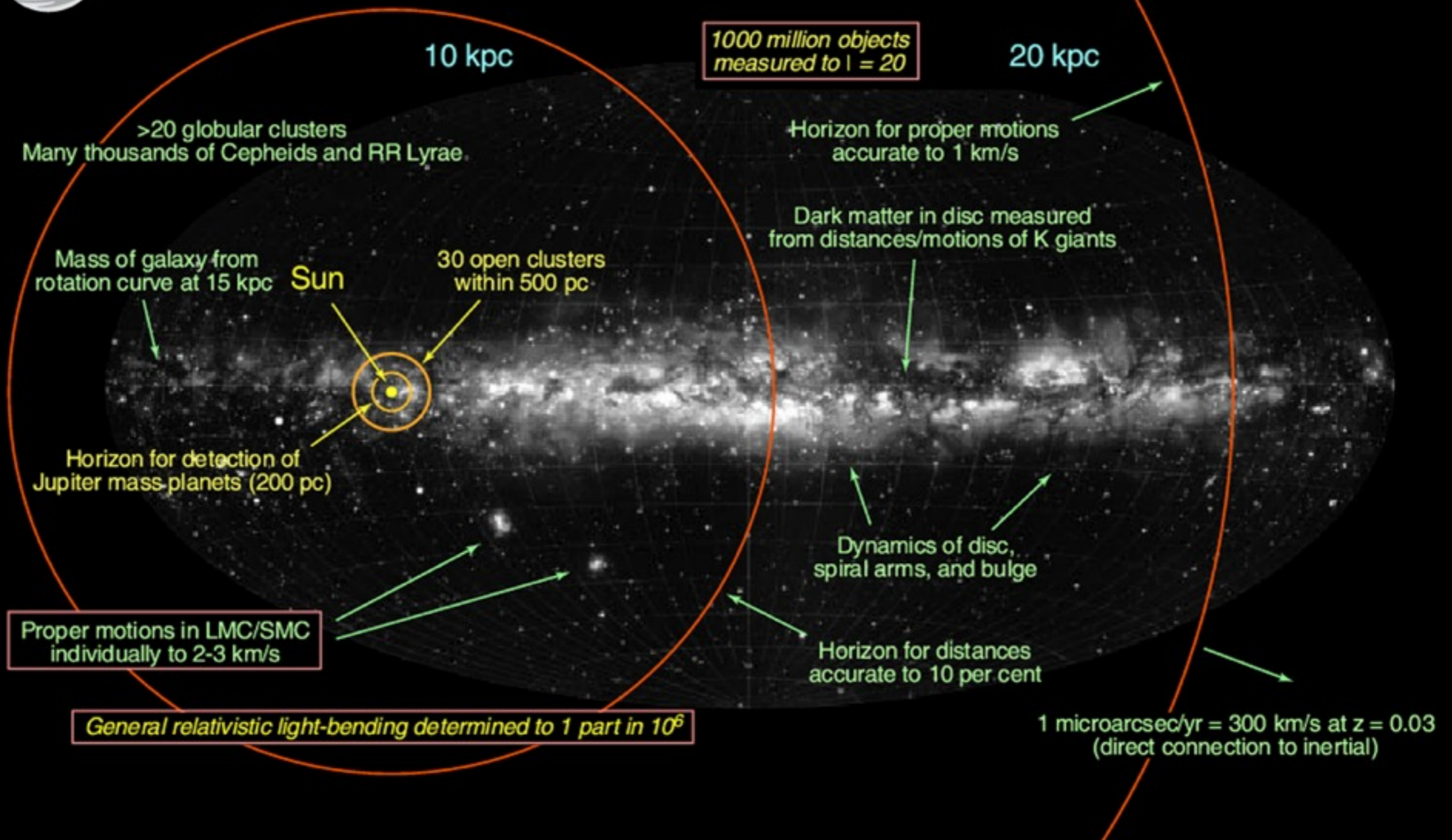
Simon Hodgkin
Institute of Astronomy, Cambridge

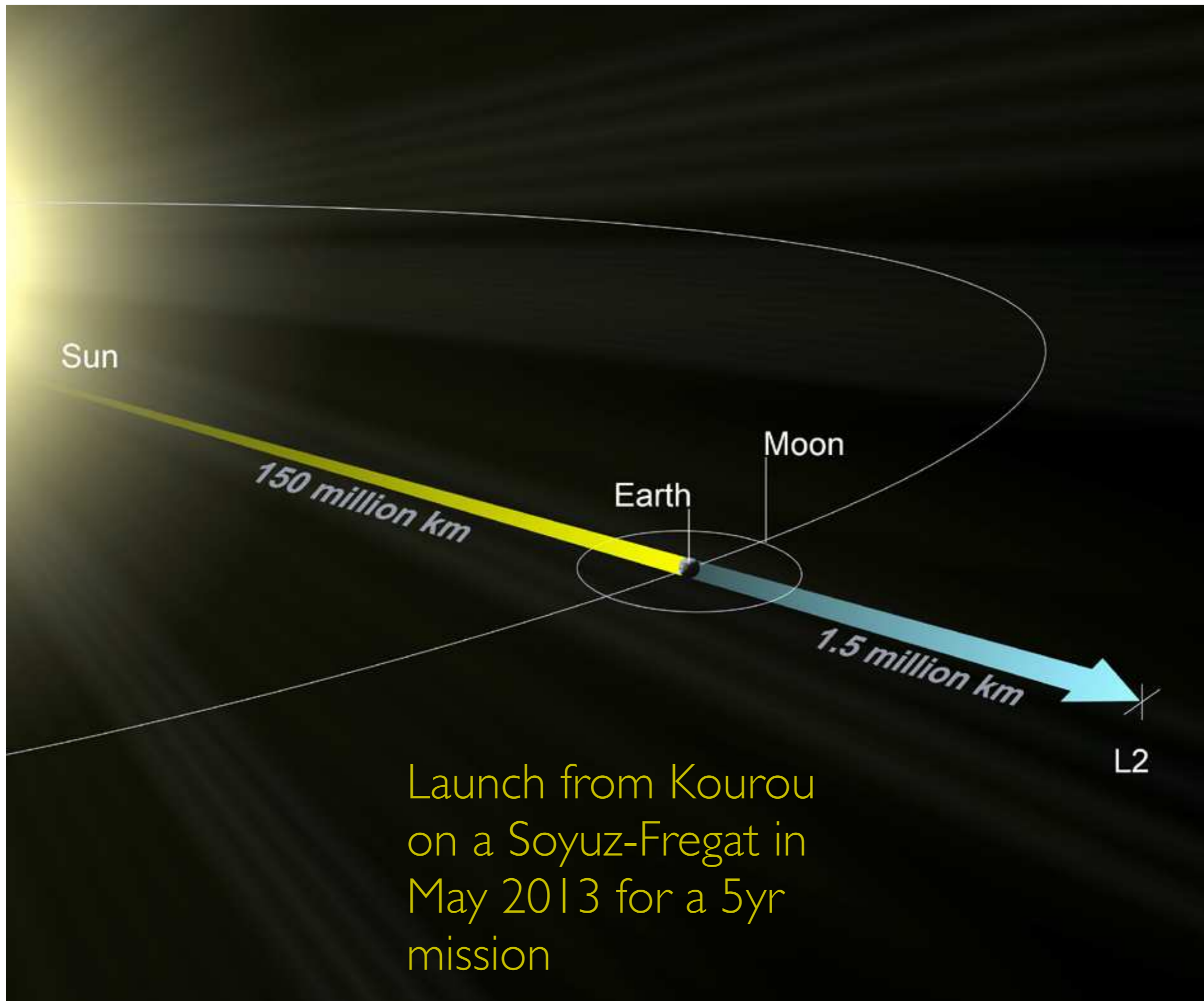
A word on nomenclature

- **Definition of a science alert:** science data that would have little or no value without quick interpretation, triggering additional (ground-based/space-based) follow up.
 - SA : science alerts
 - ASA : astrometric science alerts
 - PSA : photometric science alerts
 - SSA: spectroscopic science alerts

