GAIA SCIENCE ALERTS

Follow-up and Alerts Verification Brochure

gaia

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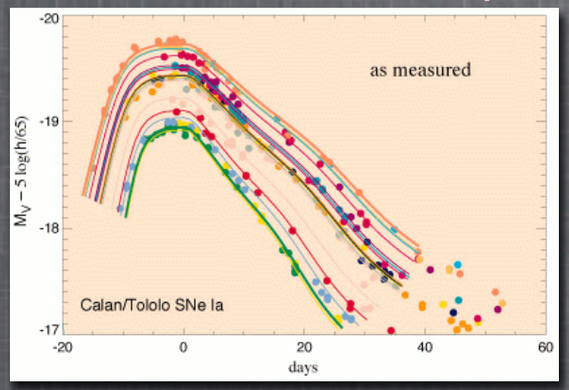
GAIA ALERS IN A NUTSHELL

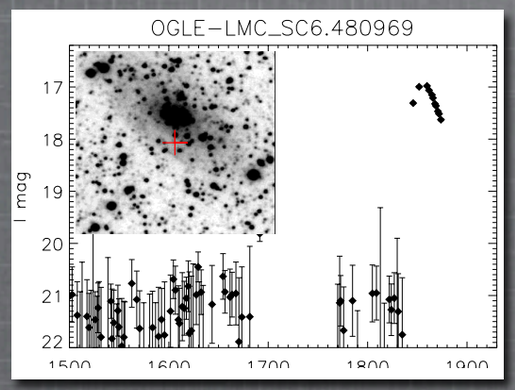
- Gaia is the milestone ESA's space mission, to be launched in late-2013
- main target: ultra precise astrometry of billion of stars to map the Galaxy
- serendipitous project: **Gaia Science Alerts**
- alerts inform about events, which scientific value will be lost if not followed-up immediately
- uses daily data transmissions to detect anomalous and transient events from the whole sky
- alerts issued usually within **12-48h** after observation
- limiting magnitude: **~20 mag**
- sampling: about **70** observations per object over 5 years (grouped in pairs)
- anomalies detected and classified on **1-2** Gaia data points (photometry and low-res spectroscopy)
- thousands of alerts per day possible (tuneable)

an extensive ground-based follow-up is needed for early verification of alerts, classification and characterisation of objects

