Transient Astronomy with the Gaia Satellite

Simon Hodgkin, Institute of Astronomy
Gaia Photometric Science Alerts Manager

sth@ast.cam.ac.uk

@spacemansimon
@gaia_alerts

Science Alerts Team


Abdullah Yoldas


Anna Hourihane


Arancha Delgado


Dafydd Wyn Evans


Diana Harrison


Floor van Leeuwen


Gerry Gilmore


Goska van Leeuwen


Gudrun Pebody


Guy Rixon


Heather Campbell


Lukasz Wyrzykowski


Morgan Fraser


Nadia Blagorodnova


Nic Walton


Sergey Koposov


Simon Hodgkin

With thanks and acknowledgements to

- DPAC
- Francesca De Angeli
- Giuseppe Altavilla
- Vasily Belokurov
- Nadejda Blagorodnova
- Josh Bloom
- Elme Breedt
- Anthony Brown
- Jos de Bruijne
- Patrick Burgess
- Ross Burgon
- Giorgia Busso
- Heather Campbell
- Gisella Clementini
- Chris Copperwheat
- Sue Cowell
- Michel Dennefeld
- Andrew Drake
- Dafydd Wyn Evans
- Laurent Eyer
- Morgan Fraser
- Gerry Gilmore
- GREAT
- Liam Hardy
- Diana Harrison
- Jorge Fernandez Hernandez
- Greg Holland
- Anna Hourihane
- Peter Jonker
- Uli Kolb
- Zuzanna Kostrzewa-Rutkowska
- Sergey Koposov
- Floor van Leeuwen
- Goska van Leeuwen
- Ashish Mahabal
- Francois Mignard
- Paul Osborne
- Lovro Palaversa
- Andrzej Pigulski
- Timo Prusti
- Marco Riello
- Guy Rixon
- Iain Steele
- Rachel Street
- Frank Suess
- Lina Tomasella (and team),
- Manuel Torres
- Yiannis Tsapras
- Massimo Turatto
- Nic Walton
- Thomas Wevers
- Sjoert van Velzen
- Patricia Whitelock
- Roy Williams
- Lukasz Wyrzykowski
- Abdullah Yoldas
- all co-I's on our numerous proposals.

Gaia DPAC
Data Processing & Analysis Consortium

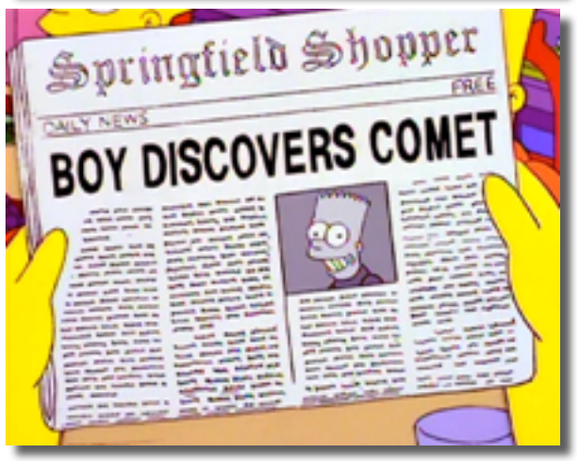
- Gaia data processing is a Pan-European cooperation
  - Academic institutions and national space agencies
  - Supported through national funding
  - Processing power spread over 6 centres
  - ESAC team integral part of DPAC

DPAC participating countries ~450 members

Including:
BR
CA
DZ
ESA
IL
US

DPCI
DPCG
DPCC
DPCT
DPCB
DPCE

(The Simpsons, Bart's Comet, S06E14)



Why do transient Astronomy ?

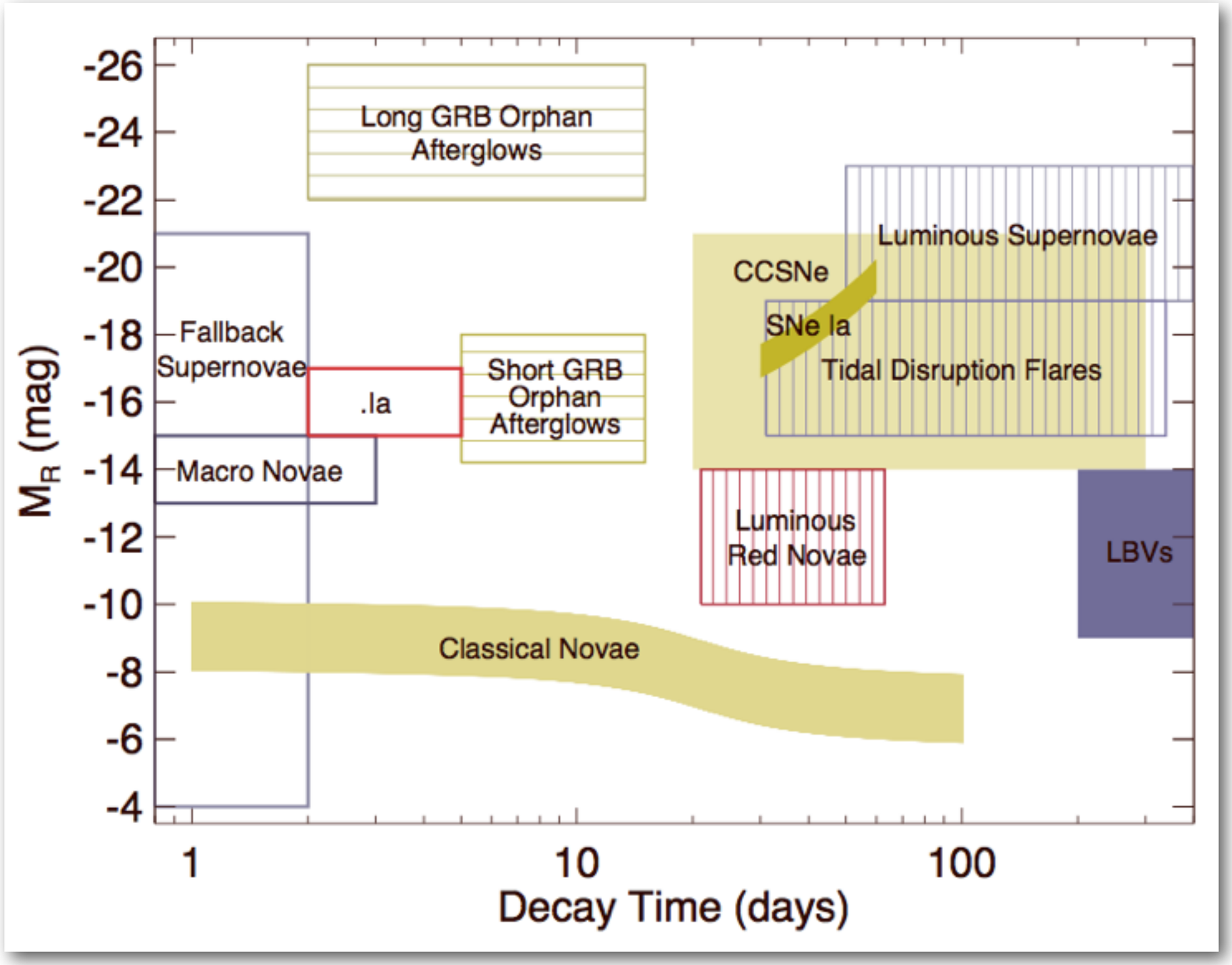
A (childlike) desire to see what's out there.

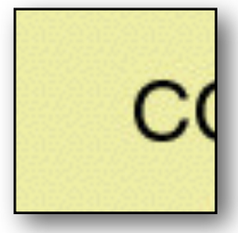
Variability is everywhere, and a useful diagnostic in Astrophysics.

Studying variable/transient behaviour leads to improved/new physics

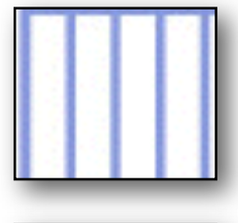
Let's go burn down the observatory so this will never happen again.

the transient zoo: from fast to slow

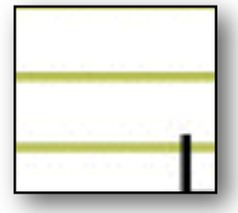




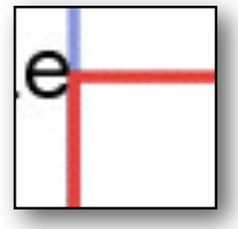
well studied



few cases

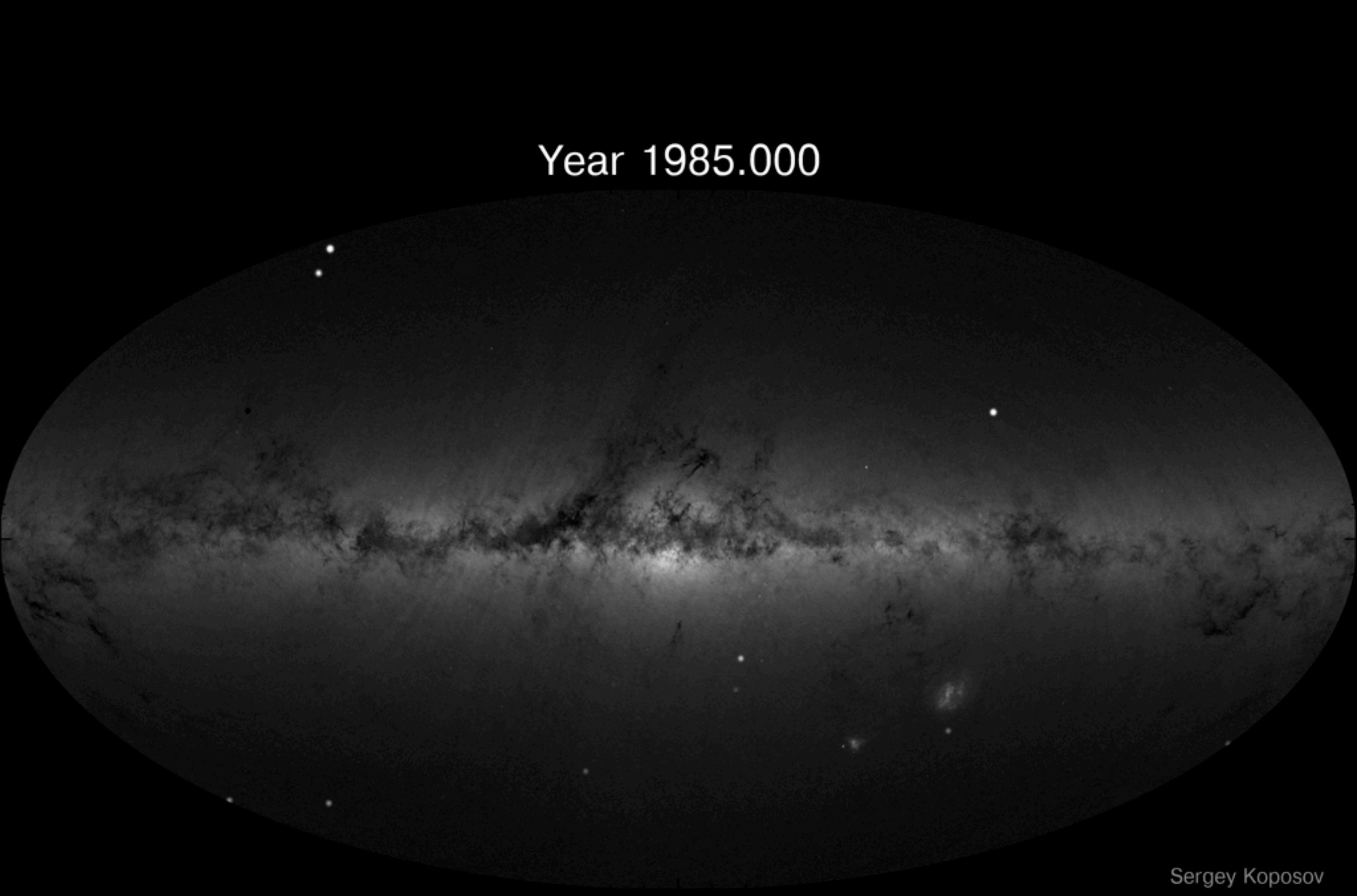


not seen yet



made up

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



www.youtube.com/watch?v=lv8HtH-O3uQ

Gaia as a transient survey

	Gaia	OGLE-IV	Catalina Sky Survey	PTF	LSST (from 2020??)
deg^2 day^{-1}	**≈ 1230**	150	1200	1000	5000
Avg Cadence	**≈ 30 days**	20min–5d days	14 days	5 days	4 days
Limiting mag	**~20.7**	22	19.5	21	r=24.7
f_{sky}	**all sky**	0.07	0.6	0.2	<0.48

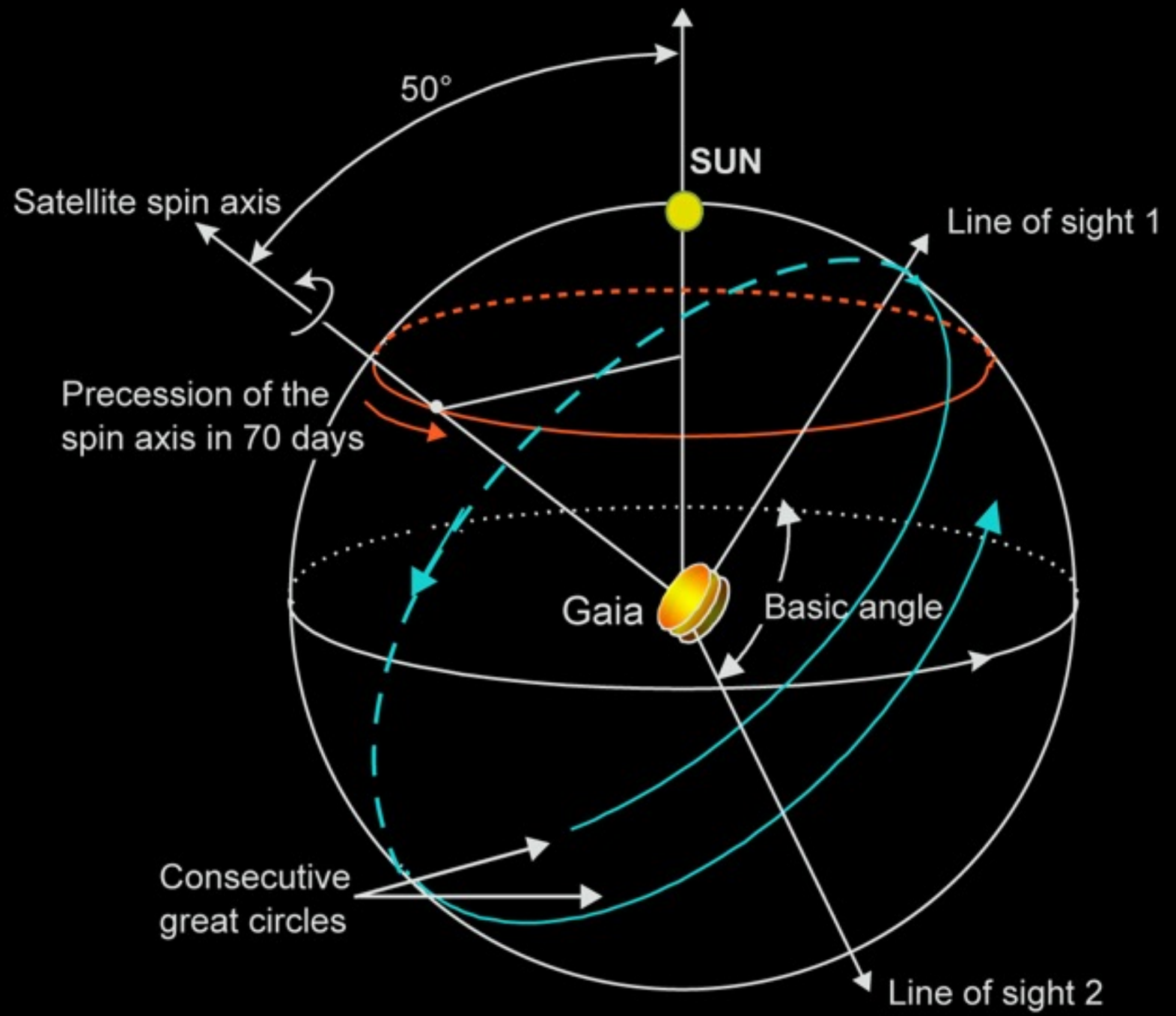
Some of us were lucky enough to go to Kourou to watch the launch