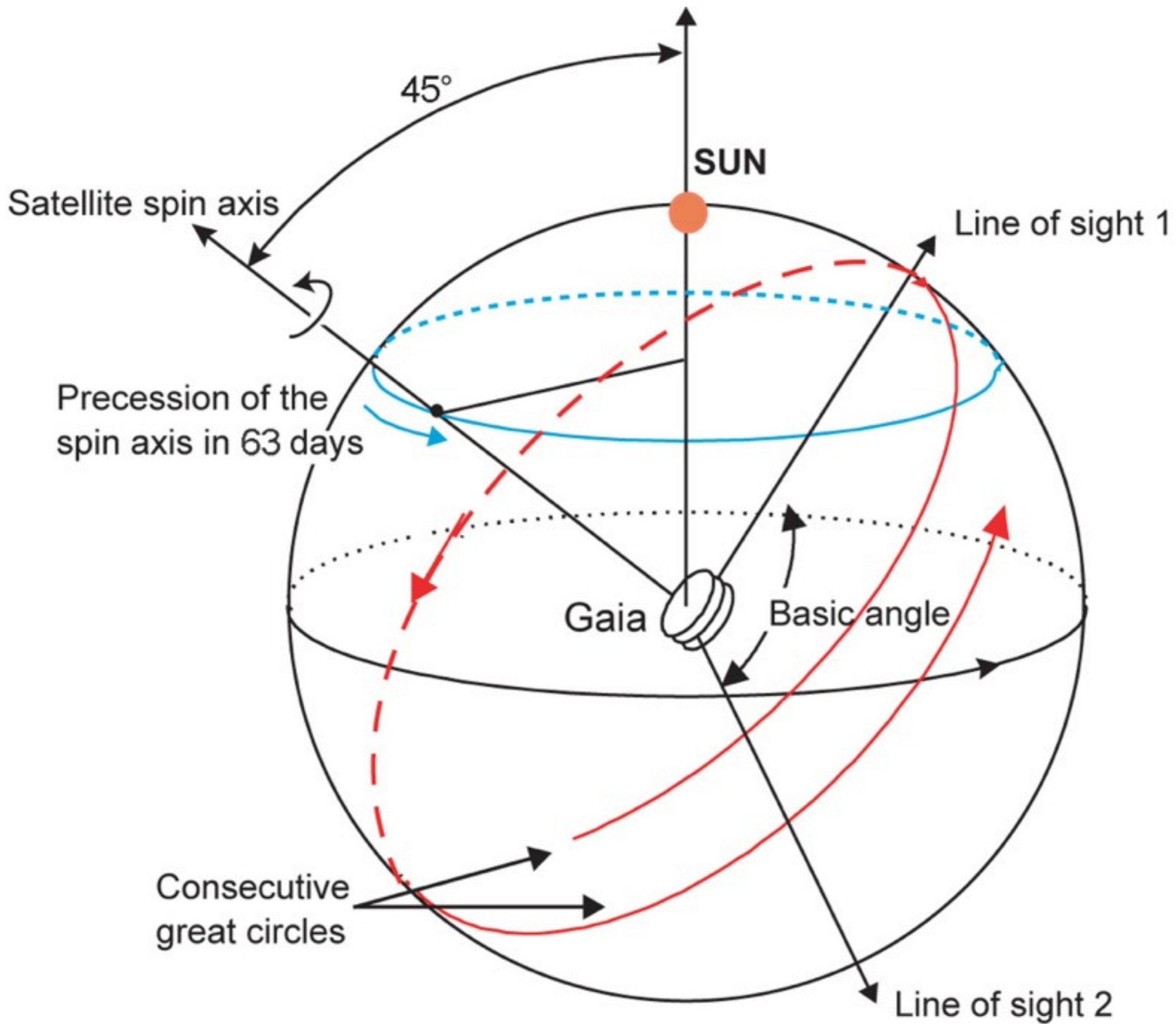








Launch from Kourou
on a Soyuz-Fregat in
May 2013 for a 5yr
mission

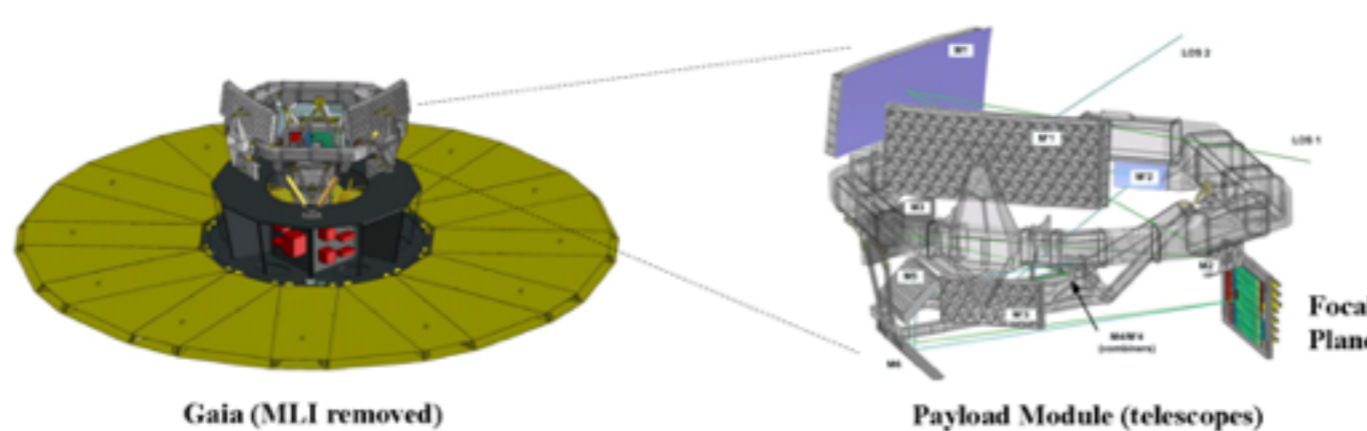
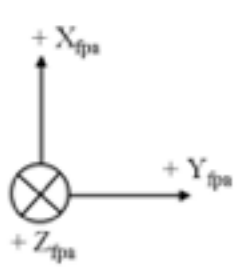
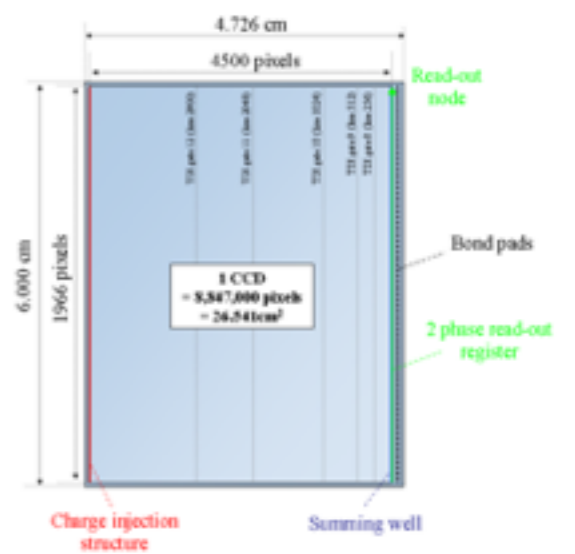
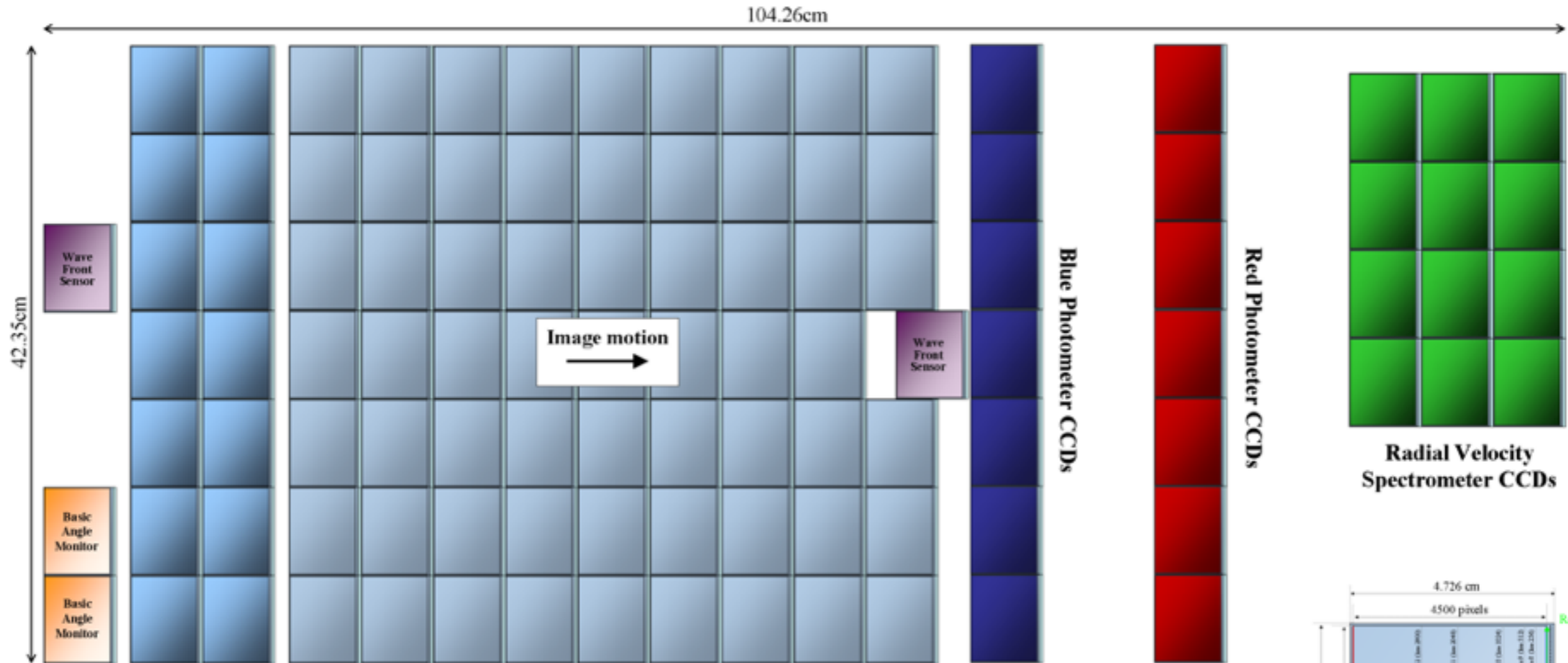