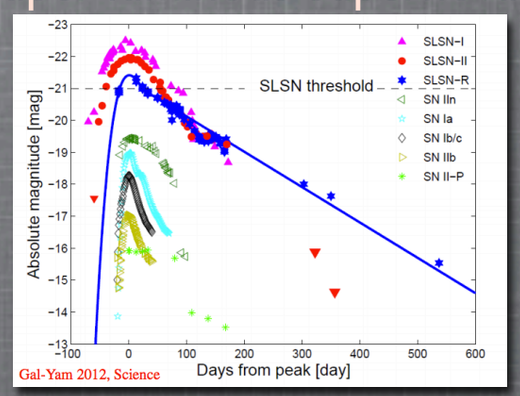
SCIENTIFIC OPPORTUNITIES

Supernovae

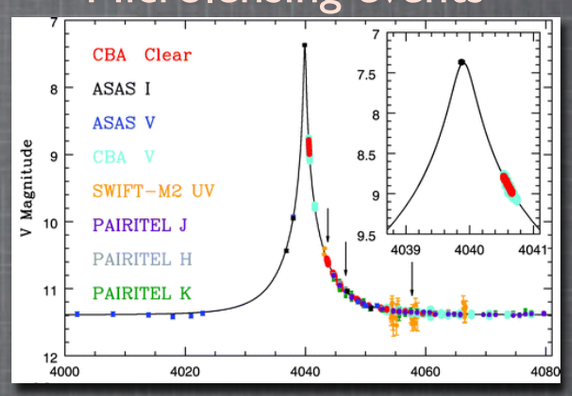




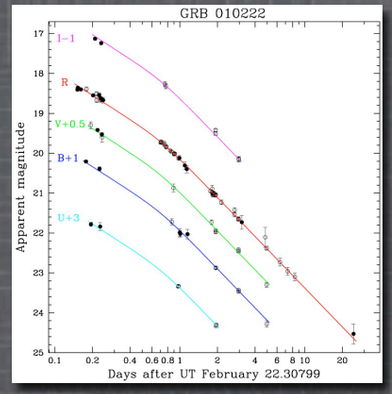
Super-luminous Supernovae



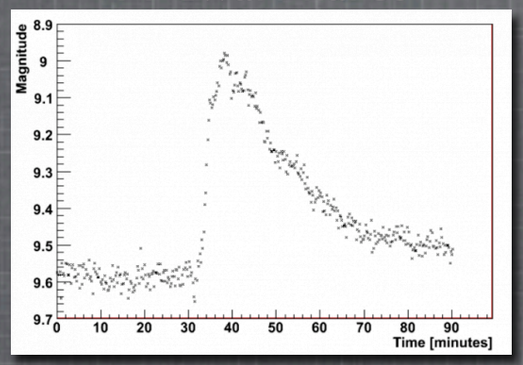
Microlensing events



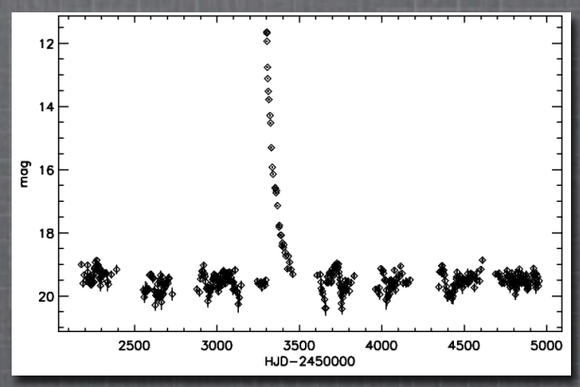
GRBs optical counterparts