Sc ky
en ou
t n

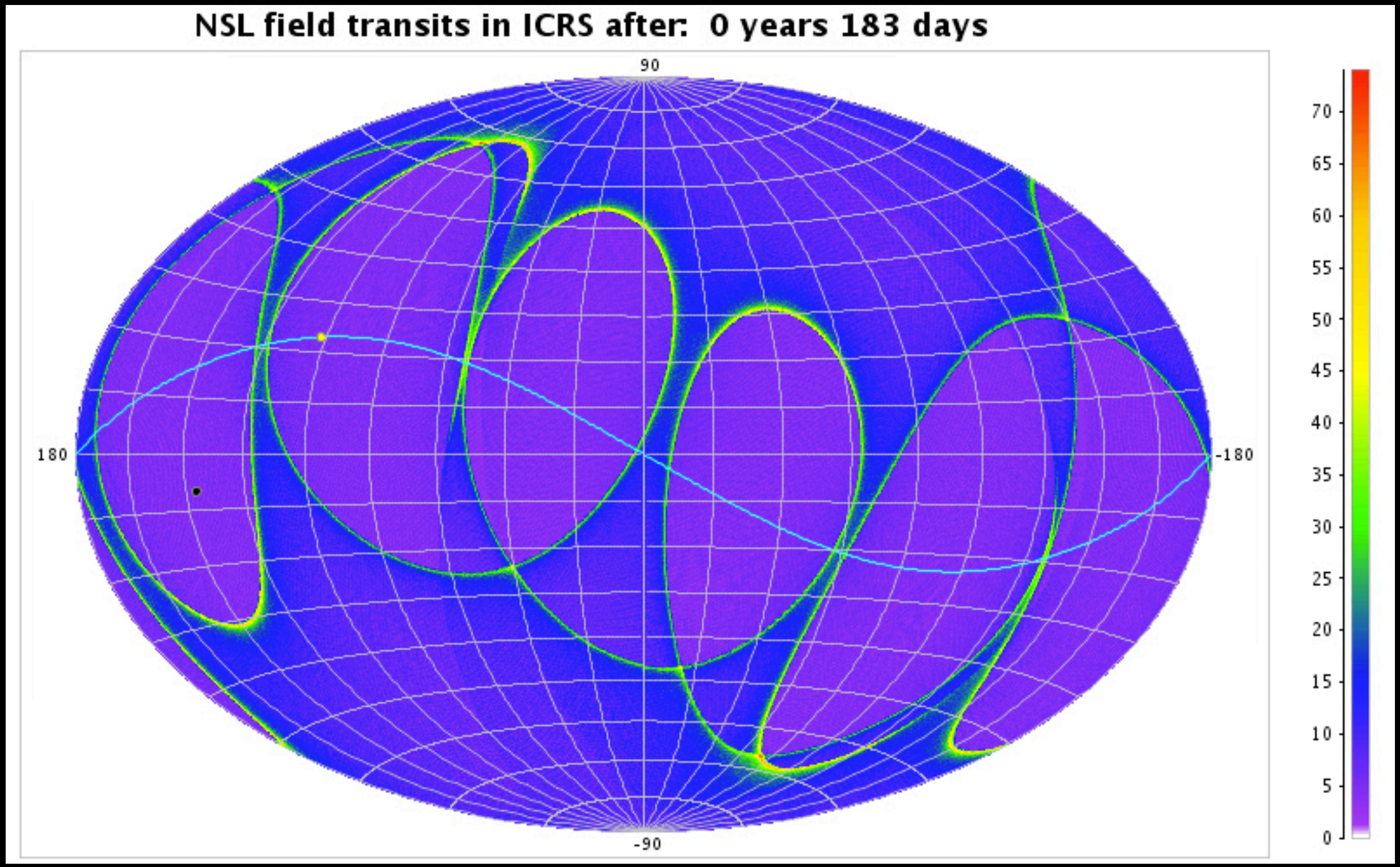
Launch December 19 2013 09:12:19 UTC

Scanning Law

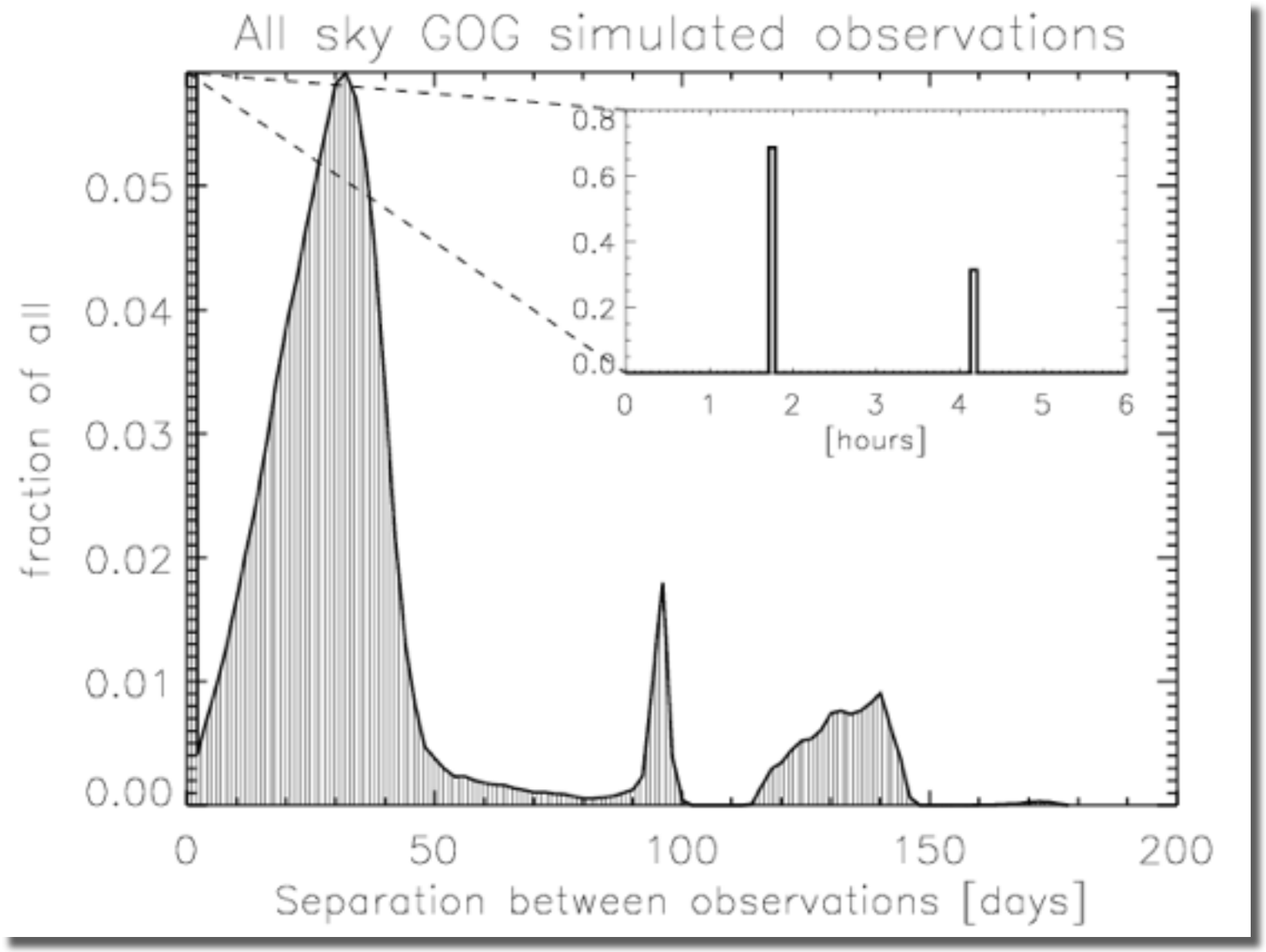
- 2 telescopes
- 1 focal plane
- spin period 6h
- precession period 70d
- FOVs 1+2 sep by 106.5m
- Time between scans: 6h
- Field revisited every ~30d
- Average of ~70 epochs
- Densest ~200 epochs



Scanning Law



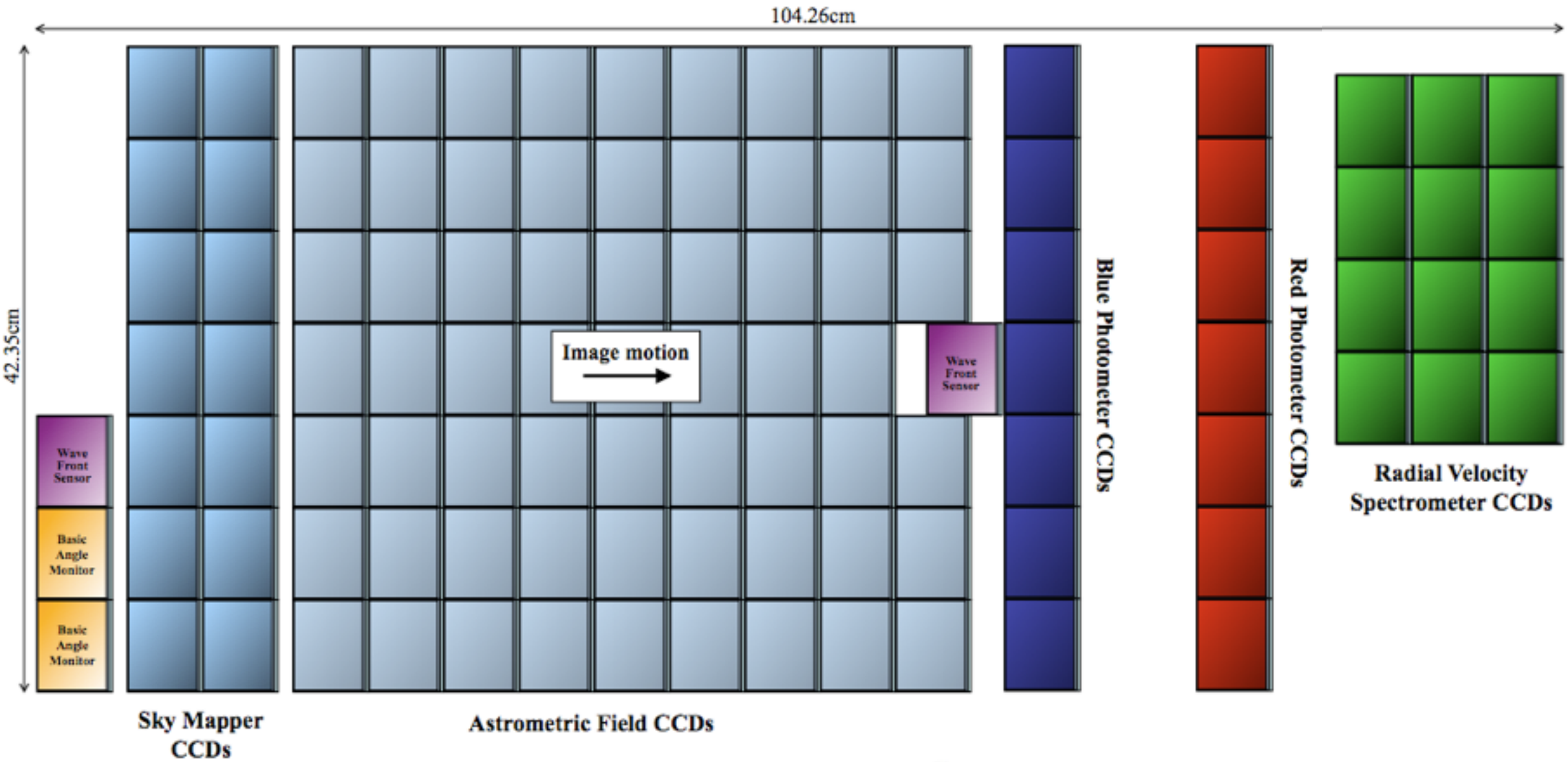
Scanning Law



- Two telescopes, one focal plane
- Time between FOVs: 106.5m
- Time between successive scans: 6h
- Field revisited every ~30 days
- Each object measured ~70 times
- Densest coverage ~200 epochs

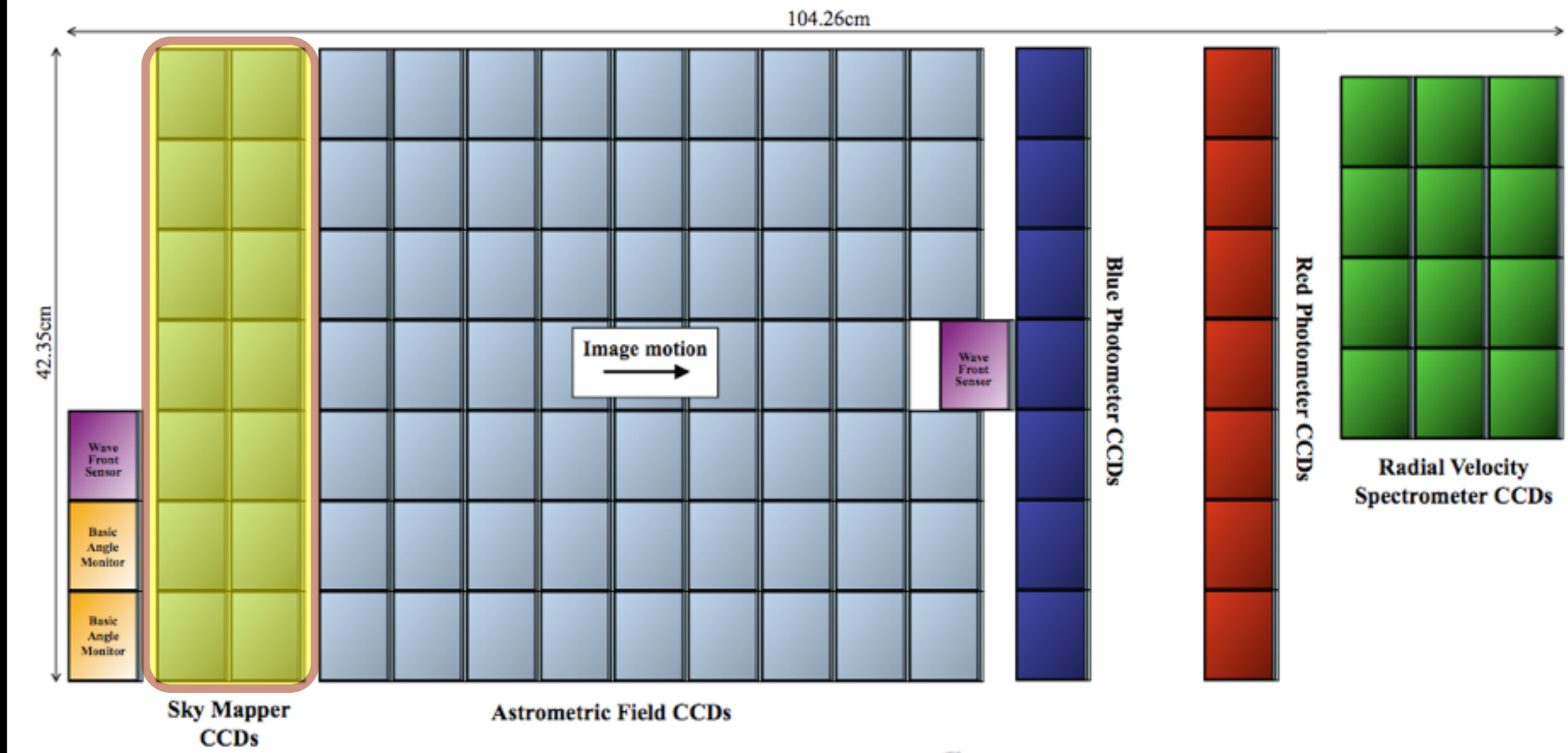
Gaia Focal Plane

FoV: 0.7 deg x 0.7 deg
pixel: 0.059”(AL) x 0.177”(AC)