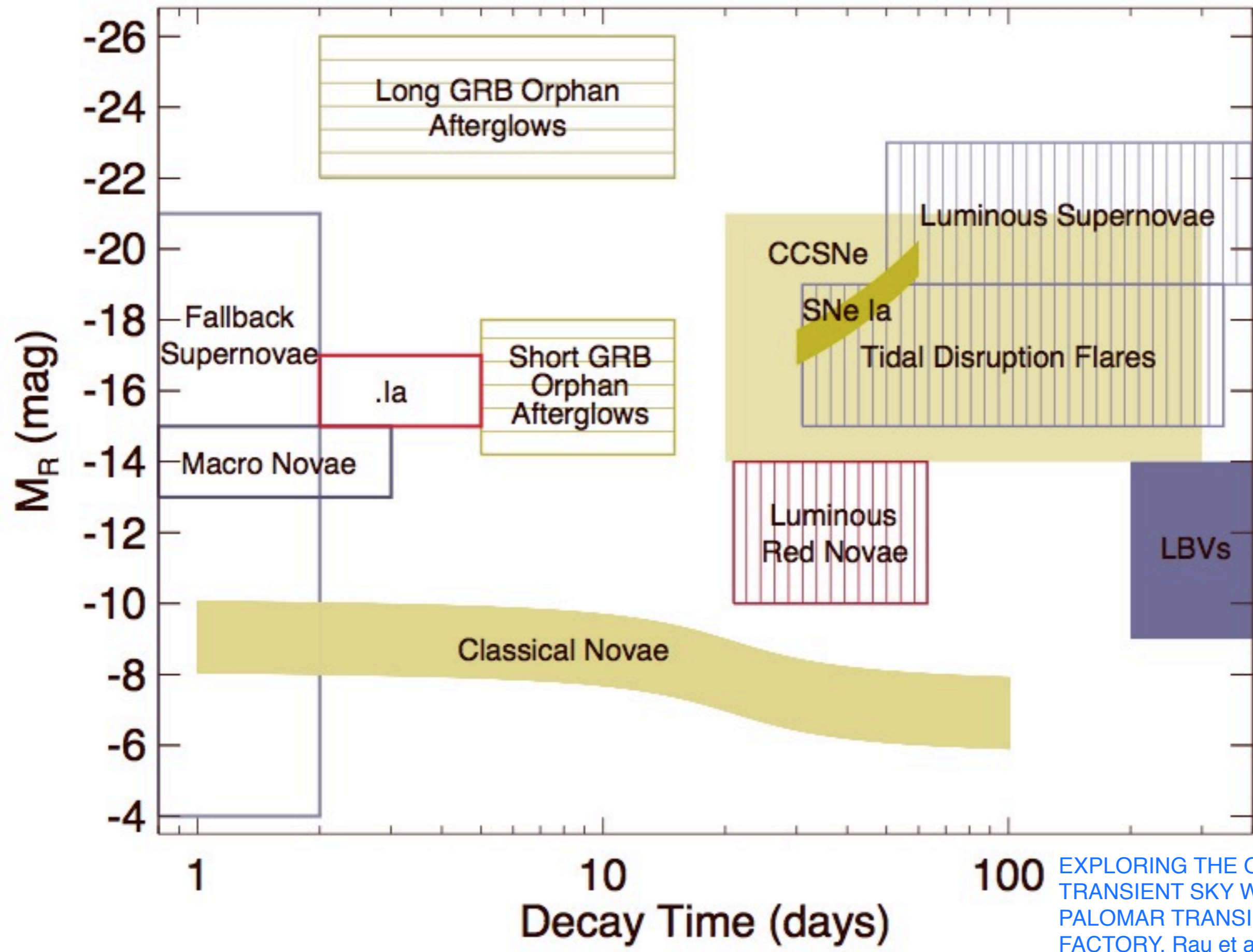


- Chip transit: 4.4s
- Field transit (9 astrometric CCDs): 40s

Gaia Focal Plane

106 CCDs \approx 938 million pixels \approx 2800 cm²

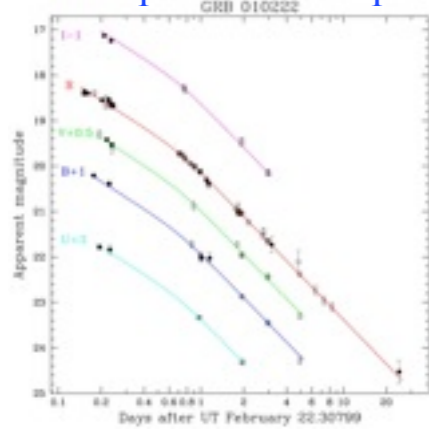




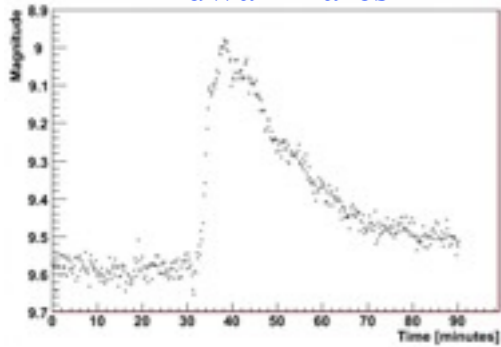
EXPLORING THE OPTICAL TRANSIENT SKY WITH THE PALOMAR TRANSIENT FACTORY, Rau et al. 2009

Potential Triggers

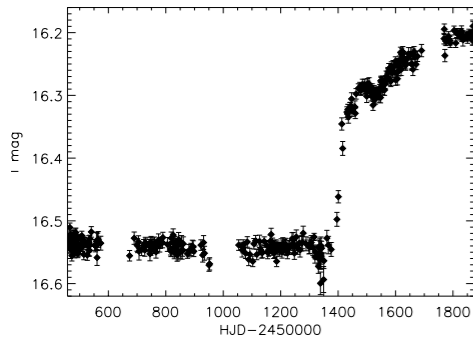
GRBs optical counterparts



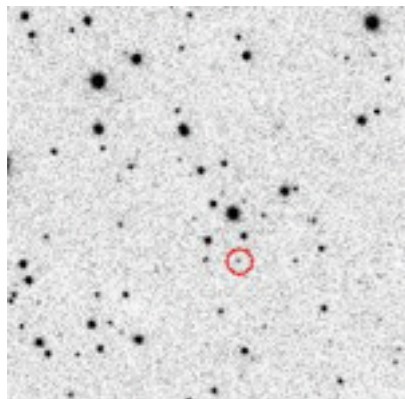
M-dwarf flares



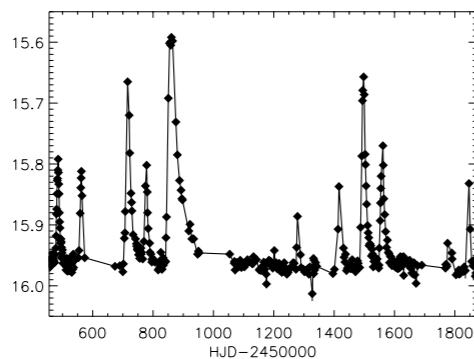
Be stars



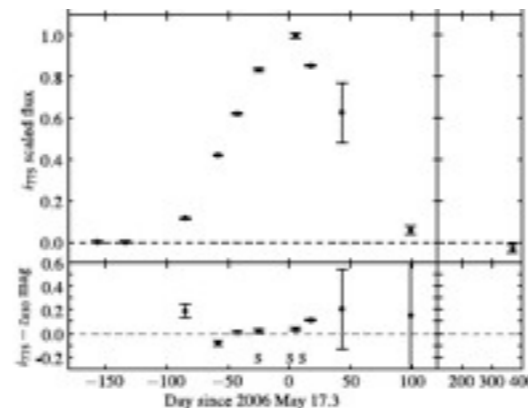
Asteroids



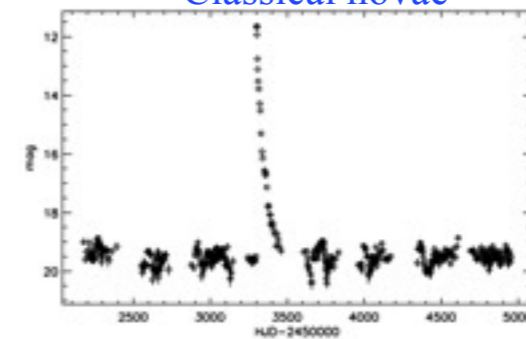
Dwarf novae



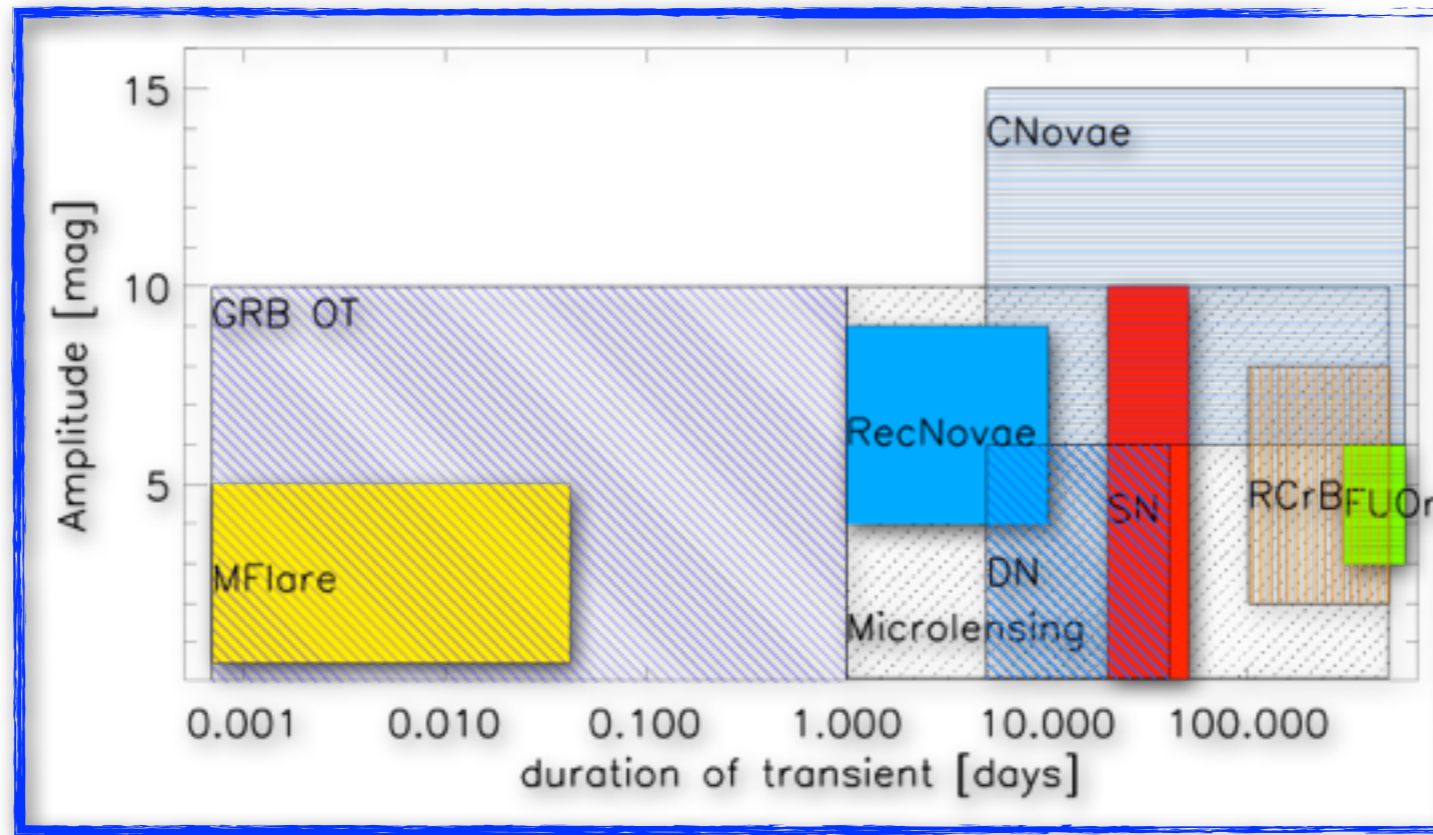
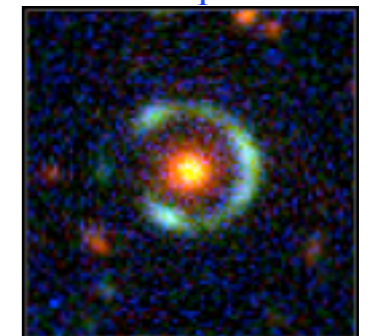
NEW THINGS??