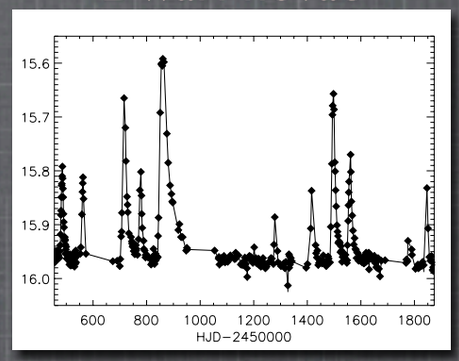
M-dwarf flares



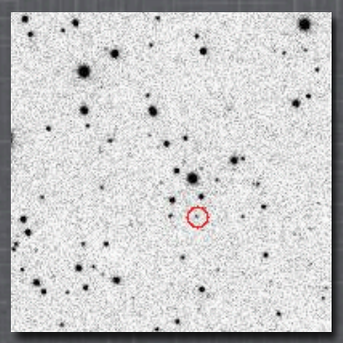
Classical novae



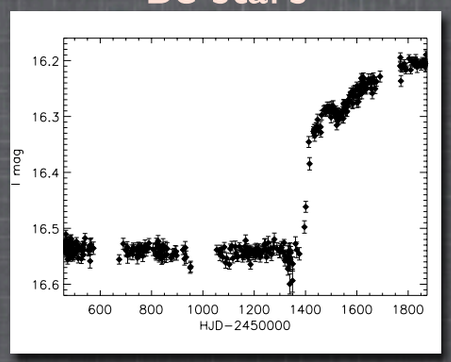
Dwarf novae



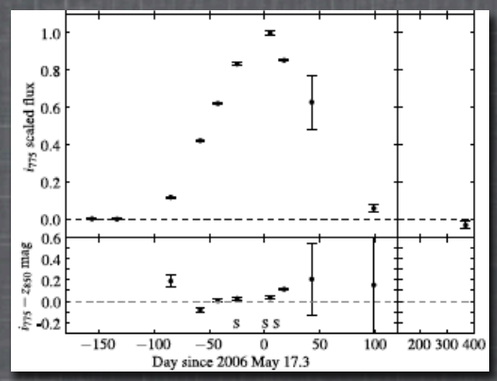
Asteroids



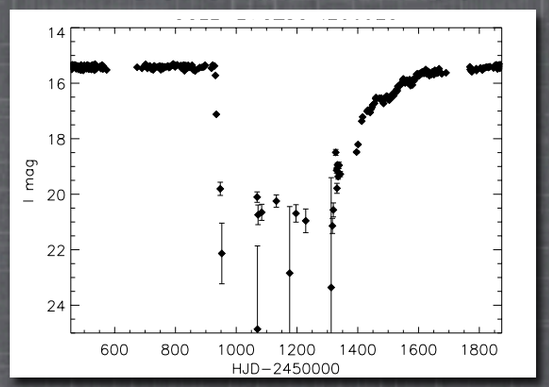
Be stars



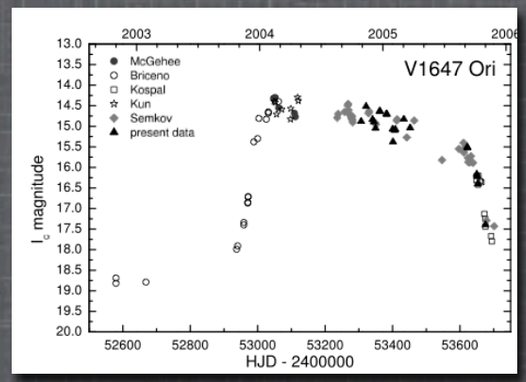
NEW THINGS??