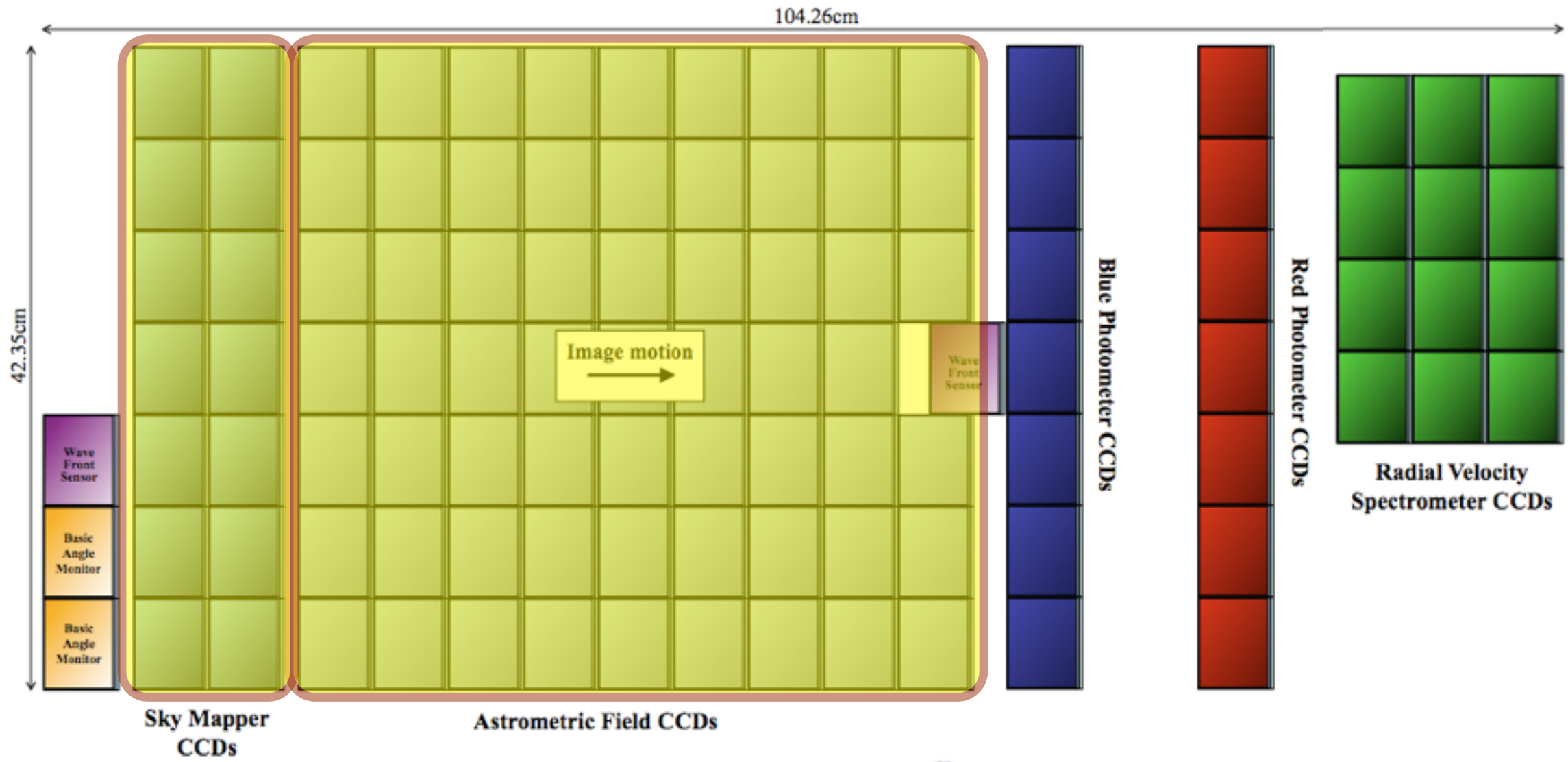
Gaia Focal Plane

FoV: 0.7 deg x 0.7 deg
pixel: 0.059”(AL) x 0.177”(AC)



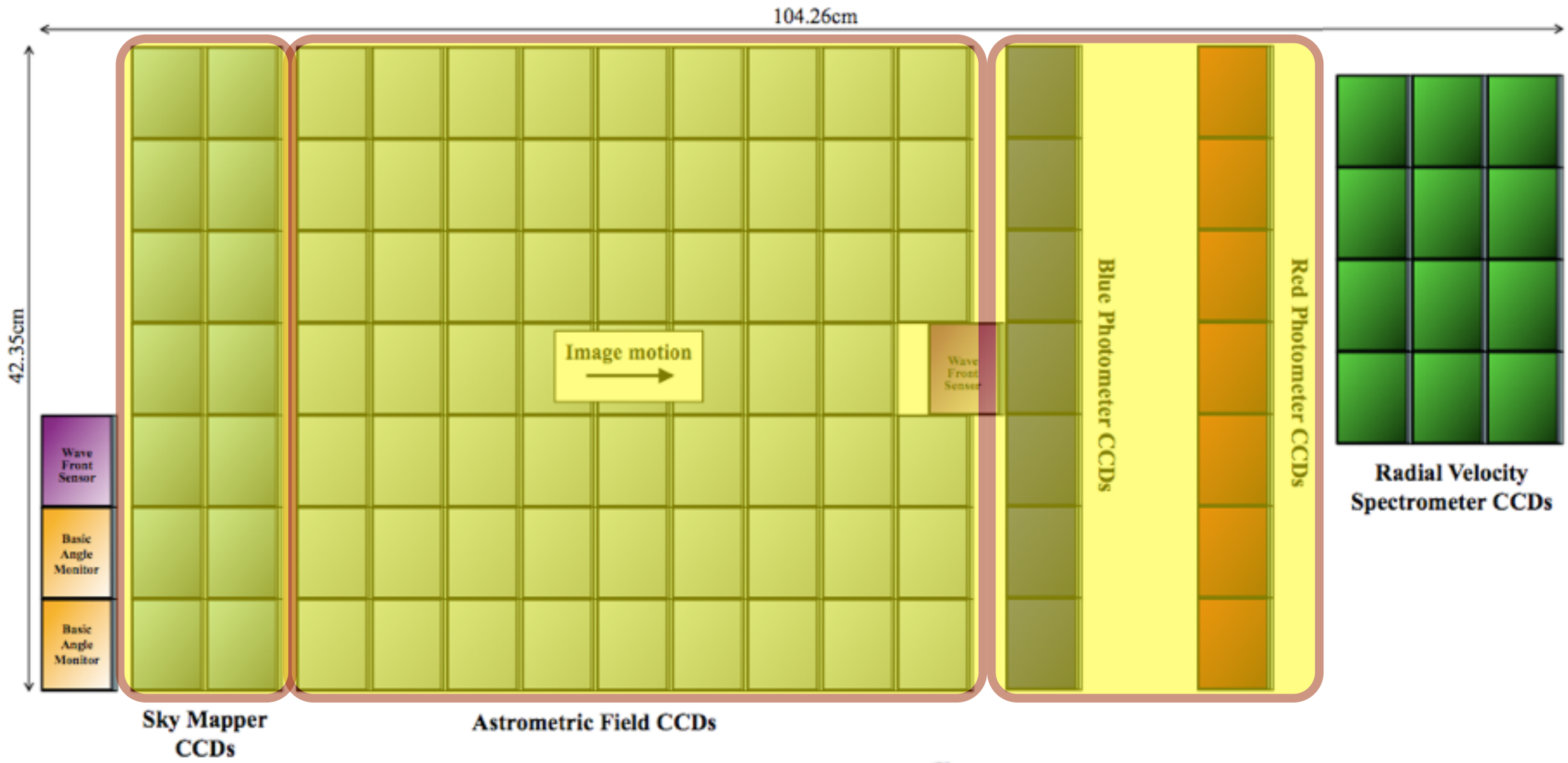
Gaia Focal Plane

FoV: 0.7 deg x 0.7 deg
pixel: 0.059”(AL) x 0.177”(AC)



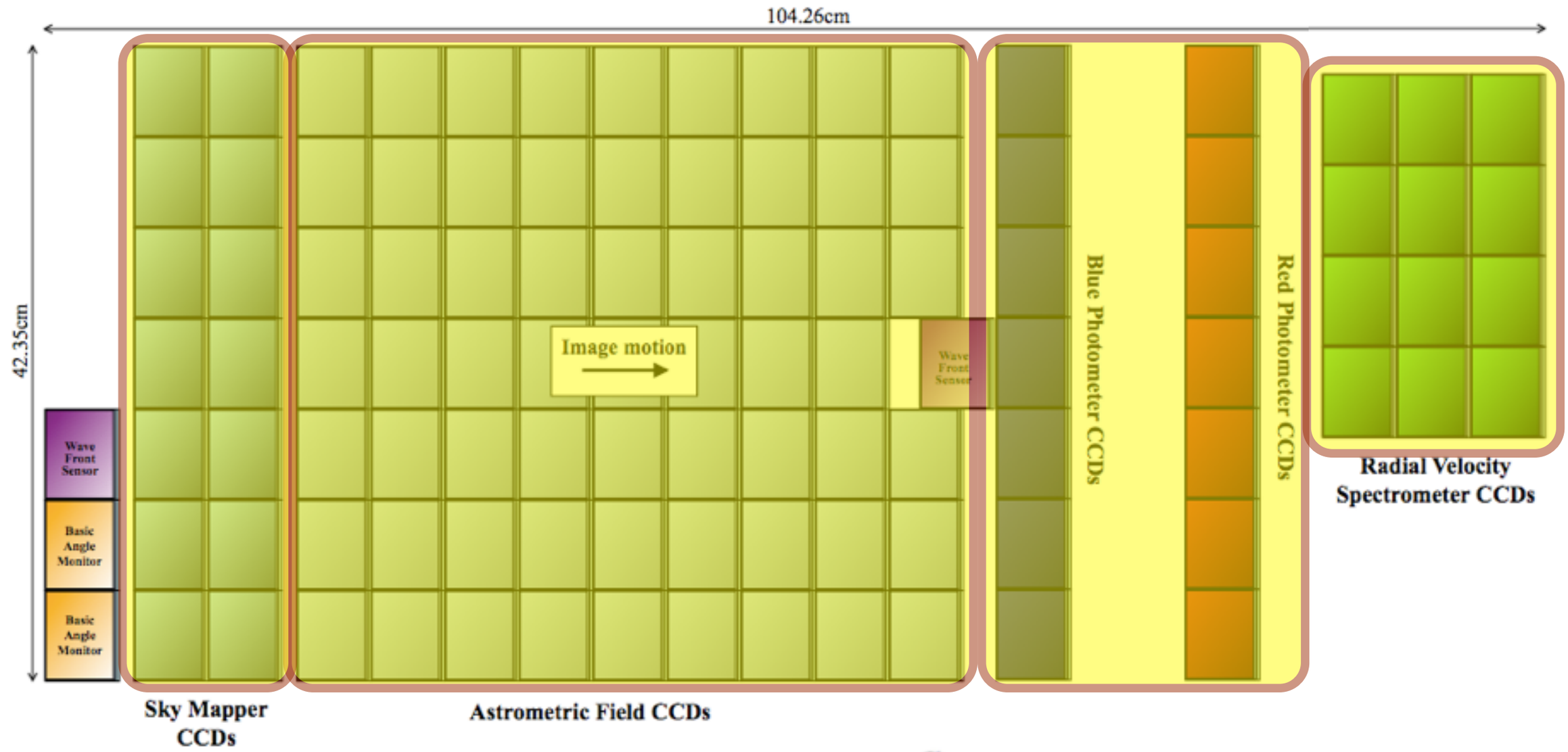
Gaia Focal Plane

FoV: 0.7 deg x 0.7 deg
pixel: 0.059”(AL) x 0.177”(AC)



Gaia Focal Plane

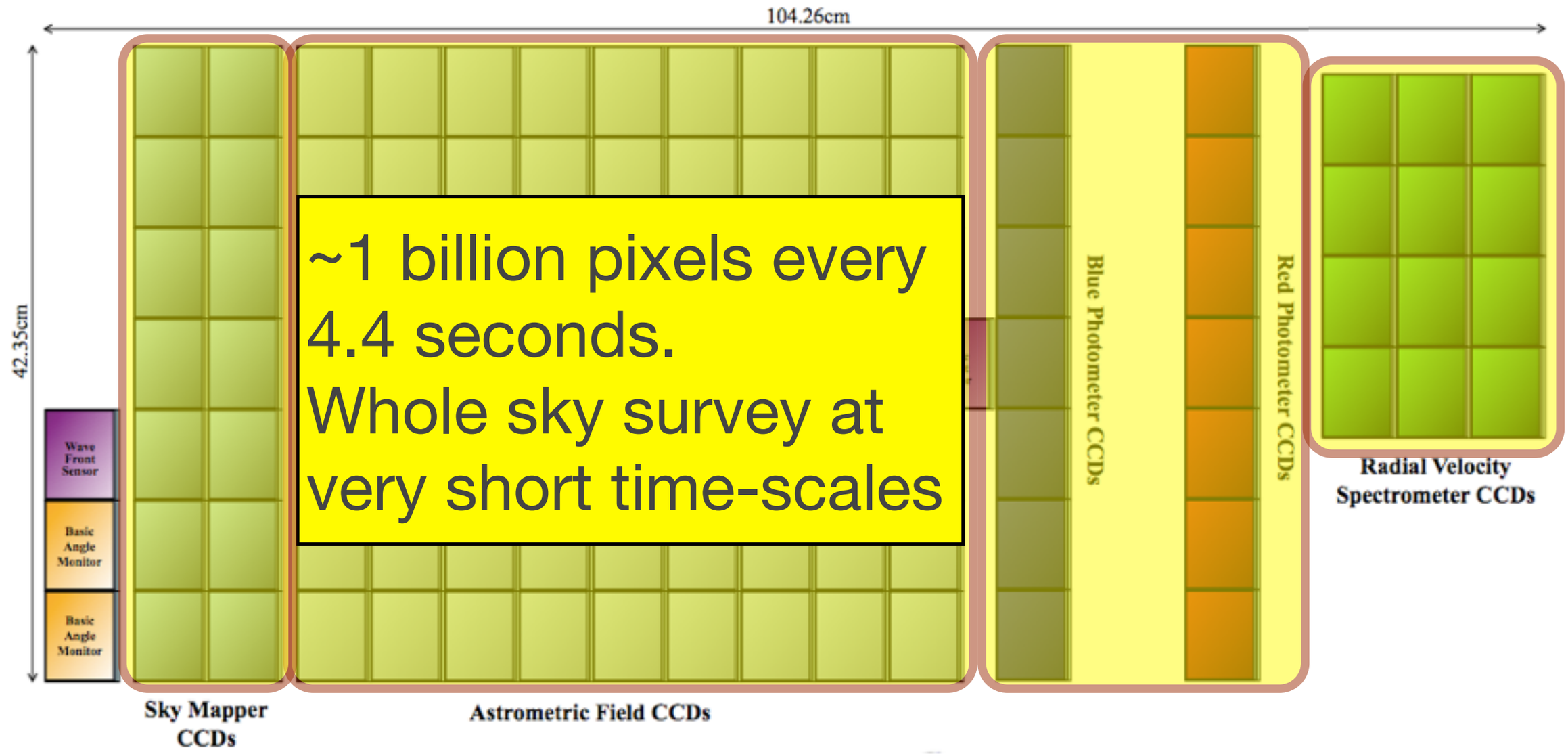
FoV: 0.7 deg x 0.7 deg
pixel: 0.059”(AL) x 0.177”(AC)