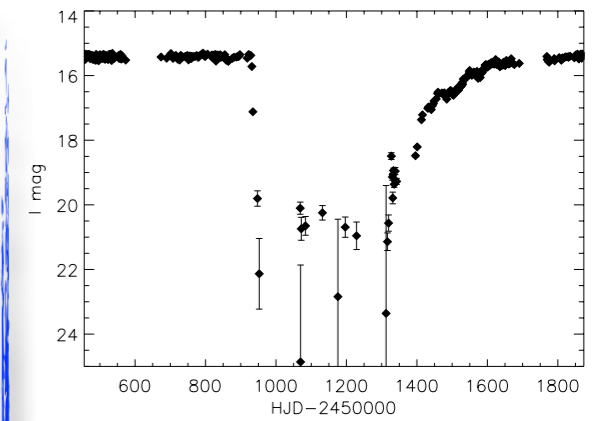
Classical novae



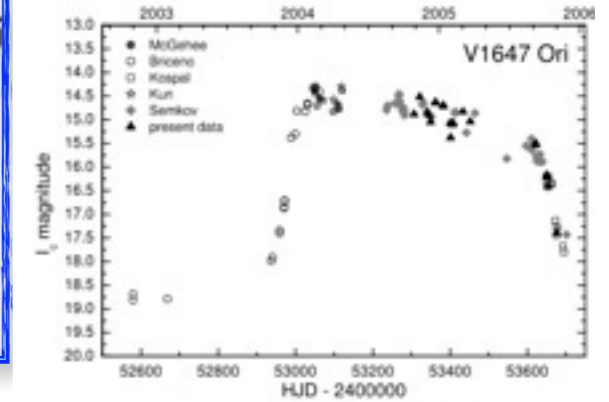
Lensed supernovae



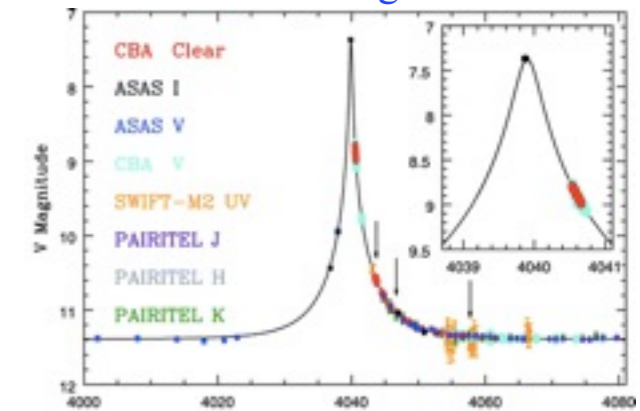
R Coronae Borealis



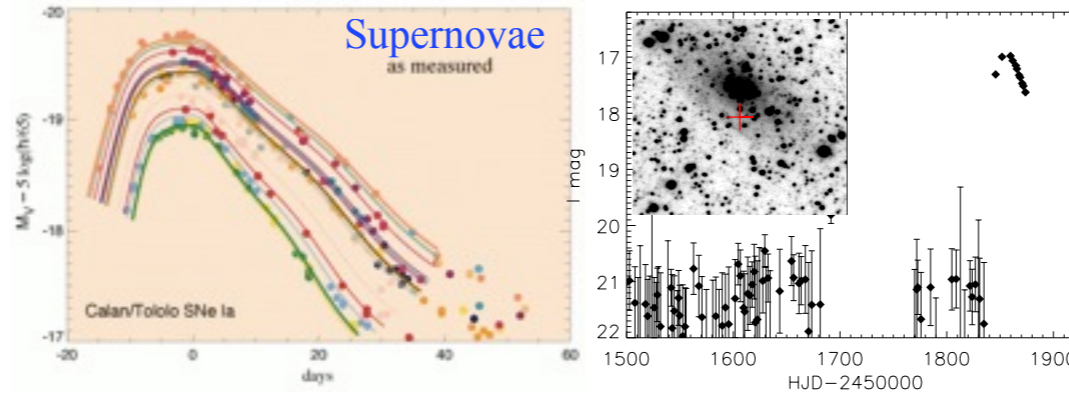
FU Orionis and similar



Microlensing events



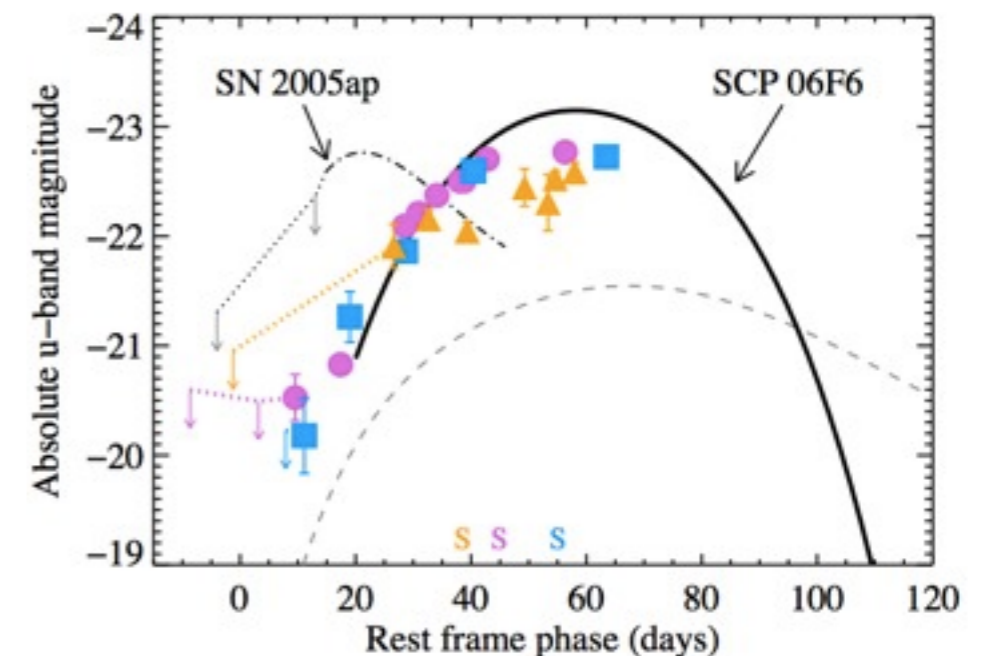
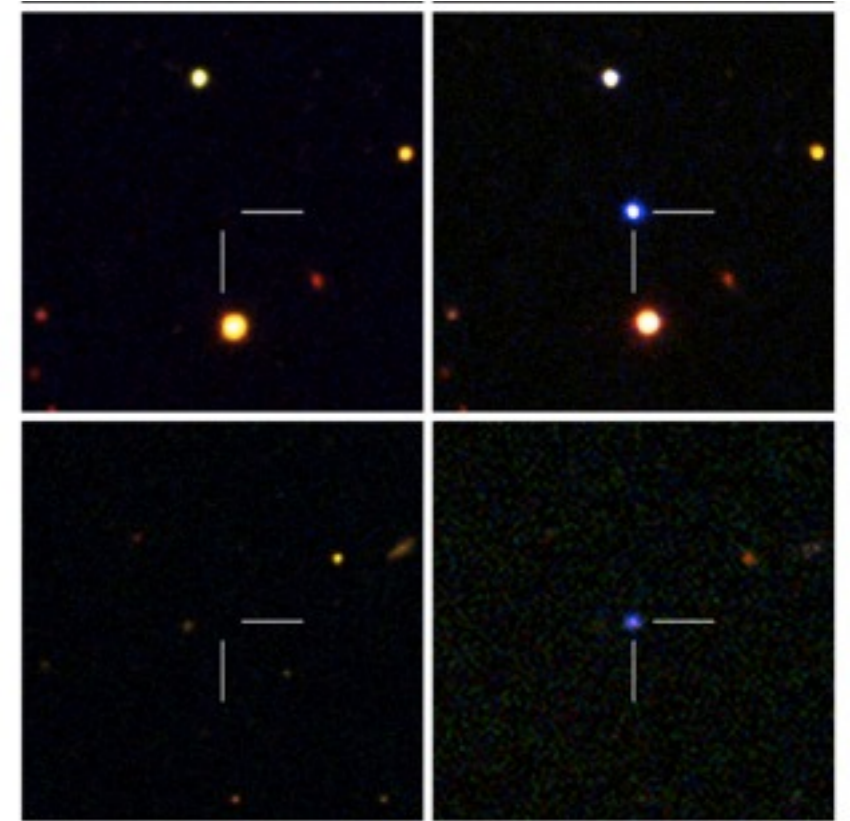
Supernovae as measured



scientific opportunities:

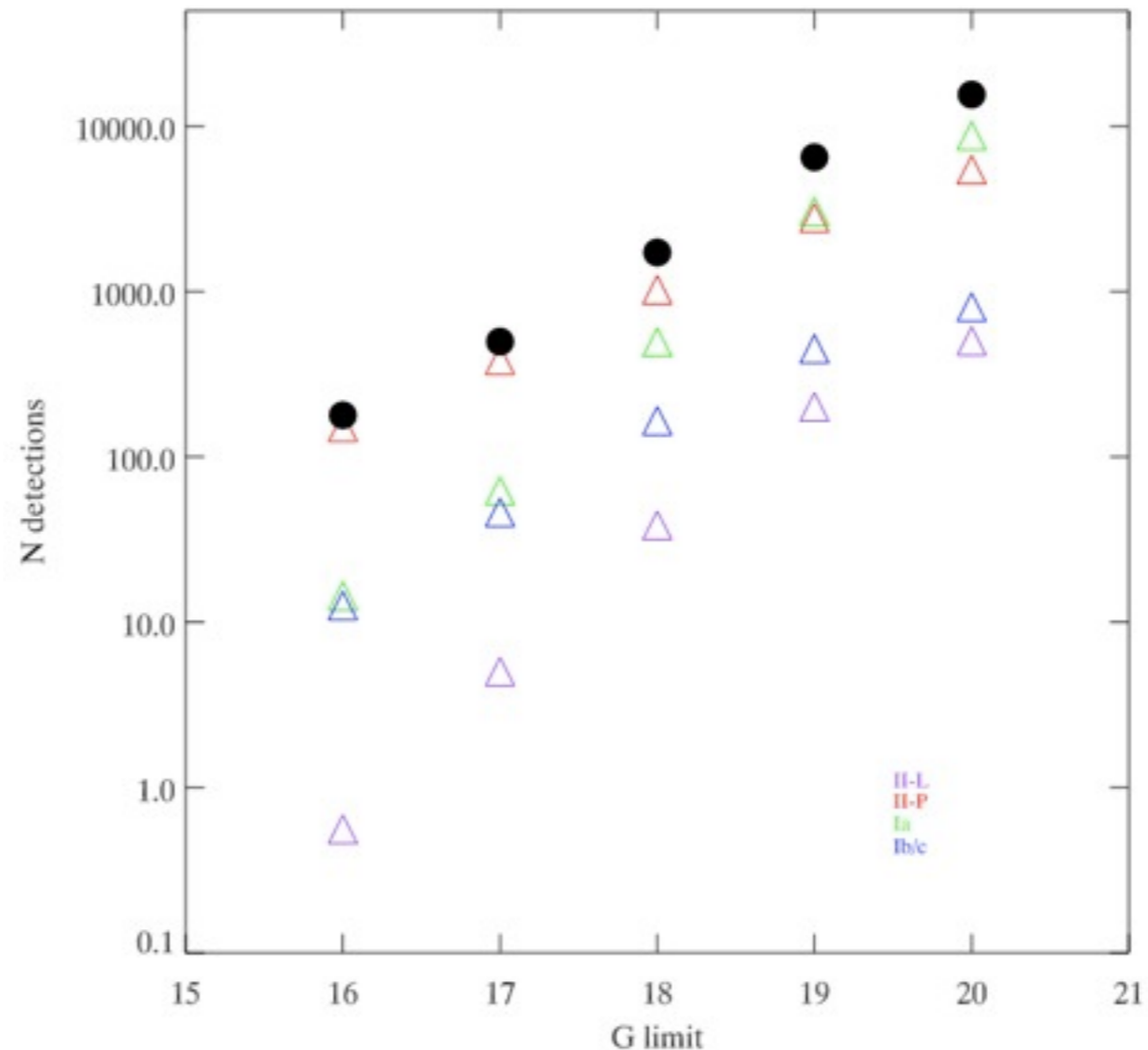
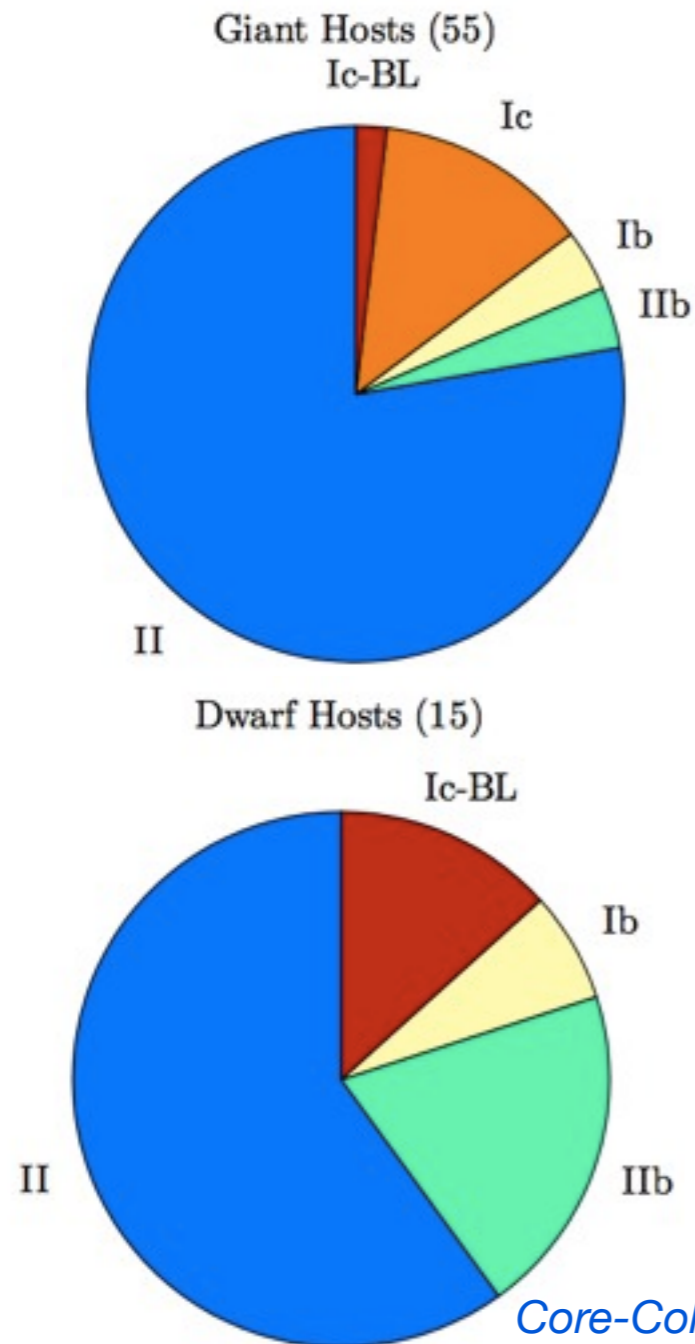
(i) SNe

- **Ultra-luminous Surpernovae:** Peculiar light curves, U band magnitude reaching -23, host galaxies faint, e.g. Quimby et al. (2010), link to the relationship between GRBs and SNe.
- **Luminous Red Novae:** bridge the gap between classical novae and supernovae - 4 known (e^- capture in an AGB star? stellar merger? planet inspiral? etc, e.g. Kasliwal et al. 2011)
- **Large “unbiased” samples of core-collapse supernovae:** the role of environment.



scientific opportunities:

(i) SNe



6000 SNe in 5 years = 3/day

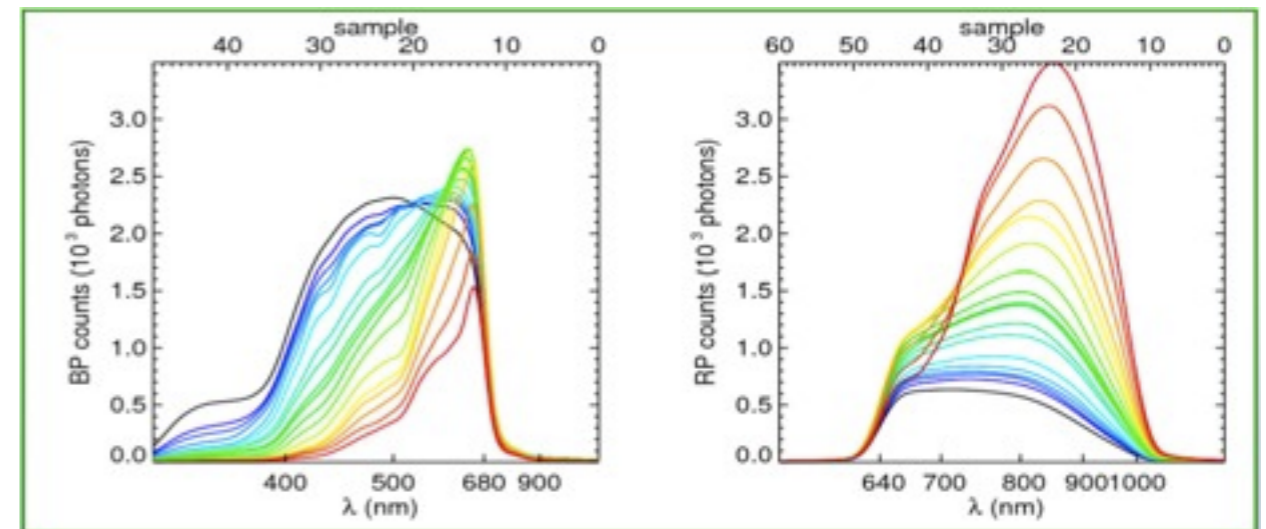
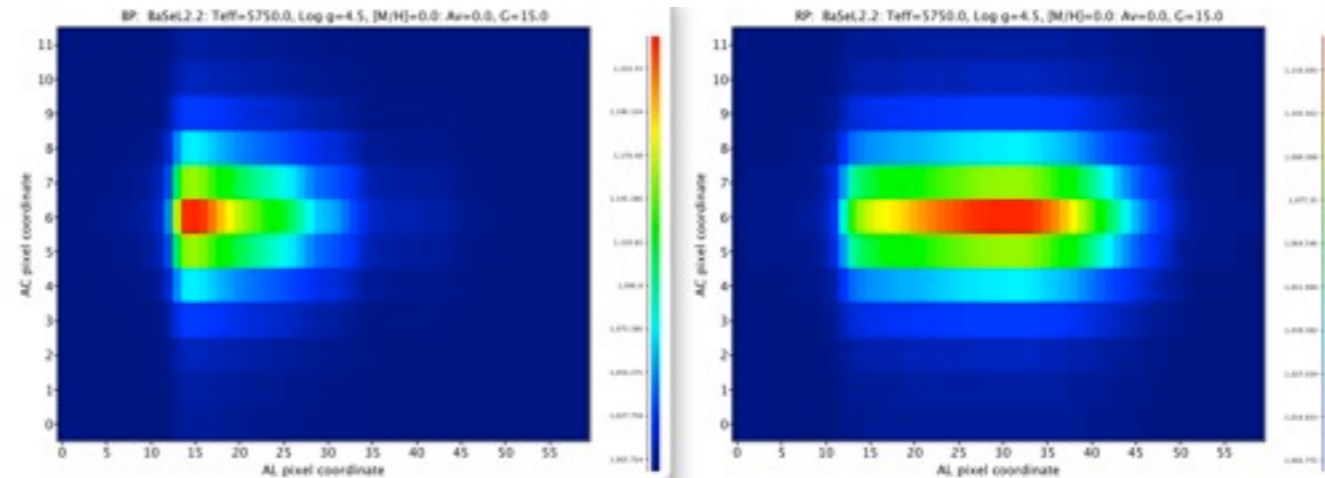
NB: the importance of local SNe for the calibration of the SNe cosmology project

GAIA-C5-TN-IOA-SHO-001

Core-Collapse Supernovae from the Palomar Transient Factory: Indications for a Different Population in Dwarf Galaxies, Arcavi et al., 2010

Finding anomalies is easy

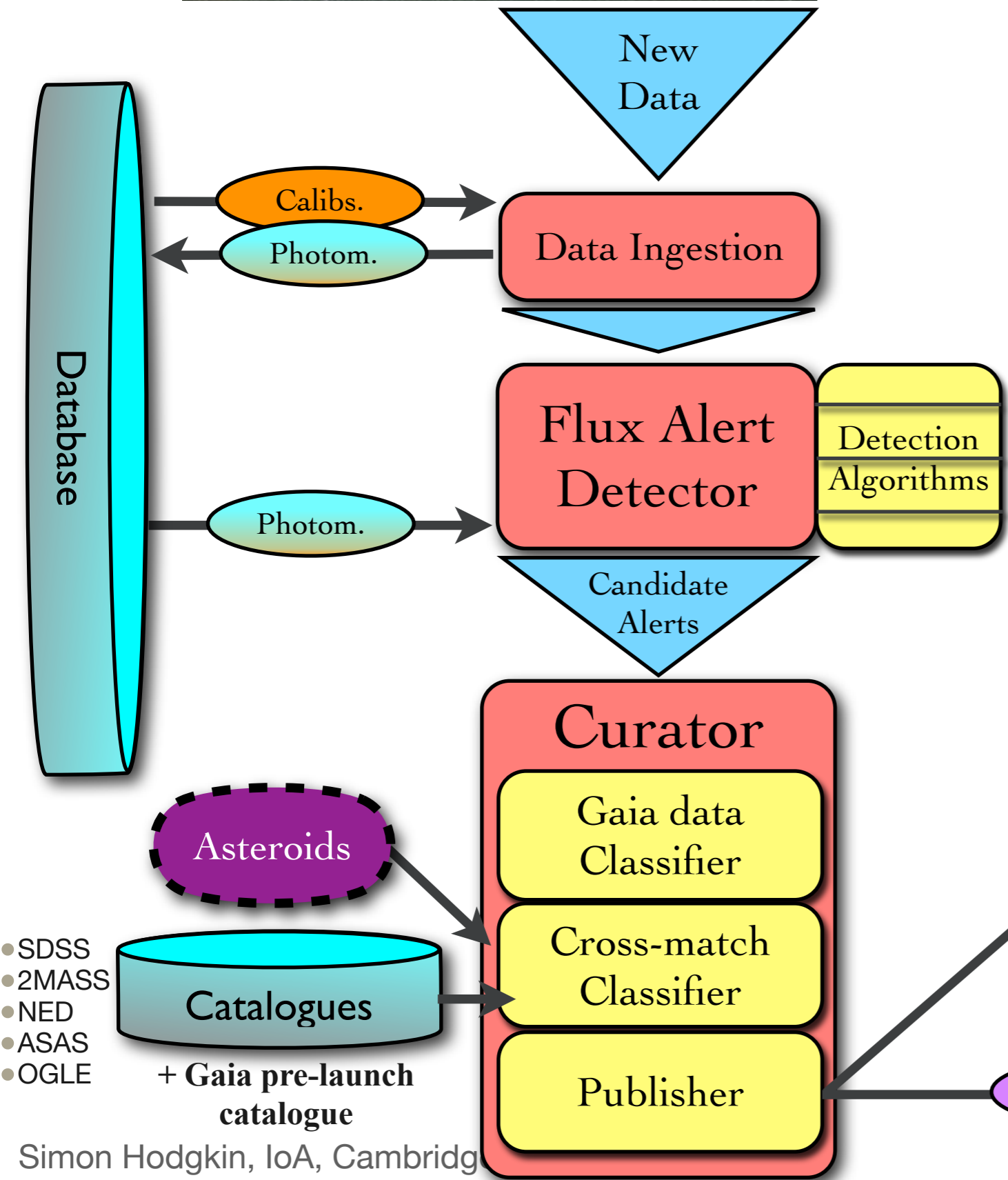
- but classifying them usually requires a significant investment of follow-up telescope time, e.g. PANSTARRS and PTF.
- Typical scheme: multi-colour photometry, followed by low dispersion spectroscopy.
- Gaia is in an extremely good position: the simultaneous BP/RP spectroscopy are perfect for source classification.





Science Alerts operation scheme

- New Data arrive to Cambridge after basic pre-processing within 1 day and are stored
- Detection is run on data calibrated with the most recent calibration available
- Numerous detection algorithms are used
- Candidate alerts are classified using Gaia data
- Sources are cross-matched with available catalogues and classified further
- Cross-matched asteroids are removed
- Alerts are stored on the Server and released