R Coronae Borealis

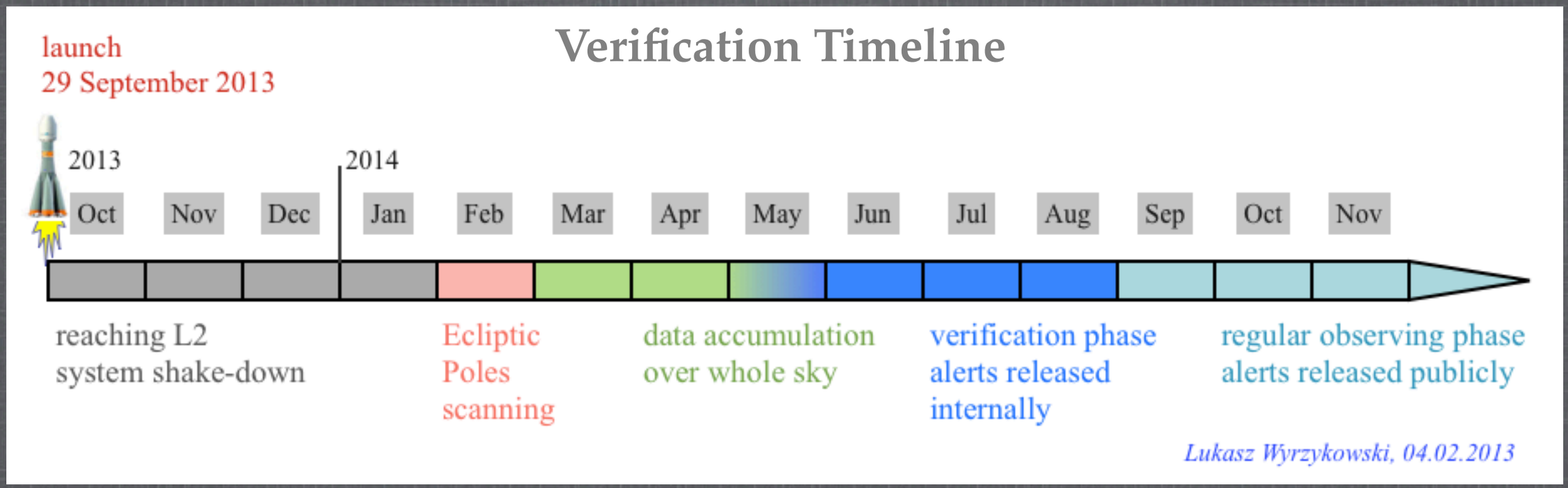


FU Orionis



VERIFICATION PHASE

- needed to demonstrate if the Gaia detection and classification works
- test and fine-tuning of the detection thresholds
- only during the verification alerts are NOT public and are available only to a dedicated group of follow-up telescopes (Gaia-FUN-TO)
- the Verification commences as soon as sufficient sky has been observed enough times to define the baseline catalogue



FOLLOW-UP REQUIREMENTS

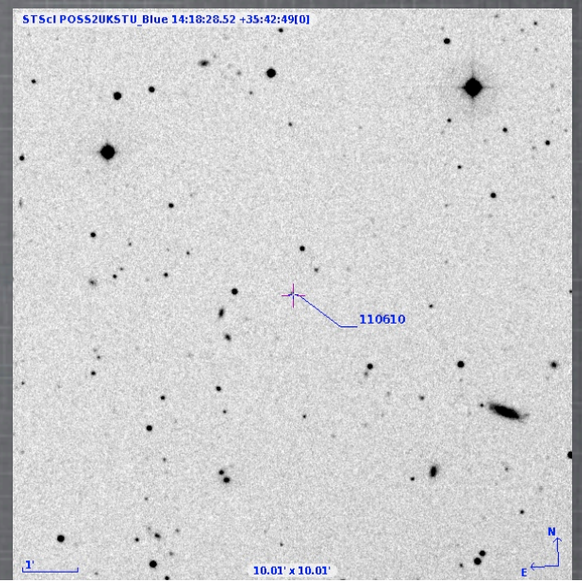
Gaia Follow-Up Network for Transient Objects

- photometric follow-up (imaging) to confirm an alert
- multi-band photometric monitoring to build a light-curve and classify an alert
- low-, mid-, high-resolution spectroscopy to confirm and refine the classification of an alert based on Gaia data

- >0.5m telescopes on both hemispheres, east and west
- ideally, fully robotised telescopes, easy to schedule with ToO
- human operated telescopes also useful, response time within 24h
- reduced data available within 24h
- unified/standardised observational output, centralised repository of data
- rules on data policy, publications, etc. has to be decided and agreed (via Memoranda of Understanding)

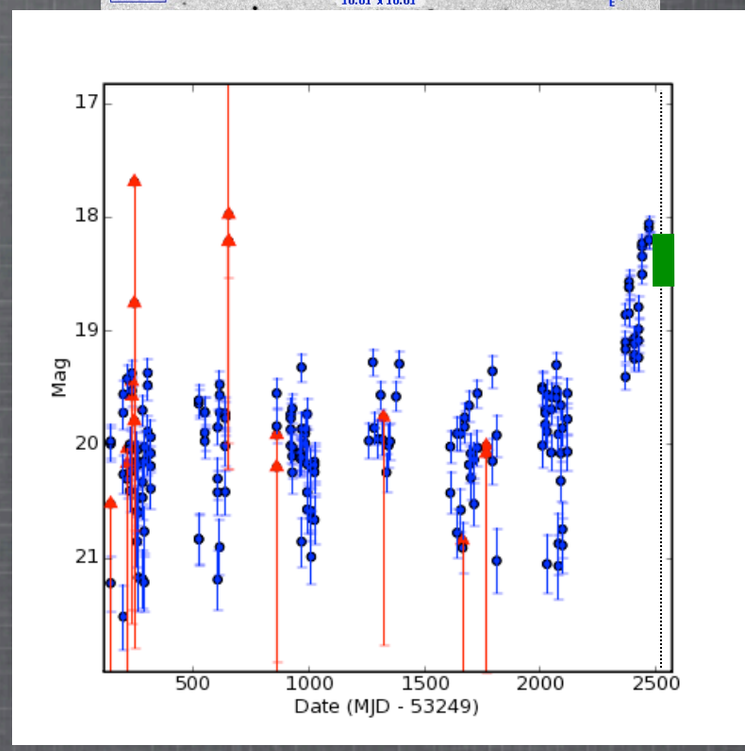
PRE-LAUNCH TEST PHASE

- to prepare the telescopes and people for Gaia alerts
- using CRTS survey transients as proxy to Gaia
- a potential new partner needs to prove capability to perform the rapid follow-up in order to join the verification
- potential scientific outcomes