Gaia Focal Plane

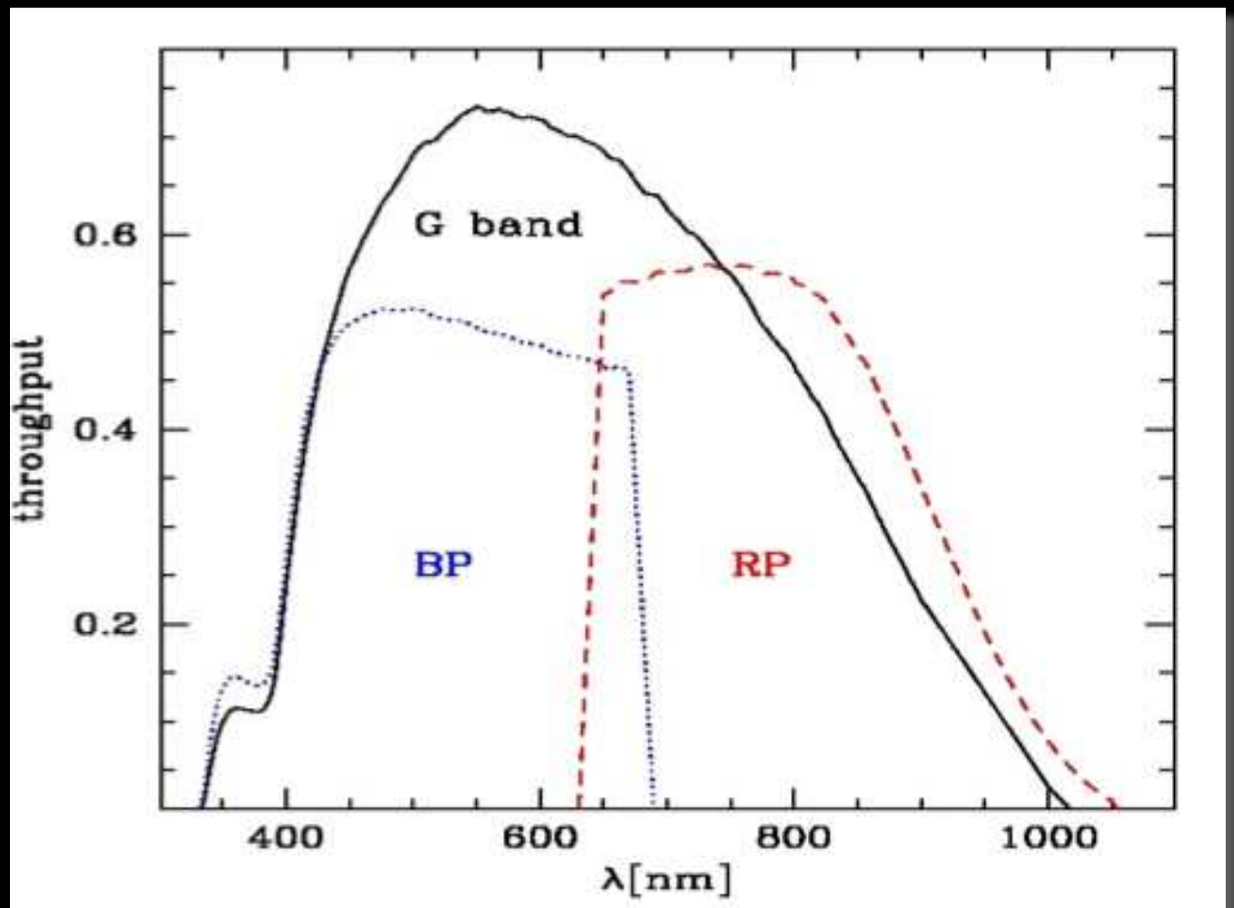
FoV: 0.7 deg x 0.7 deg
pixel: 0.059”(AL) x 0.177”(AC)

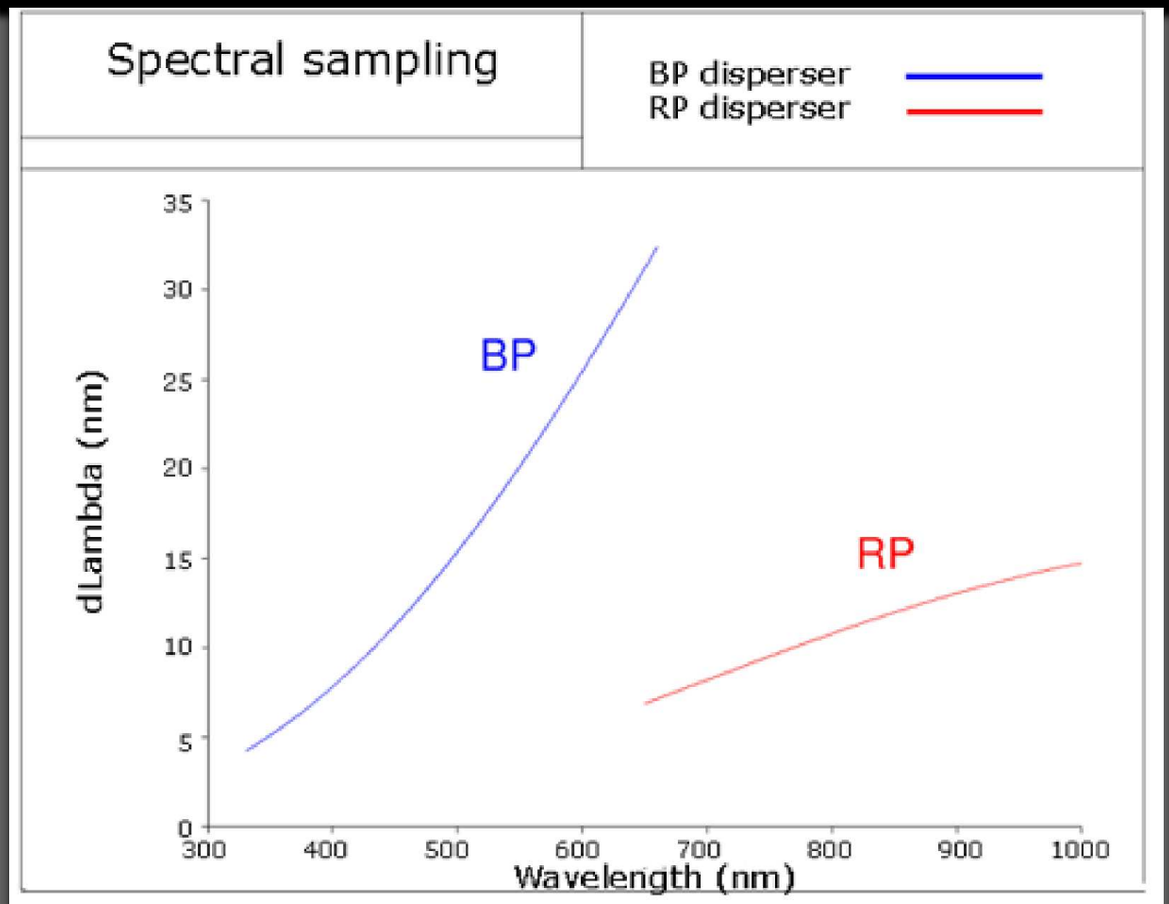
106 CCDs ~ 938 million pixels ~ 2800 cm²



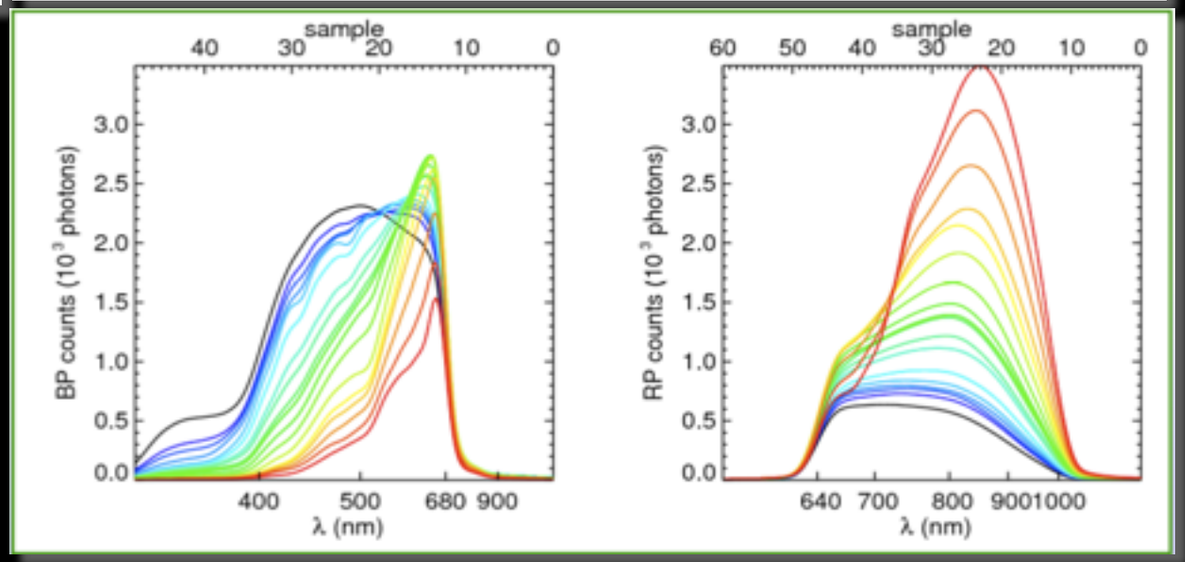
~1 billion pixels every 4.4 seconds.
Whole sky survey at very short time-scales

BP/RP spectra: classification





- two low-res fused-silica prisms
- BP 330-680nm @ 4-32 nm/pixel
- RP 640-1000nm @ 7-15 nm/pixel



Routine operations

- In 5-year routine phase since 18 July 2014
- Nominal scanning law optimised for Jupiter quadrupole moment general relativity experiment
- Data collection:
  - 225 billion astrometric measurements
  - 45 billion photometric measurements
  - 4.4 billion spectra
- Magnitude limits
  - Astrometry and photometry between $2 < G < 20.7$ mag
  - Stars brighter than $G = 3$ mag captured with Sky Mapper imaging
  - Spectra till $G_{RVS} = 16.2$ mag (and $G > 2$ mag)

Timeline for Data Flow

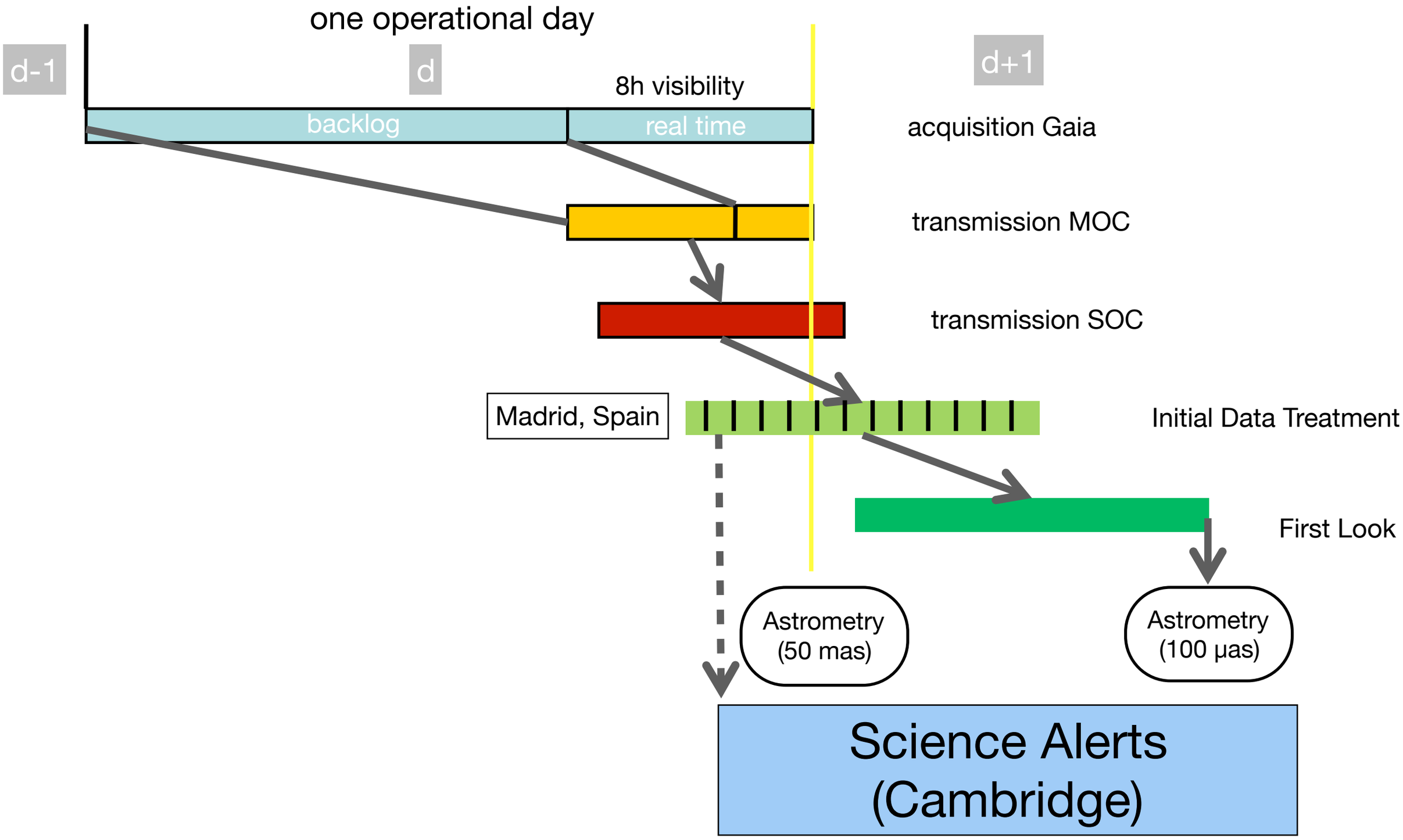
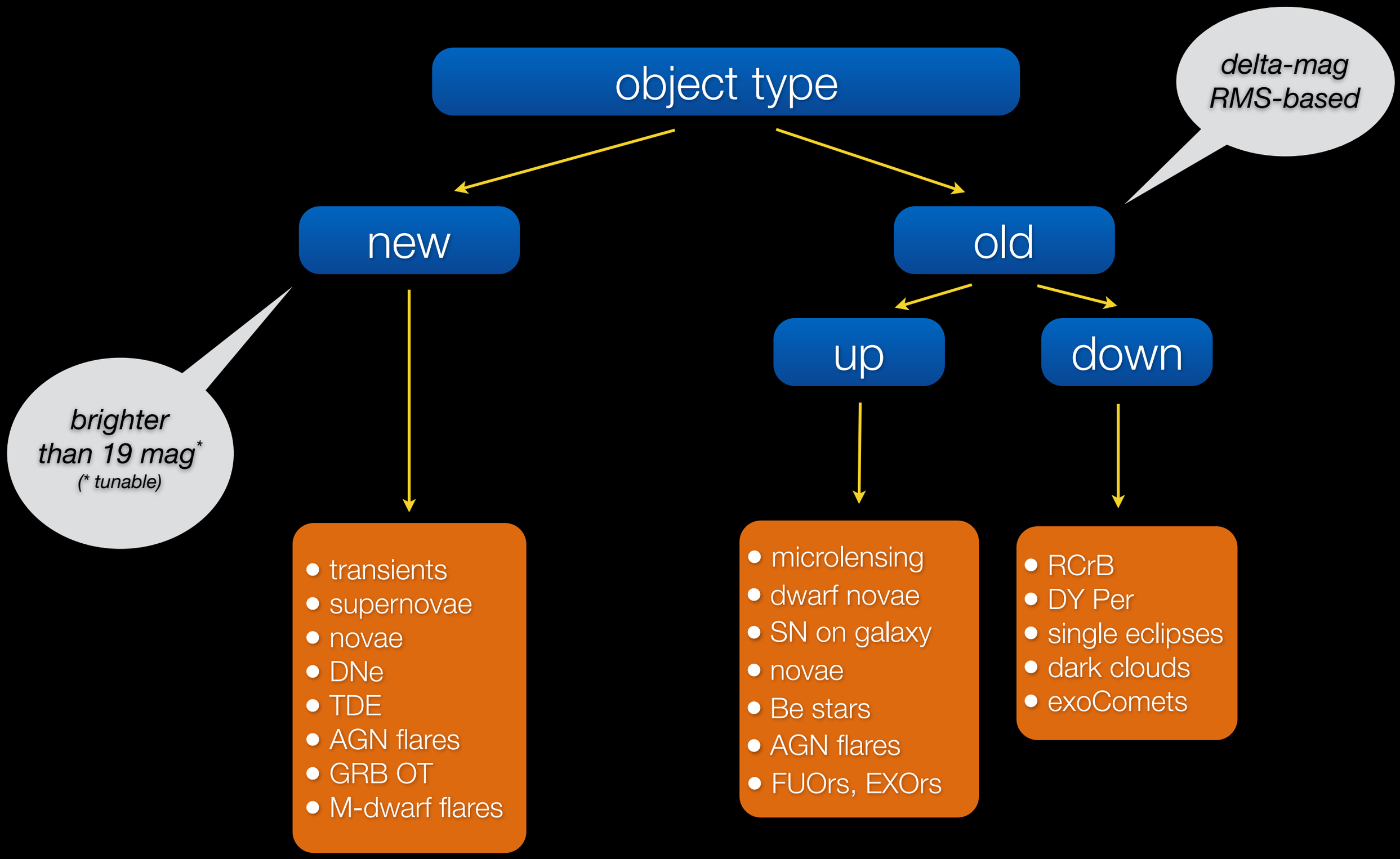