- SDSS
- 2MASS
- NED
- ASAS
- OGLE

Timeline for the data flow

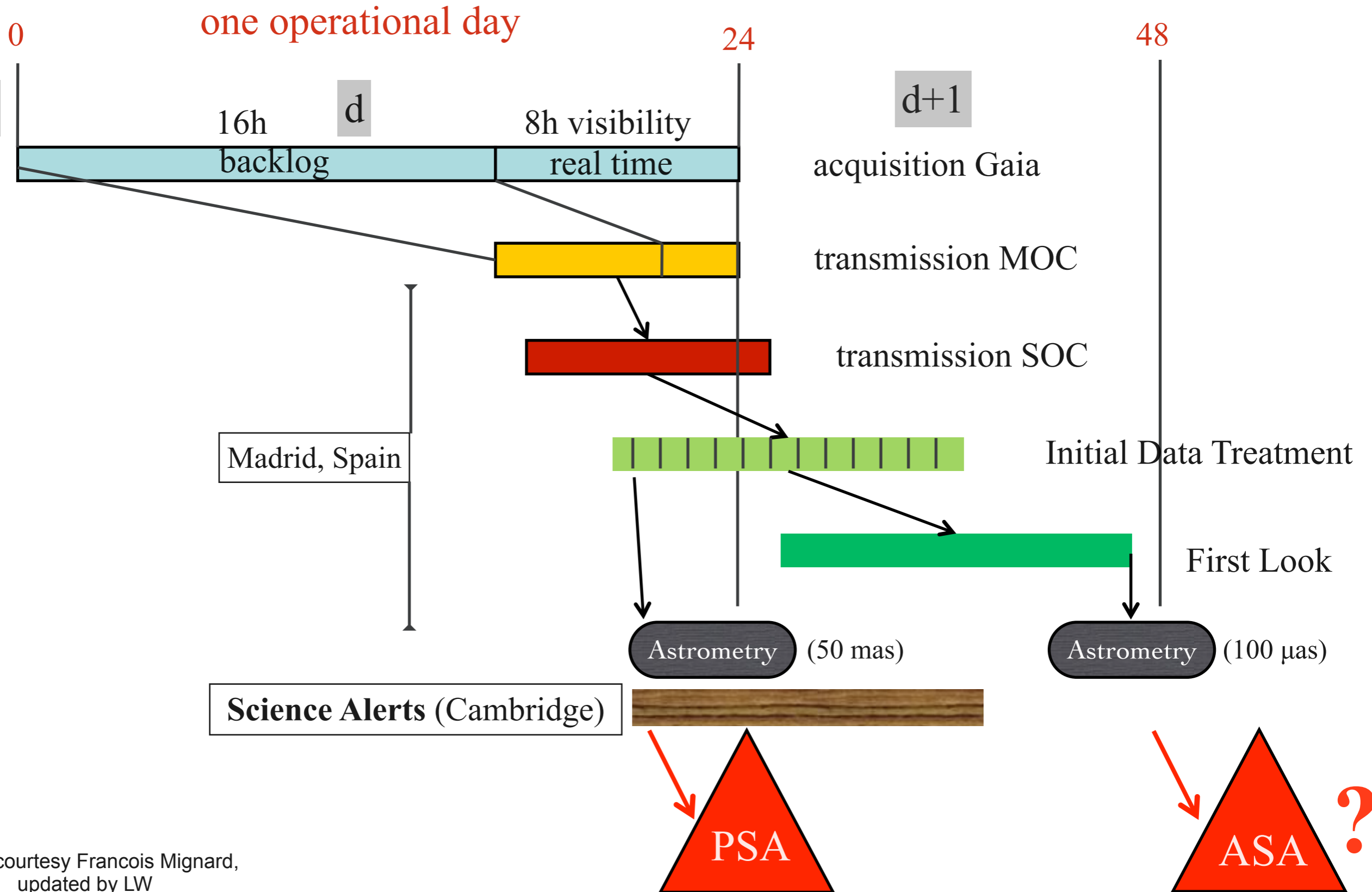



Figure courtesy Francois Mignard,
 updated by LW
 Simon Hodgkin, IoA, Cambridge, UK

http://www.skyalert.org/

Show all bookmarks ttp://www.skyalert.org/ Google

Google Maps Gaia CASU plone consume STH find go entertain hard observe meet soft stars

http://www.skyalert.org/ http://www.skyalert.org/ http://www.skyalert.org/events/...



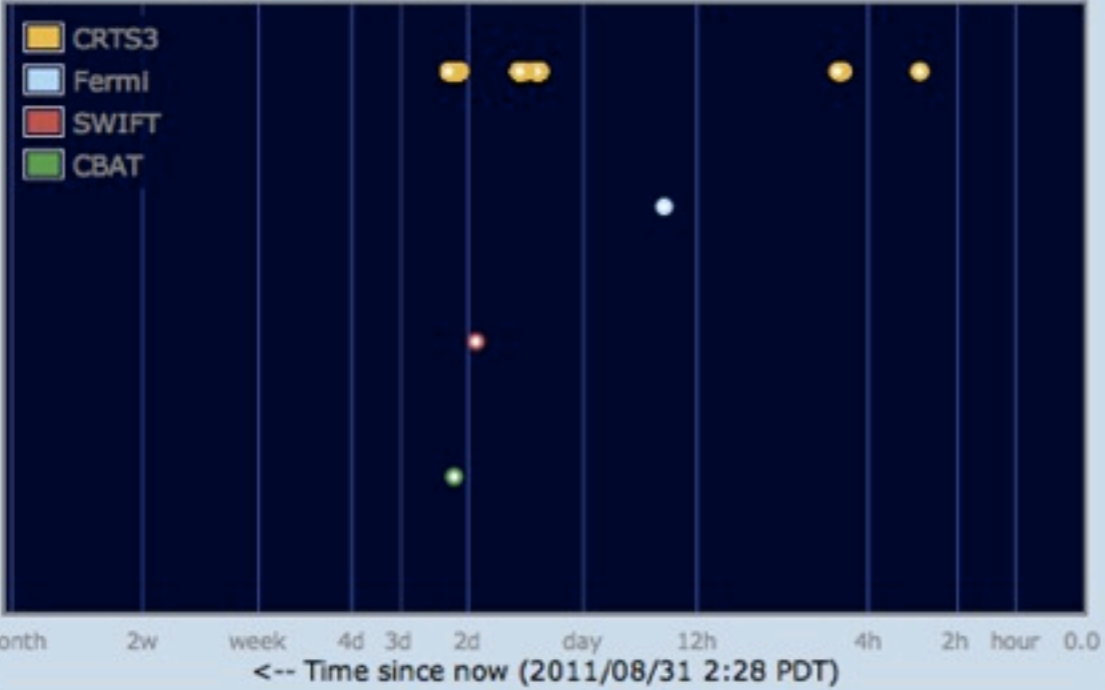
Skyalert.org

Sponsored by the National Science Foundation
[Browse Event Streams](#) | [Browse Skyalert Feeds](#) | [my Feeds and Alerts](#)

Logged in as: simonhodgkin (Simon Hodgkin) [\(logout\)](#)

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.



month 2w week 4d 3d 2d day 12h 4h 2h hour 0.0
 <-- Time since now (2011/08/31 2:28 PDT)

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

Skyalert News

[Reporting of a Gravitational Wave Detection](#)

Wed, 31 Aug 2011

The [LIGO](#) Open Data program has made an example of a data release associated with a detection of gravitational waves, available at <http://www.ligo.org/science/GW100916/>. This is MOCK DATA, ...

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
- [Build a custom feed](#)
- [Get email when an interesting event occurs](#)
- [Authoring your own event stream](#)
- [Validate a VOEvent or author an event](#)
- [Resolve an event identifier \(IVORN\)](#)
- [Guide to Running Skyalert \(pdf\)](#)
- [Install your own Skyalert](#)
- Contact us at help@skyalert.org

Follow-up Facilities

Gmail Calendar Documents Photos Reader Web more - Sign in

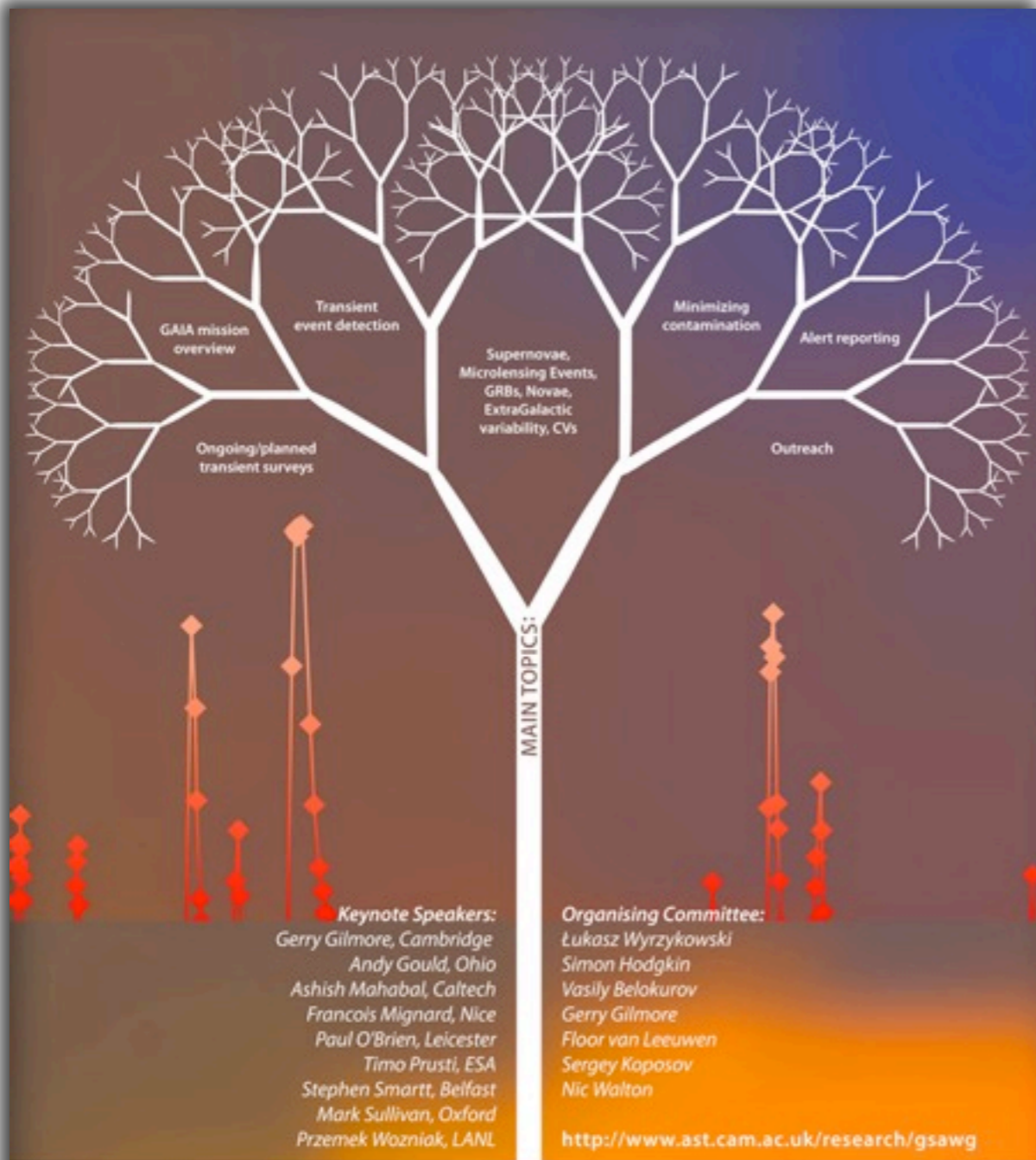
Google docs Telescopes for Gaia Anyone with the link Updated 8 hours ago by wyrzykow Saved Share