Simple guide for photometry:

1. observe any alert (e.g. from CRTS)
2. reduce the data *asap*
3. attach astrometry (WCS)
4. derive photometry (e.g. with SExtractor)
5. submit to Calibration Server



follow-up example
from Giuseppe Altavilla

Astrometry.net

Astromatic.net
Your first stop for astronomical pipeline software

SExtractor

FOLLOW-UP CALIBRATION SERVER

for Gaia Science Alerts Photometric Follow-up

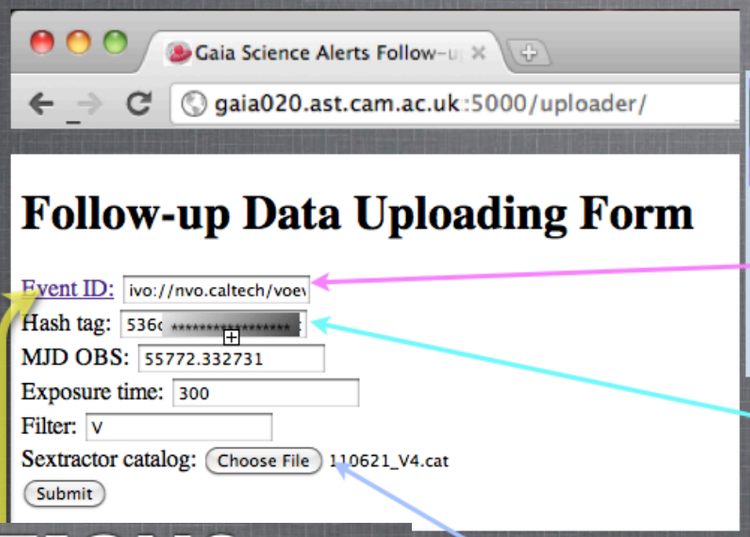
GAIA SCIENCE ALERTS

Cambridge Photometric Calibration Server manual

Łukasz Wyrzykowski & Sergey Koposov
Institute of Astronomy, University of Cambridge, UK
last update: 30 July 2012