Figure courtesy Francois Mignard, updated by LW+STH

Alert Detection: Daily



Year 1: in a nutshell

From 13 Oct 2014 — 9 Jun 2015

297 IDT runs processed (204.. 517)

~16 billion transits ingested

~52 million alert candidates

Filtering per day

We have: ~10^8

We want: ~10^8

Transits

Mitigation

Detection

~10^5-10^6

Alert candidates

<10^3

Classification

~1

Alerts

~10

Gaia: Key Strengths and Weaknesses

- ☑ Low dispersion spectra of every transit down to 19th mag
- ☑ Spatial resolution (HST-like) and astrometric precision
- ☑ Fast photometry (4.5 sec)
- ☑ High dynamic range (mag 3—20)
- ☑ Photometric precision
- ☑ Well behaved biases

- ☒ Low cadence (2h, 4h, 30d)
- ☒ ~few day delay between observation and publication

Classification by humans

aggressive biased filters (galactic plane, ecliptic plane, near galaxy)

>=2 people eyeballing few 100s candidates a day

at least 2 people had to confirm

assign Gaia name and publish if agreed

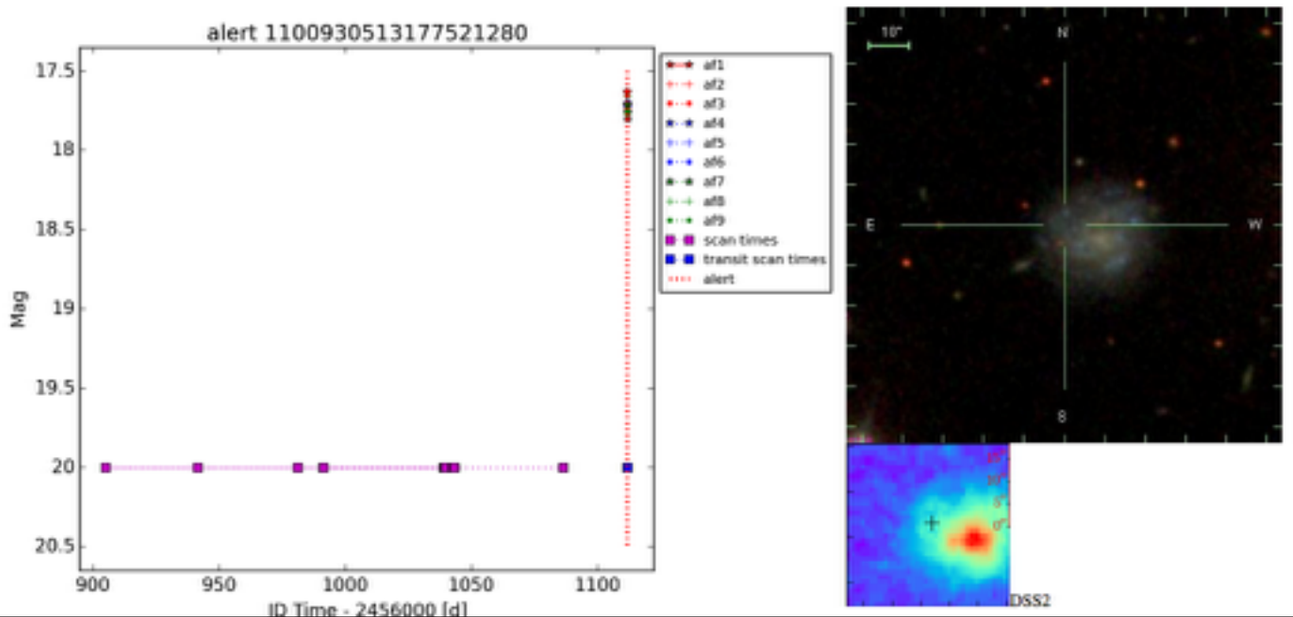
Date	Cand Name	Runid	Yes Eyeballers	No Eyeballe	Comments	Approved for publication?	Published?
	GaiaCandid15-0184	503	NBM, LW,STH?		SN close to galaxy core (2.13 arsec). It does not seem a binary star from the spectrum. The SN is too far away to be one of the spurious detections. LW: too red for a young SN, but let's try. I'd say the spectrum is galaxy dominated :(	STH	Gaia15afy
	GaiaCandid15-0185		LW,NBM,STH?	MF,HC	LW: OldSource channel - SDSS galaxy getting brighter from 20 to 19 mag, BPRP change a bit, but not very blue. Still, clearly change in mag. SDSS gal with spec_z=0.1. cool! this one really seems to be in the nucleus! It has raised over 1 mag. How reliable is the photometry as we change scan angles on this ? Can we run getlc on it and check with a larger aperture or something ? LW: you can see larger aperture photometry in ENV plots. There is clearly a jump in photometry. http://kohav.astrouw.edu.pl/~wyrzykow/cgi-bin/displayEnvironmentHtml.py?sourceid=1307577160902814464&ra=250.968109&dec=27.586195&name=GaiaCandid15-0185. LW: WHY you people do not like this one???? STH - because it's a gradual trand of only <=1 mag in brightness. I thought it was okay.		
30-05-2015	GaiaCandid15-0187	505	LW,STH,NBM		LW: likely CV: from 18.8 to 15 mag in 60 days, change in spec to quite blue, slow rise, or just past maximum already and declining. Nice single source detection.	STH	Gaia15afz
	188		LW,STH,NBM		LW: new blue source on top of very faint SDSS galaxy	STH	Gaia15aga
	190		LW,STH,NBM		new blue source next to gal. NBM: Looks line an old SN IA	STH	Gaia15agb
	191	510/511	LW,sth,NBM		bright new source 17.8 mag, BPRP looks like SN to my eye, hostless, nothin on SDSS image. STH : yep - looks good	STH	Gaia15agc
1-Jun-2015	GaiaCandid15-0192	510	NBM,STH, MF		SN in low surface brightness galaxy classified as starburst at z=0.03. Probable SN II. I could see a bit of H alpha there, so could b 2w old. No detection in other surveys at the moment of writing. STH: looks good	STH	Gaia15agd

Classification by humans

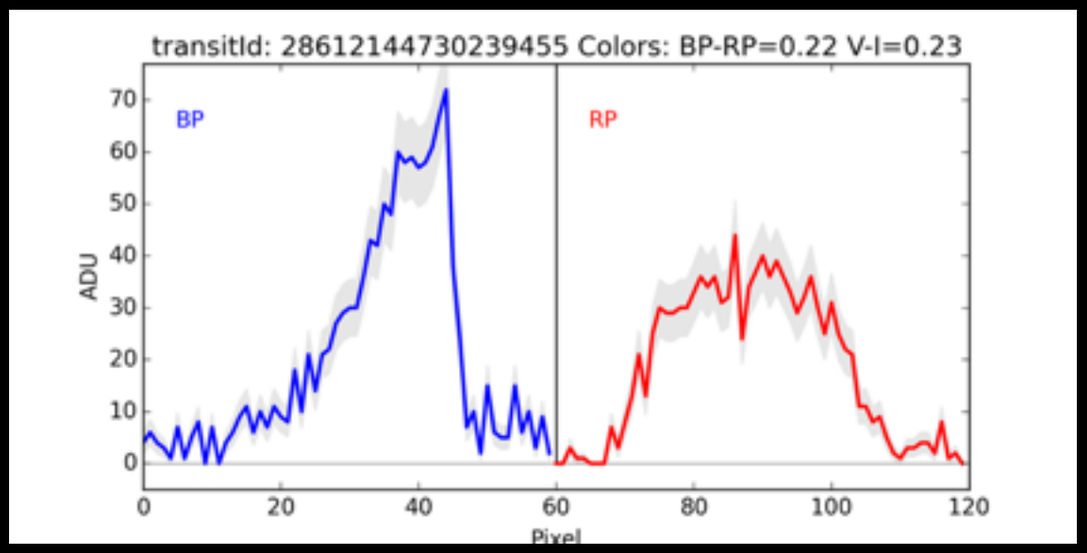
lightcurve + ancillary data

NewSource. Last non-detection date: 2015-03-04T20:39:42°

JD time-2456000	transitId	af1[mag]	af2[mag]	af3[mag]	af4[mag]	af5[mag]	af6[mag]	af7[mag]	af8[mag]	af9[mag]	mean
1111.603507	2860240391795956O	17.63	17.63	17.66	17.72	17.70	17.73	17.72	17.76	17.77	17.70
1111.779664	28612144730239455	17.80	17.74	17.77	17.76	17.72	17.69	17.70	17.66	17.75	17.73