File Edit View Insert Format Data Tools Help wyrzykow is viewing

Formula: Show all formulae

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
	Telescope/obse name	Location	Longitude (+ for E, - for W)	Latitude (+ for N, - for S)	Altitude [m]	Size [m]	Field-of-view, [deg^2]	Limit DEC	Limit HA	instruments	CCD size [arcsec/pix]	limiting magnitude (R or equivalent)	filters	spectral range	spectral resolution	time available alerts follow-up
1	Loiano	Bologna, Italy				1.5										
2	Belgian Mercator	La Palma, Spain	-17°52'42"	17°52'42"	2333	1.2	6.5x6.5'			Merope, Hermes, Maia(soon)	0.19		7 Geneva filters + R + I		85000	From Geneva upon request and pending acceptance by Geneva group Stellar Variability.
3	Swiss Euler	La Silla, Chile	-70.73	-29.2567	2347	1.2	10x10'	=+29 deg (z=2)		Coralie (spectrograph), ECAM CCD	0.3"	CCD: -19?	Geneva filters (U,B1,B2 G) plus RG, ZG (Gunn?), IC (Cousins orders)	380 nm to 690 nm (69 Echelle orders)	65000	tentative: upon request and pending internal (Geneva Stellar Variability Group) acceptance.
4	Asiago	Padova, Italy				1.82										
5	APT2	Catalina, Italy				0.8										
6	TNT Teramo	Italy				0.72										
7	Ondrejov	Czech Rep.				0.08										
8	Ondrejov	Czech Rep.				0.254										
9	Ondrejov	Czech Rep.				0.3										
10	Ondrejov	Czech Rep.				0.4										
11	Ondrejov	Czech Rep.				0.5										
12	Ondrejov	Czech Rep.				0.6										
13	Konkoly	Hungary, Piszkestető	19.8956	47.9178	959.6	1	45x45'			CCD			UBV(RI), uvby			upon request from the GAL Alerts WG

Telescopes backup of 24.06.2011 Loiano



GAIA SCIENCE ALERTS WORKSHOP

To focus community attention on and involvement in the scientific possibilities that arise from the Gaia Science Alerts data stream
 Institute of Astronomy, Cambridge: 23 - 25 June 2010

University of Cambridge, Institute of Astronomy, Madingley Rd, Cambridge CB3 0HA. Tel Reception: +44 (0)1223 337548 E-mail: gsaw2010@ast.cam.ac.uk

Important dates: Registration closes - 30 April 2010, Invitations allocated - 10 May 2010



Gaia Science Alerts Verification and Follow-up Workshop

Wednesday 29 June - Friday 1 July 2011, at the
 Institute of Astronomy, University of Cambridge

DETAILS AND REGISTRATION
<http://www.ast.cam.ac.uk/iaa/research/gdawg>

For more information e-mail gsawg@ast.cam.ac.uk
 © 2011 Institute of Astronomy, Madingley Road, Cambridge CB3 0HA. Telephone +44 (0)1223 337548

<http://www.ast.cam.ac.uk/ioa/research/gsaawg/>



Main Page

Welcome to the web site of the Gaia Science Alerts Working Group!

The Science Alerts Working Group is focussed on the real-time detection of variable sources. These include supernovae, microlensing events, exploding and eruptive stars, etc.

navigation

- Main Page
- Links
- People
- Current events
- Recent changes
- Random page
- Help

science

- Triggers
- Contaminants

alerts

- Detection System
- Verification phase
- Follow-up

FU Orionis (FUors)

FU Orionis (V1647 Ori) is young pre-main sequence stars, illuminating a McNeil's nebula in the vicinity of NGC 2068 star-forming region.

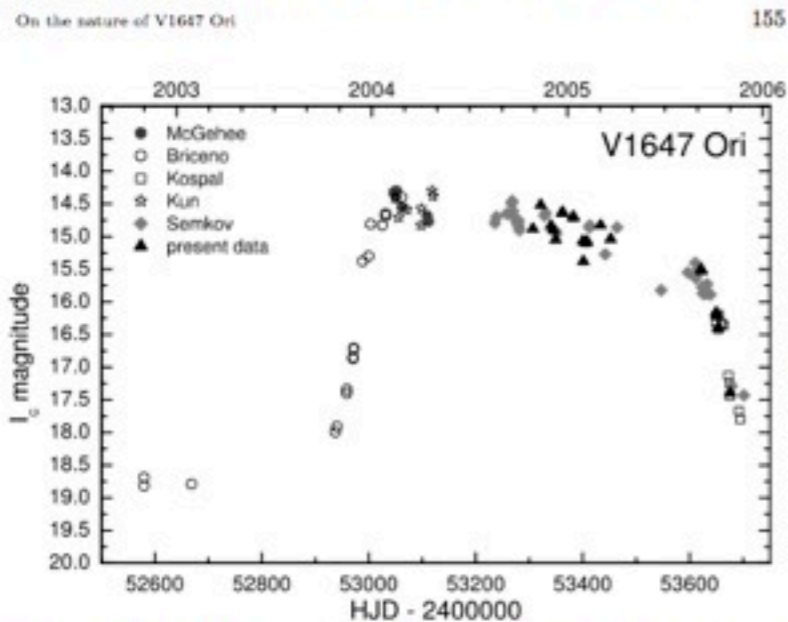


Figure 4. V1647 Ori light curve in the I_C passband. Our data and data from McGeehee et al. (2004), Briceño et al. (2004), Kospál et al. (2005), Kun et al. (2004) and Semkov (2004, 2006) were used.

Characteristics:

- Very rare
- Outbursts repeat with a time scale of 40 years (1978, 2003)
- Amplitude: 5 mag over 4 months
- Outbursts last for 2 years
- Spectra: F or G supergiants
- Spectrum: red, heavily veiled continuum with strong emission of H_{α} ; in blue consistent with an early B spectrum
- X-ray variability present
- FU Ori and V1057 Cyg rise over 1 yr, whereas V1515 Cyg rise over 20 years

Simon Hod

Triggers:Be

OGLE and MACHO data were studied for Be stars.

- OGLE (LMC, SMC): Sabogal et al. 2005, Mennickent et al. 2006
- OGLE (Bulge): Sabogal et al. 2008
- MACHO: Keller et al. 2002

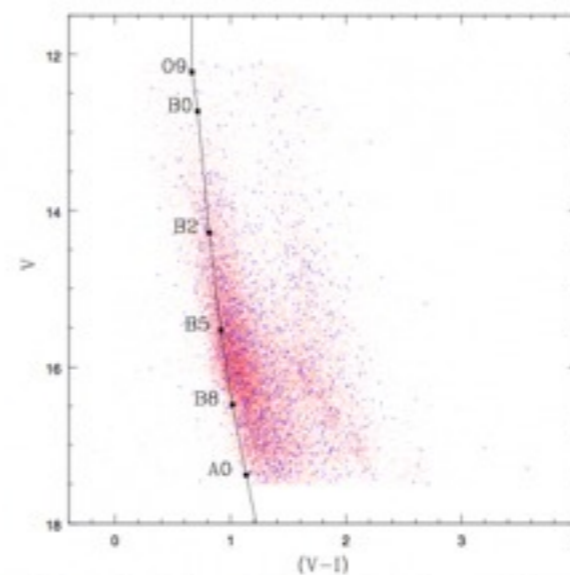


Figure 4. V vs. $(V - I)$ diagram for the selected Be star candidates. The track of the main sequence (MS) (Allen 2000) is shown for reference. Apparent V magnitudes for it were calculated assuming the distance modulus of the Galactic bulge (14.5 mag) and $A_V = 2.23$ (obtained by calculating the mean of A_V values of the 48 Galactic Bulge fields).

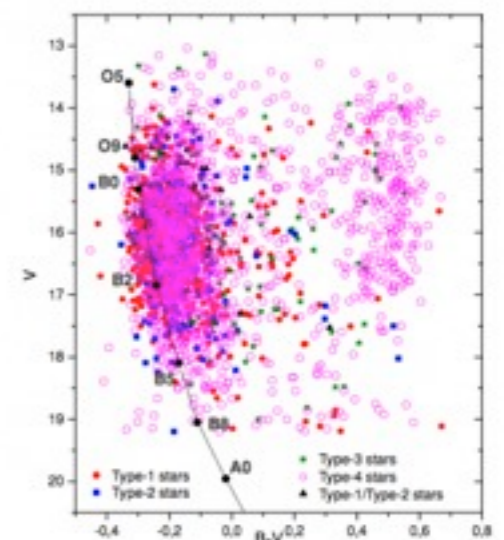


Figure 1. V versus $B - V$ diagram for the total sample of stars of the LMC. The track of the main sequence (Allen 2000) is shown for reference.

Opportunities

The screenshot shows the Zooniverse website interface. At the top, the logo reads "ZOONIVERSE REAL SCIENCE ONLINE". Below the logo is a navigation menu with buttons for "HOME", "PROJECTS", "ABOUT", "EDUCATION", and "BLOGS". The main content area features a "Planet Hunters" project banner with the text "With your help, we are looking for other stars" and a "JOIN IN" button. To the left of the banner is a thumbnail for "planethunters.org" showing a yellow planet. Below the banner, there is a section titled "The Zooniverse Community" with the text "455,116 people just like you...". A profile card for Jo Echo Syan is visible, including her name, status (Married), location (UK), and a quote about her experience on Zooniverse.

braindump

watch list: monitoring of known anomalous objects

discovery + follow-up of new/exotic kinds of phenomena

zooniverse style projects (GalaxyZoo) to help us identify and classify transients

social networking collaborative projects

telescopes are already in the classroom

scientific return improves the science