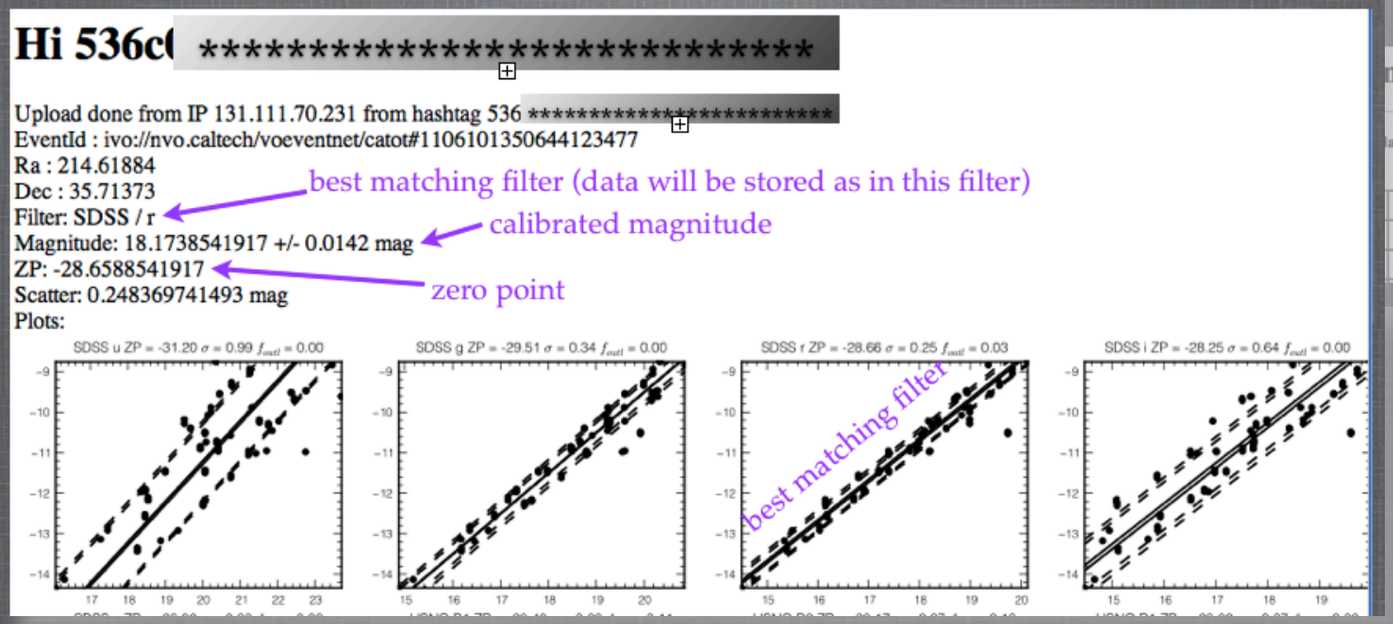
UPLOADING THE FOLLOW-UP DATA

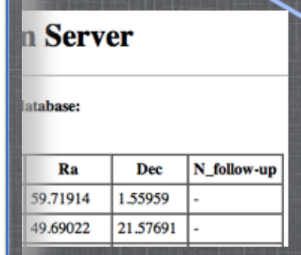
http://gaia020.ast.cam.ac.uk:5000 (temporary site)



Your unique access name / pass
(provided by Cambridge)

RESULT OF CALIBRATIONS





REQUIRED SEXTRACTOR FIELDS:

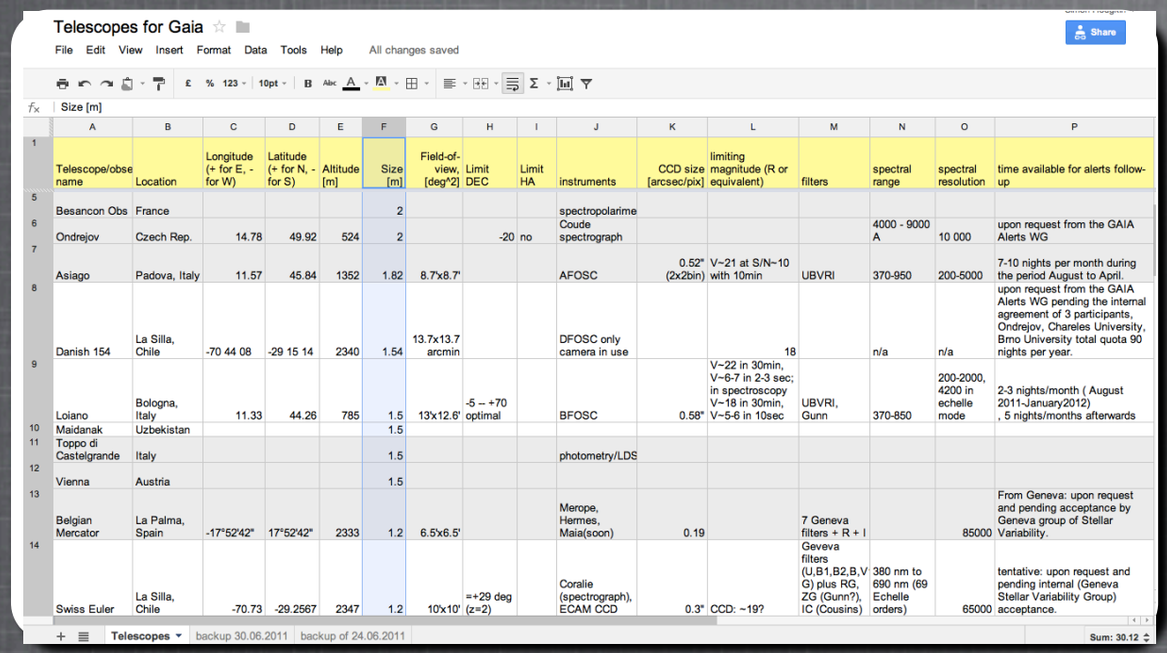
```
# ALPHA_J2000    Right ascension of barycenter (J2000)  [deg]
# DELTA_J2000    Declination of barycenter (J2000) [deg]
then, either:
# MAG_APER       Fixed aperture magnitude vector [mag]
# MAGERR_APER    RMS error vector for fixed aperture mag.  [mag]
or:
# MAG_AUTO       Automatic aperture magnitude [mag]
# MAGERR_AUTO    RMS error for automatic aperture mag.  [mag]
```