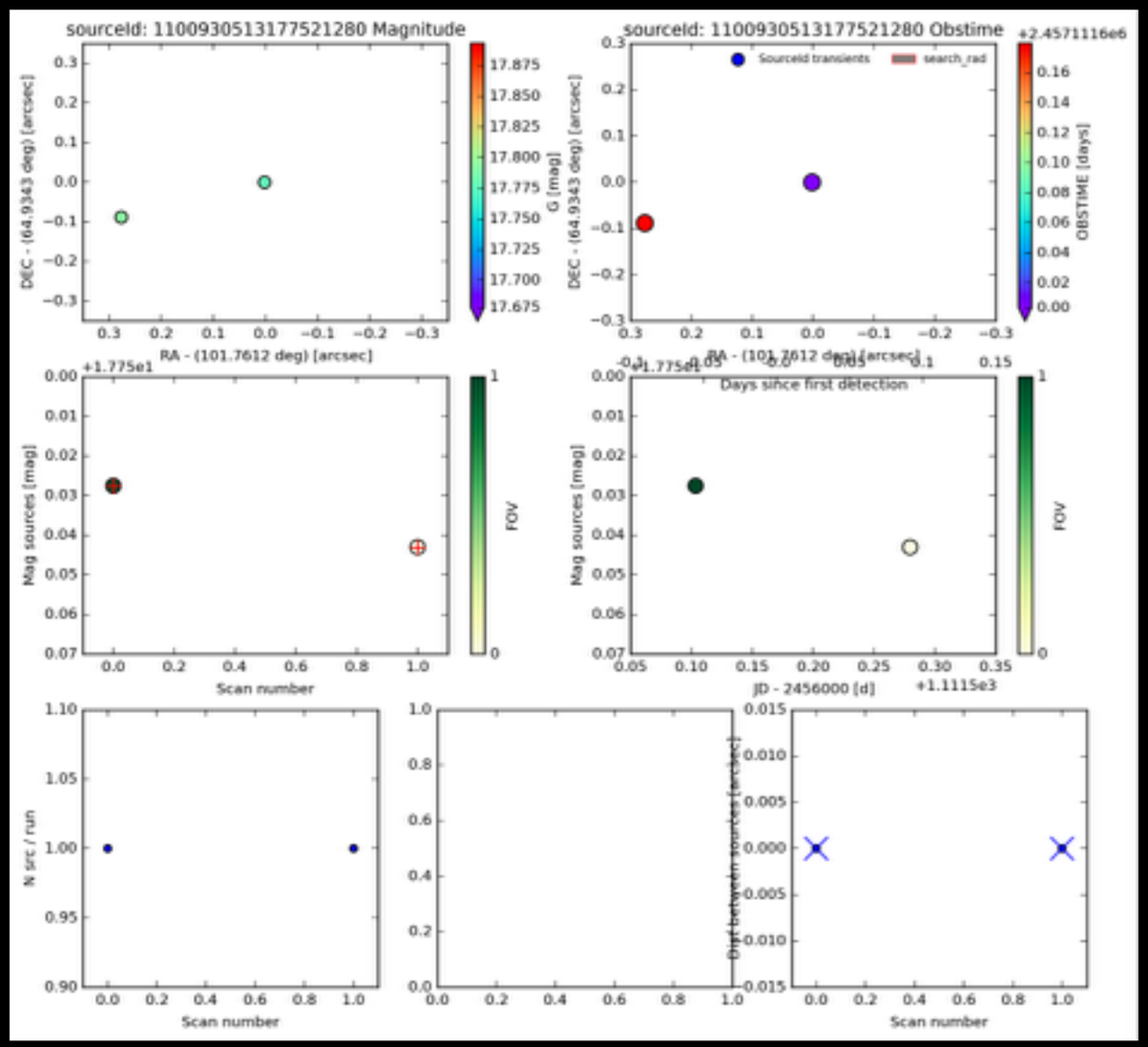


BP/RP spectra



Wyrzykowski & Blagorodnova

Environment



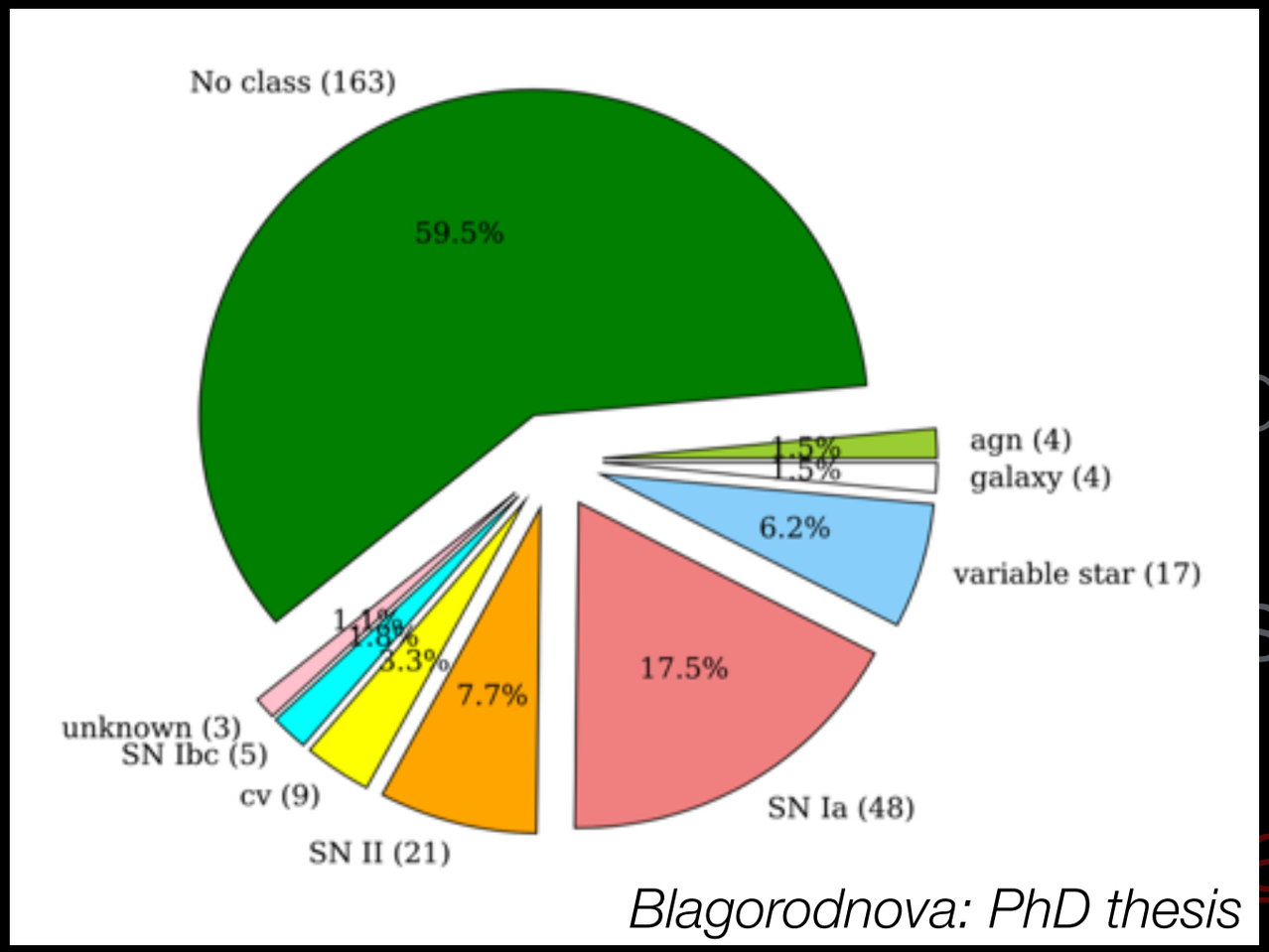
NOT and LT spectroscopic classification of supernovae Gaia15acz and Gaia15aek

ATel #7378; *S. Mattila, J. Harmanen, T. Kangas (University of Turku), A. S. Piascik, C. Davis, I. A. Steele (Liverpool John Moores University), N. Blagorodnova, M. Fraser, H. Campbell, S. Hodgkin, N. Walton (University of Cambridge), L. Wyrzykowski (Warsaw University Observatory), E. Kankare, R. Kotak (Queen's University Belfast)*
on 13 Apr 2015; 11:49 UT

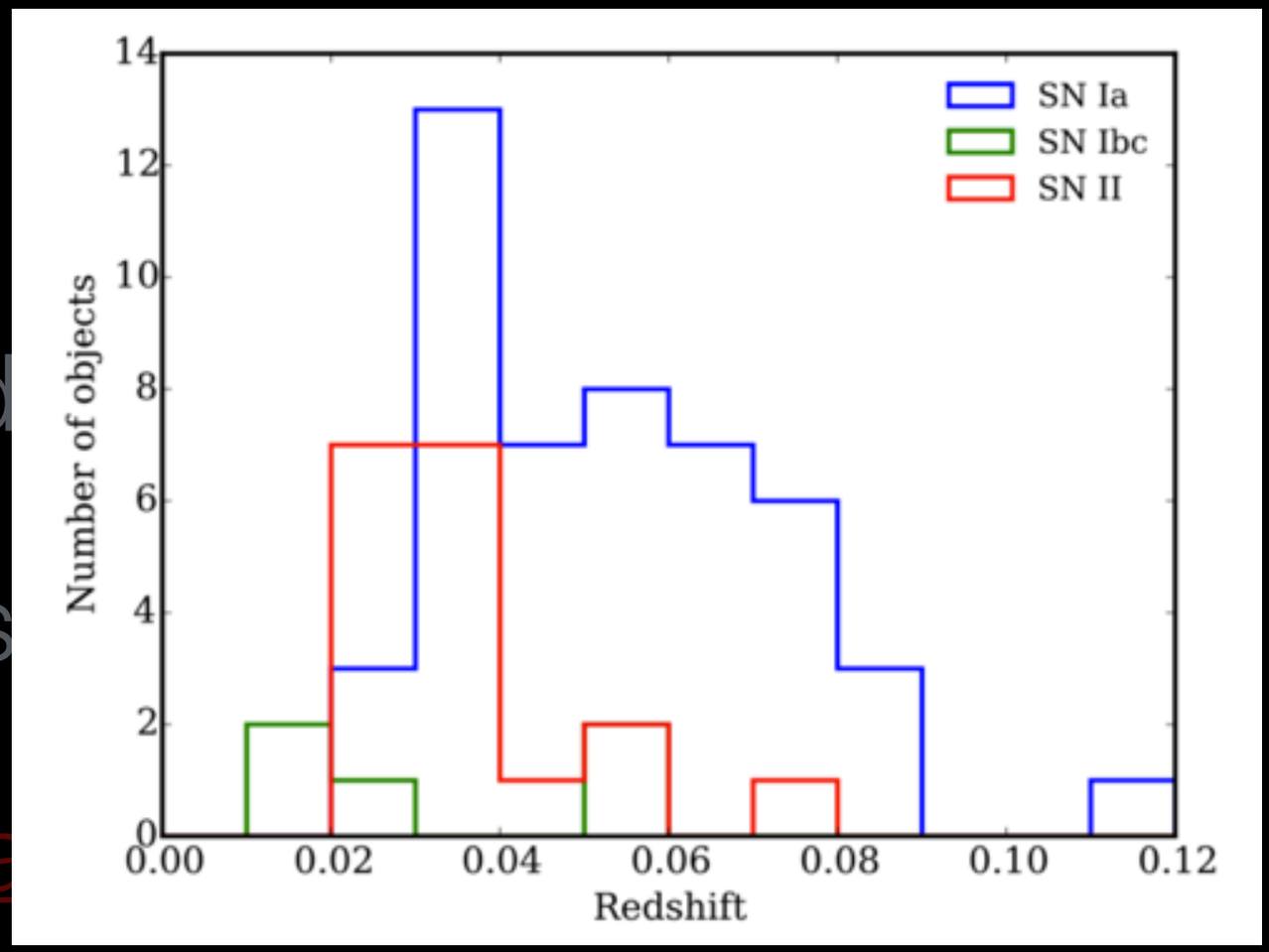
=> Gaia15aek

Supernova type IIP 2 weeks past max

Year 1: in a nutshell



Blagorodnova: PhD thesis



273 published alerts

108 classified (40%, incl: 4 AGN, 9 CV, 74 SN)

PUBLICATION OF ALERTS

```
787 objects were discovered by PS1 (prof)
153 objects were discovered by CRTS (prof)
113 objects were discovered by Gaia Photometric Science Alerts programme (prof)
 86 objects were discovered by All Sky Automated Survey for SuperNovae (ASAS-SN) (prof)
 81 objects were discovered by OGLE-IV wide field survey (prof)
 64 objects were discovered by DECam (prof)
 56 objects were discovered by PTF (prof)
 50 objects were discovered by Subaru/Hyper Suprime-Cam (prof)
 38 objects were discovered by La Silla-QUEST (prof)
 32 objects were discovered by MASTER (prof)
```

http://www.rochesterastronomy.org/sn2015/snstats.html

Gaia15add and Gaia15adj transients confirmed by Euler imaging

ATel #7277; *L. Palaversa, S. Saesen, T. Semaan, N. Mowlavi, L. Eyer (Department of Astronomy, University of Geneva, Switzerland)*
on 23 Mar 2015; 16:31 UT

Spectroscopic Classification of Gaia15abn as a Type Ia Supernova

ATel #7139; *A. S. Piascik, I. A. Steele (Liverpool JMU)*
on 25 Feb 2015; 12:13 UT

Spectroscopic Classifications of 7 Optical Transients

ATel #7087; *I. Shivvers, A. V. Filippenko (UC Berkeley)*
on 17 Feb 2015; 06:54 UT

PESSTO spectroscopic classification of optical transients

ATel #7068; *L. Le Guillou (LPNHE), A. Mitra (LPNHE), S. Baumont (LPNHE), N. Chotard (IPNL), P-F. Leget (LPC-Clermont), J. Anderson (ESO), N. Elias-Rosa (INAF-OAPd), C. Inserra (QUB), K. Maguire (ESO), S. Smartt (QUB), K. W. Smith (QUB), M. Sullivan (Southampton), S. Valenti (LCOGT), O. Yaron (Weizmann), D. Young (QUB), Ilan Manulis (Weizmann), C. Baltay, N. Ellman, E. Hadjiyska, R. McKinnon, D. Rabinowitz, S. Rostami (Yale University), U. Feindt, M. Kowalski (Universitat Bonn), P. Nugent (LBL Berkeley)*
on 14 Feb 2015; 17:07 UT

Spectroscopic classification of Gaia Alerts

ATel #7177; *H. Campbell, M. Fraser, S. T. Hodgkin, S. Koposov, N. Blagorodnova (University of Cambridge), L. Wyrzykowski, Z. Kostrzewa-Rutkowska (Warsaw University Observatory), P. Jonker, T. Wevers (University Nijmegen/SRON), M. A.P. Torres (ESO), S. Van Velzen (Johns Hopkins)*
on 5 Mar 2015; 09:53 UT

Gaia discovery of a Supernova candidate in ESO 297- G 008

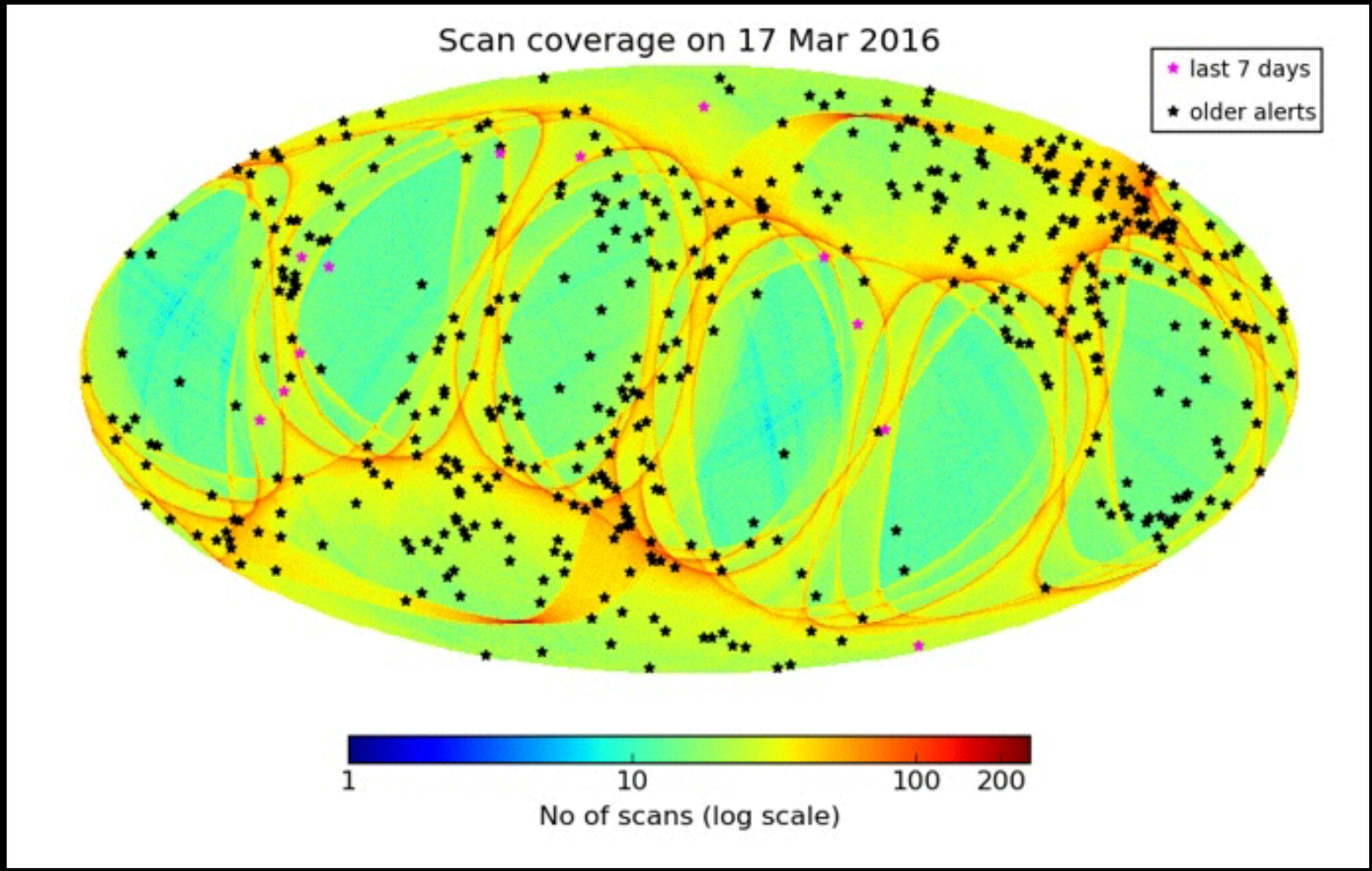
ATel #7328; *N. Blagorodnova, H. Campbell, A. Delgado, M. Fraser, S. Hodgkin, D. Harrison, S. Koposov, G. Rixon, N. Walton (University of Cambridge), L. Wyrzykowski, Z. Kostrzewa-Rutkowska (Warsaw University Observatory)*
on 31 Mar 2015; 18:49 UT

Gaia15abn transient confirmed by Mercator imaging

ATel #7110; *L. Palaversa, T. Semaan, N. Mowlavi, L. Eyer (Department of Astronomy, University of Geneva, Switzerland)*
on 19 Feb 2015; 15:20 UT

Łukasz Wyrzykowski

Alerts to date



Why so many candidates?

- Spurious new sources (diffraction spikes)
- Spurious transits (VPU duplicates)
- Wrong light curves (bad source-transit matching)

- Running without calibration
- SSOs, periodic variables not robustly excluded
- Internal mistakes with scan coverage

Reducing Contaminants

Goal (since Alerts switch-off): minimise alerts from contaminants.

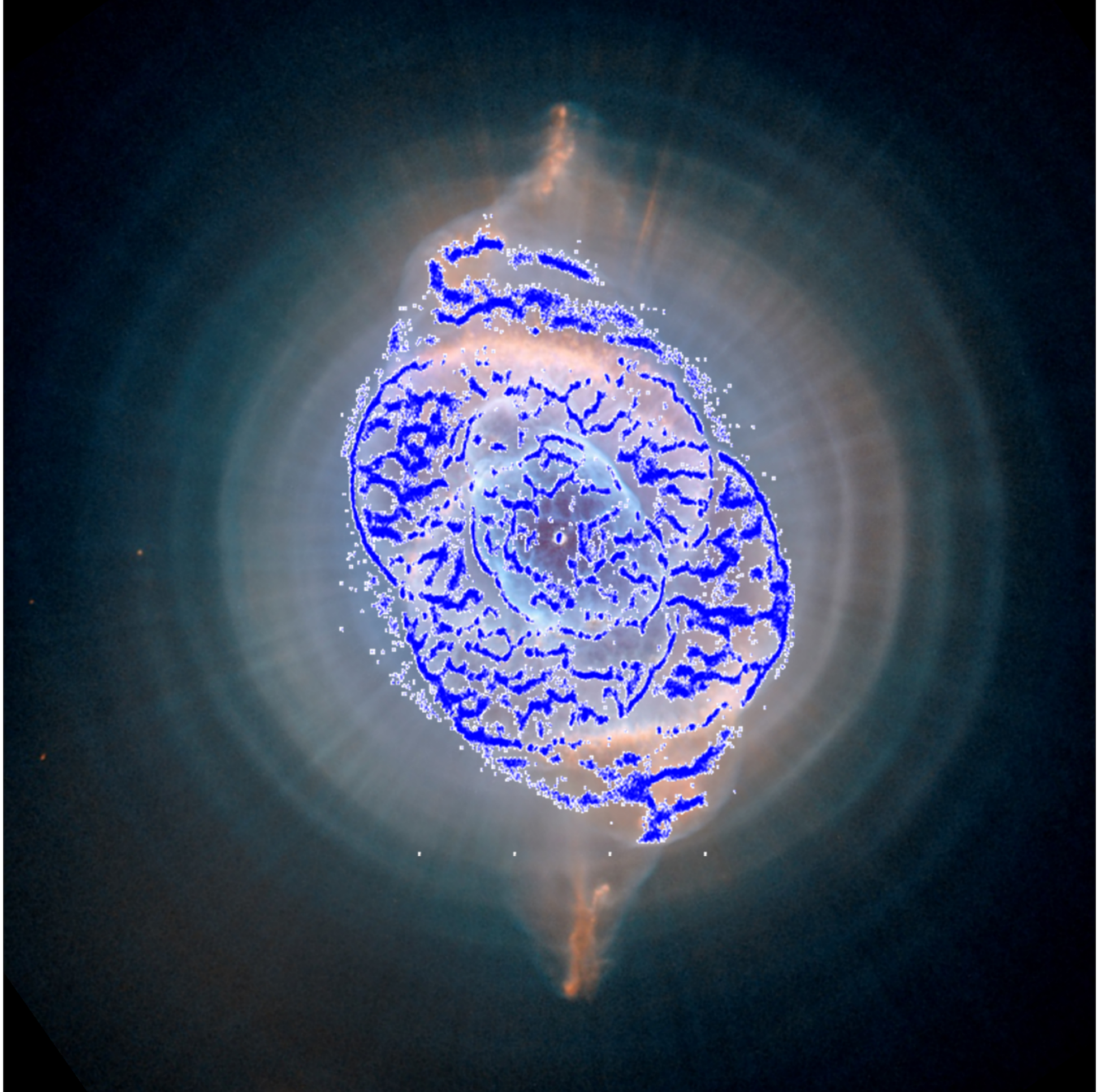
Incorporated cycle0 re-crossmatch, blacklist, and our own flags to reduce alert rate from spurious detections/XMs.

Current Alert Rates are ~100-1000s per day (depending on scan region)

We can now run automated filtering and classification algorithms: Lightcurve Classifier (Random Forest), Spectral Classifier (Blagorodnova et al. 2014), XM and Environment Analysis

Cateye Nebula

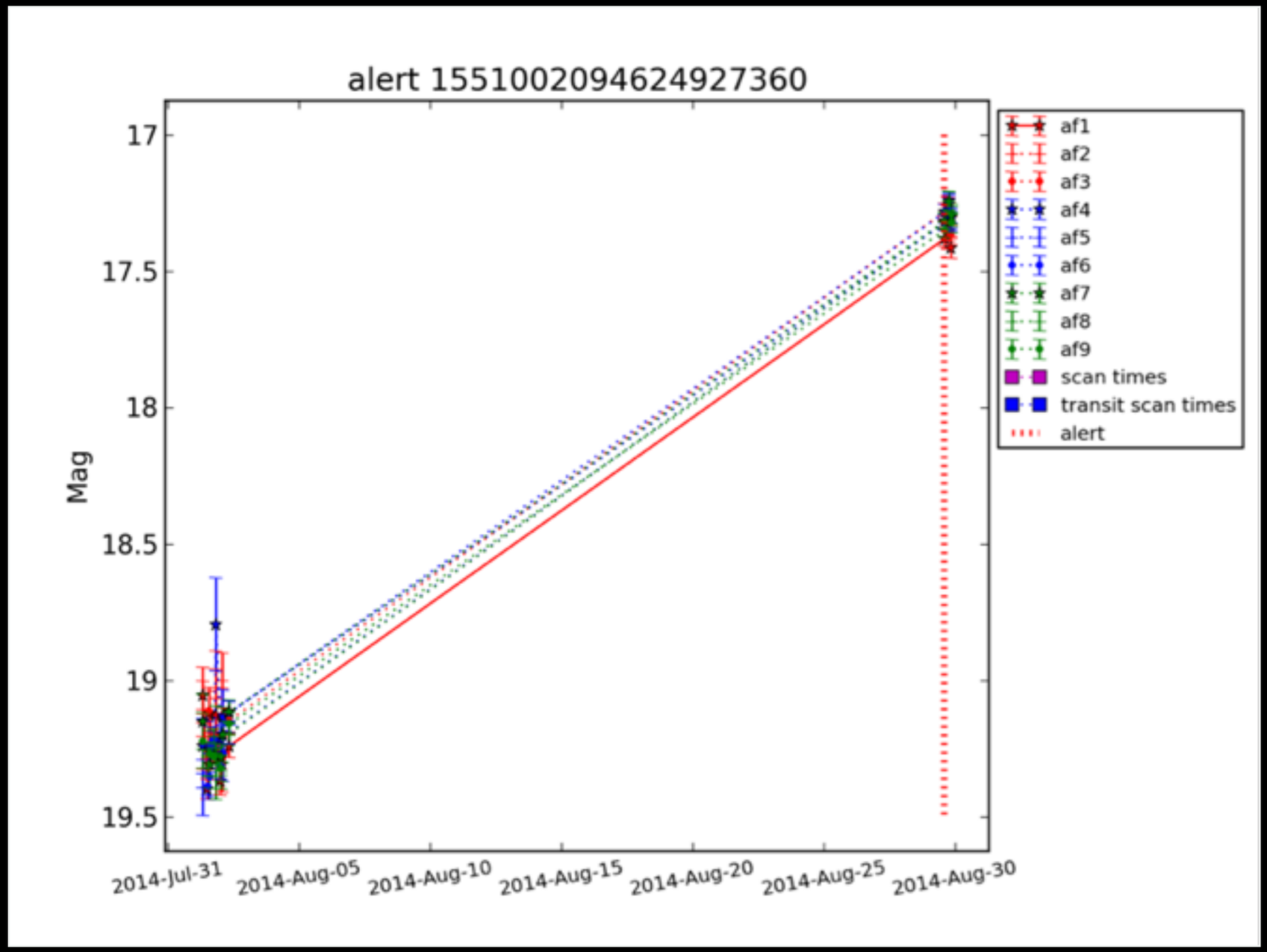
The scale of the image is ~1 by ~1 arcminute. There are ~84,000 Gaia detections made in this area from 25 July to 21 August 2014. Gaia is actually able to detect not only stars but also high surface brightness filamentary structures



HST image credit: NASA, ESA, HEIC, and The Hubble Heritage Team (STScI/AURA)
Gaia image credit: ESA/Gaia/DPAC/UB/IEEC

Gaia14aaa: our first Supernova

- Uncalibrated photometry
- Measurements separated by ~30 days



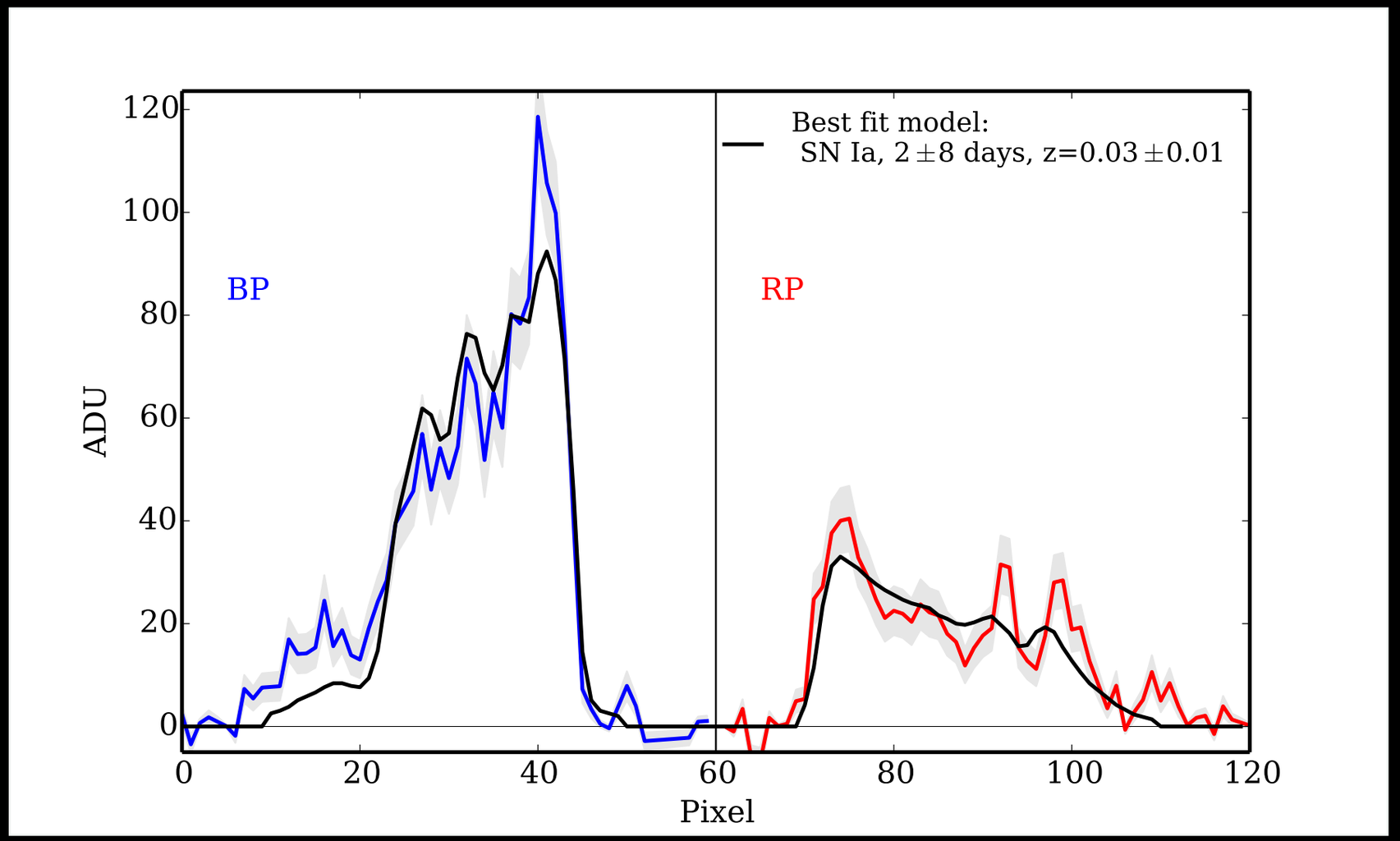
GAIA DISCOVERS ITS FIRST SUPERNOVA

While scanning the sky to measure the positions and movements of stars in our Galaxy, Gaia has discovered its first stellar explosion in another galaxy far, far away.

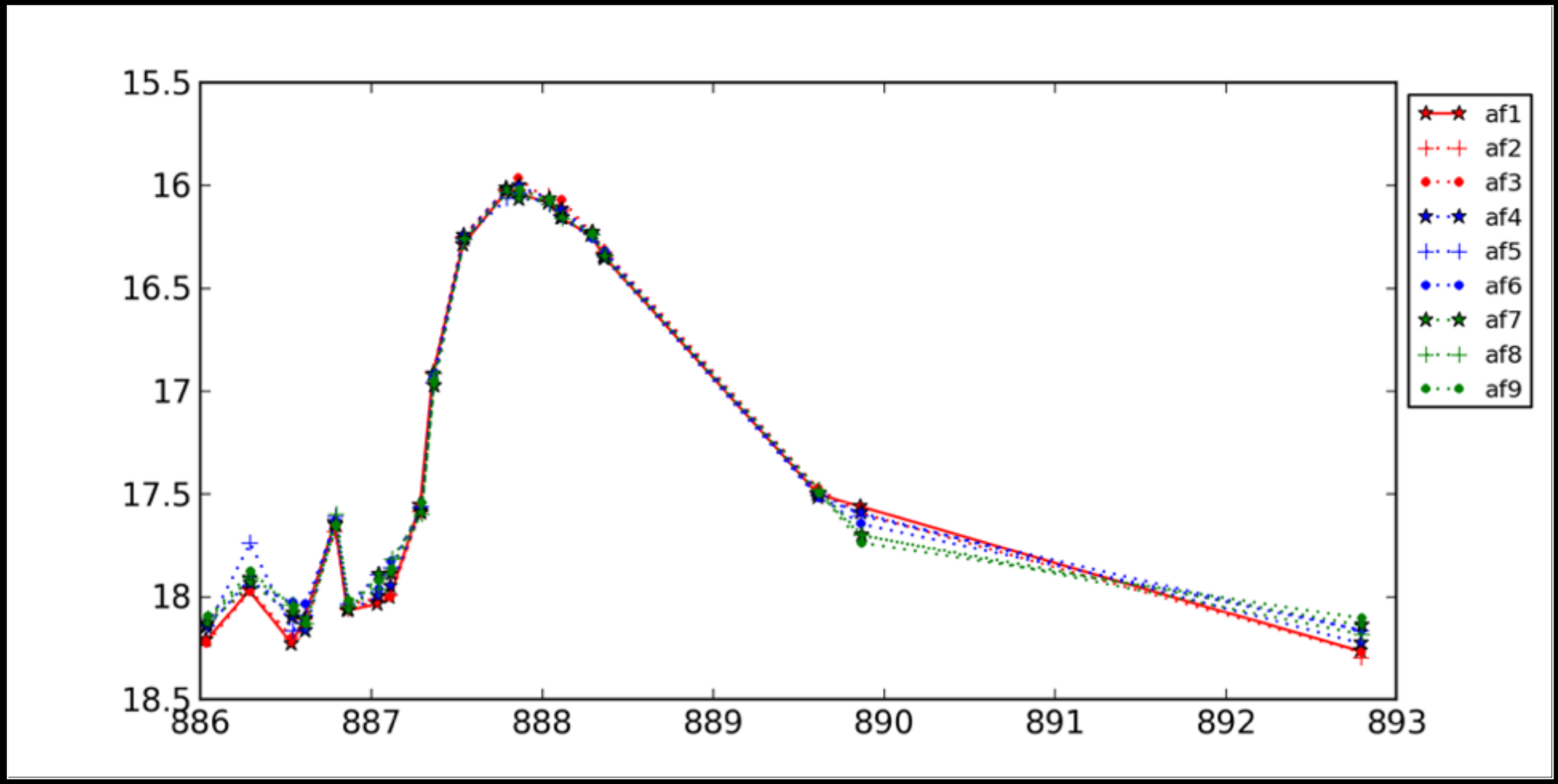
This powerful event, now named Gaia14aaa, took place in a distant galaxy some 500 million light-years away, and was revealed via a sudden rise in the galaxy's brightness between two Gaia observations separated by one month.