access can be fully automatised

software developed by Sergey Koposov, IoA

NOW IT'S TIME TO JOIN!

Gaia Follow-Up Network for Transient Objects
GaiaFUN-TO



Telescopes for Gaia

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Size [m]

	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 for alerts follow-up
5	Besancon Obs	France				2				spectropolarime						
6	Ondrejov	Czech Rep.	14.78	49.92	524	2		-20	no	Coude spectrograph				4000 - 9000 A	10 000	upon request from the GAIA Alerts WG
7	Asiago	Padova, Italy	11.57	45.84	1352	1.82	8.7'x8.7'			AFOSC	0.52" (2x2bin)	V~21 at S/N~10 with 10min	UBVRI	370-950	200-5000	7-10 nights per month during the period August to April.
8	Danish 154	La Silla, Chile	-70 44 08	-29 15 14	2340	1.54	13.7x13.7 arcmin			DFOSC only camera in use		18		n/a	n/a	upon request from the GAIA Alerts WG pending the internal agreement of 3 participants, Ondrejov, Chareles University, Brno University total quota 90 nights per year.
9	Loiano	Bologna, Italy	11.33	44.26	785	1.5	13'x12.6'	-5 -- +70 optimal		BFOSC	0.58"	V~22 in 30min, V~6-7 in 2-3 sec; in spectroscopy V~18 in 30min, V~5-6 in 10sec	UBVRI, Gunn	370-850	200-2000, 4200 in echelle mode	2-3 nights/month (August 2011-January2012) , 5 nights/months afterwards
10	Maidanak	Uzbekistan				1.5										
11	Toppo di Castelgrande	Italy				1.5				photometry/LDS						
12	Vienna	Austria				1.5										
13	Belgian Mercator	La Palma, Spain	-17°52'42"	17°52'42"	2333	1.2	6.5'x6.5'			Merope, Hermes, Maia(soon)	0.19		7 Geneva filters + R + I		85000	From Geneva: upon request and pending acceptance by Geneva group of Stellar Variability.
14	Swiss Euler	La Silla, Chile	-70.73	-29.2567	2347	1.2	10'x10'	=+29 deg (z=2)		Coralie (spectrograph), ECAM CCD	0.3"	CCD: ~19?	Geveva filters (U,B1,B2,B,V G) plus RG, ZG (Gunn?), IC (Cousins)	380 nm to 690 nm (69 Echelle orders)	65000	tentative: upon request and pending internal (Geneva Stellar Variability Group) acceptance.

Telescopes | backup 30.06.2011 | backup of 24.06.2011 | Sum: 30.12

SIGN-IN HERE

www.tinyurl.com/telescopes-for-gaia

OR EMAIL US!

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Sergey Koposov: koposov@ast.cam.ac.uk

Gaia Science Alerts Working Group Wiki:

WWW: http://www.ast.cam.ac.uk/ioa/research/gsawg