Gaia14aaa: our first Supernova

- Uncalibrated photometry
- Measurements separated by ~30 days
- Best fit model spectrum SN Ia



Gaia14aae, ASASSN-14cn



Gaia14aae: A new AM CVn

- Outburst in Gaia, but object also seen in outburst in ASAS and Pan-STARRS
- WHT follow up sees strong Helium lines - AM CVn classification

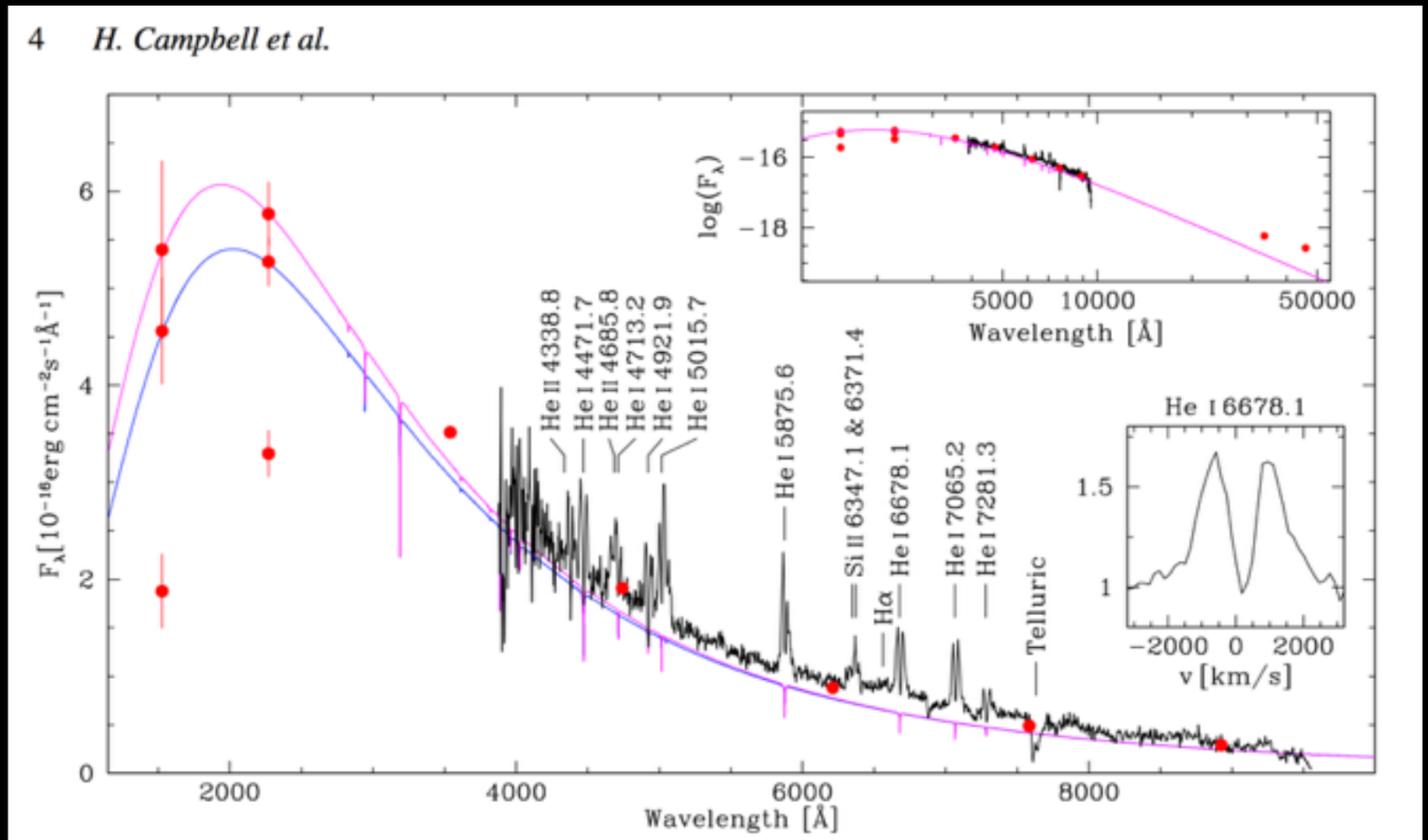
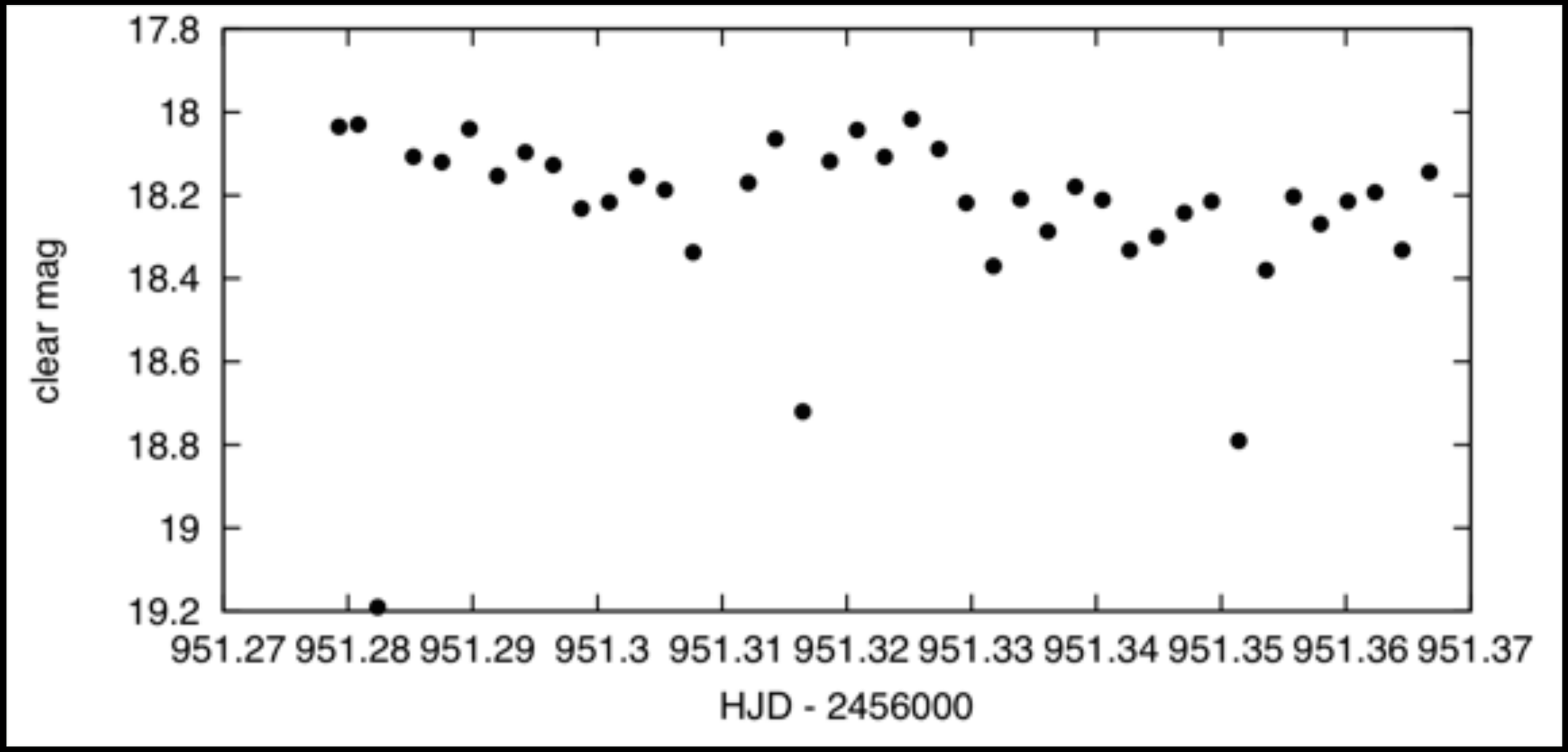


Figure 1. WHT+ACAM spectrum of Gaia14aae taken on 2014 October 13 during quiescence, showing double-peaked He emission and an absence of H lines. The historical *GALEX* and SDSS photometry are also shown as red points; the fainter *GALEX* magnitudes probably cover an eclipse. The blue and magenta lines are $T_{\rm eff}$ = 12700 K and 13100 K respectively He-atmosphere models fitted to the optical flux and two different epochs of UV flux. The top-right inset shows the spectral energy distribution (SED) fit with the WISE data included, the bottom-right inset shows a zoom in of the He I λ6678 line in velocity space.

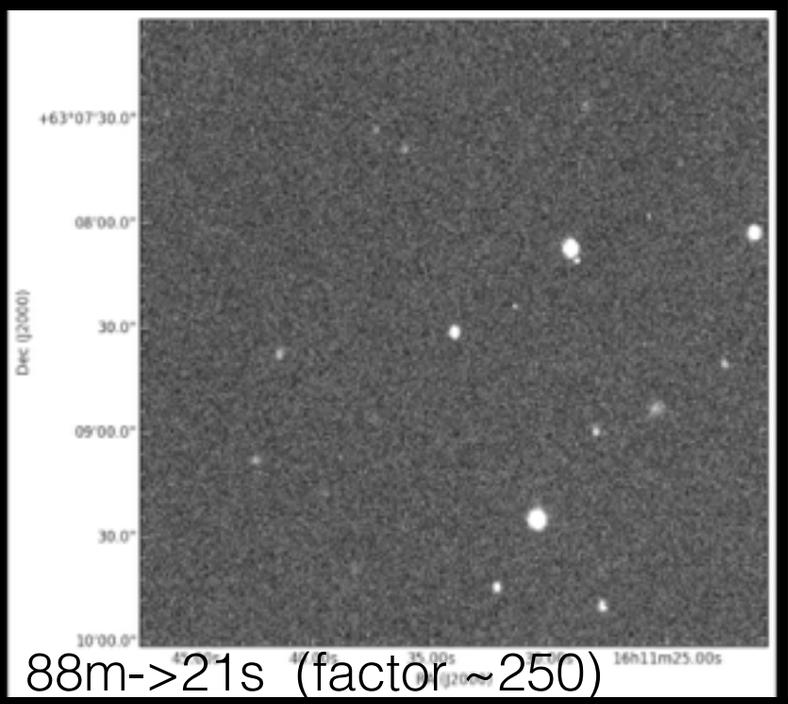
Gaia14aae: an eclipsing AM CVn



- Enrique de Miguel (Centre for Backyard Astrophysics) followed up the alerts and saw eclipses

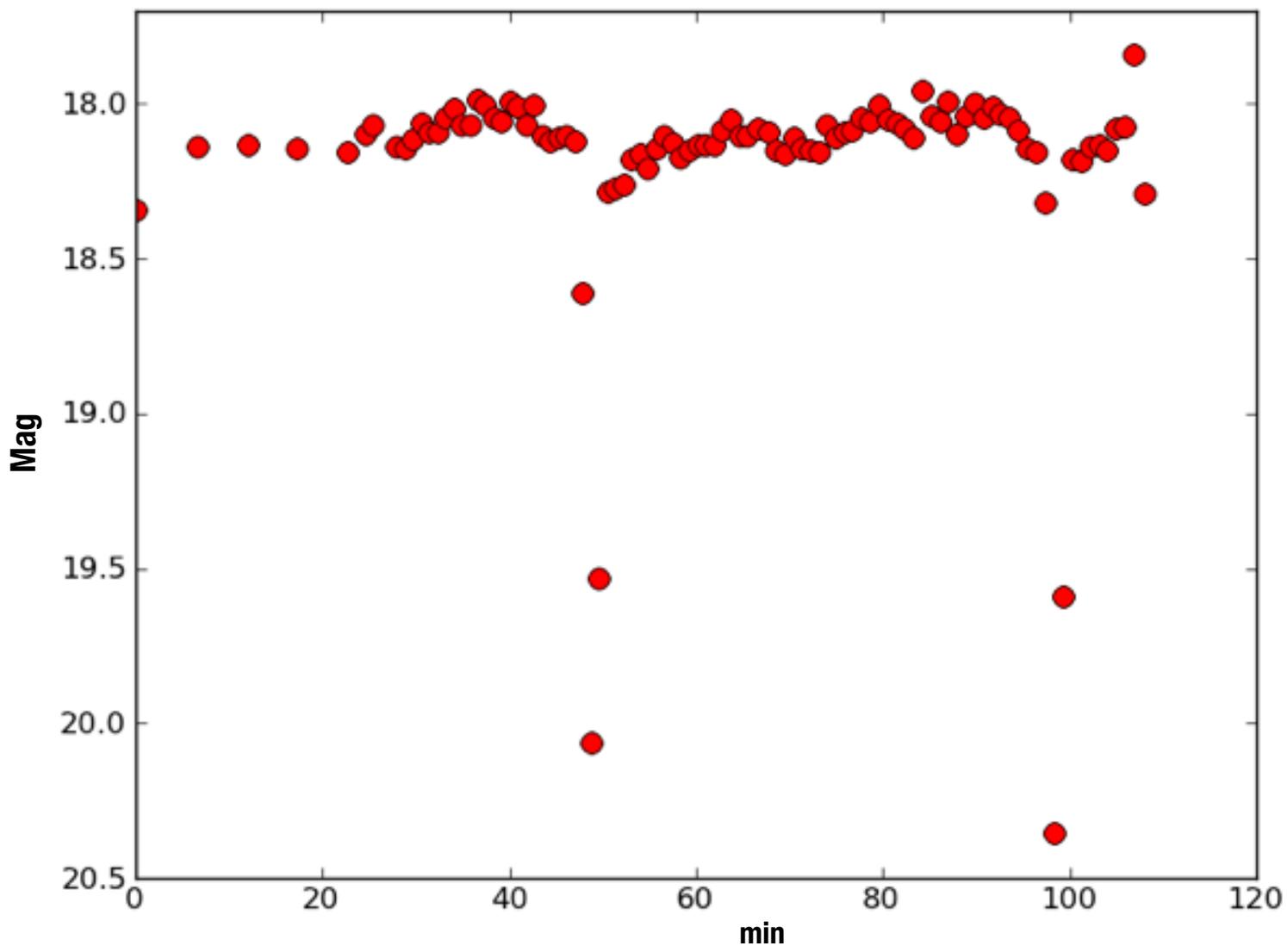
Gaia14aae: an eclipsing AM CVn

- Loiano Observatory (152cm Cassini Telescope)
- Additional CBA, WHT, Asiago data



88m->21s (factor ~250)

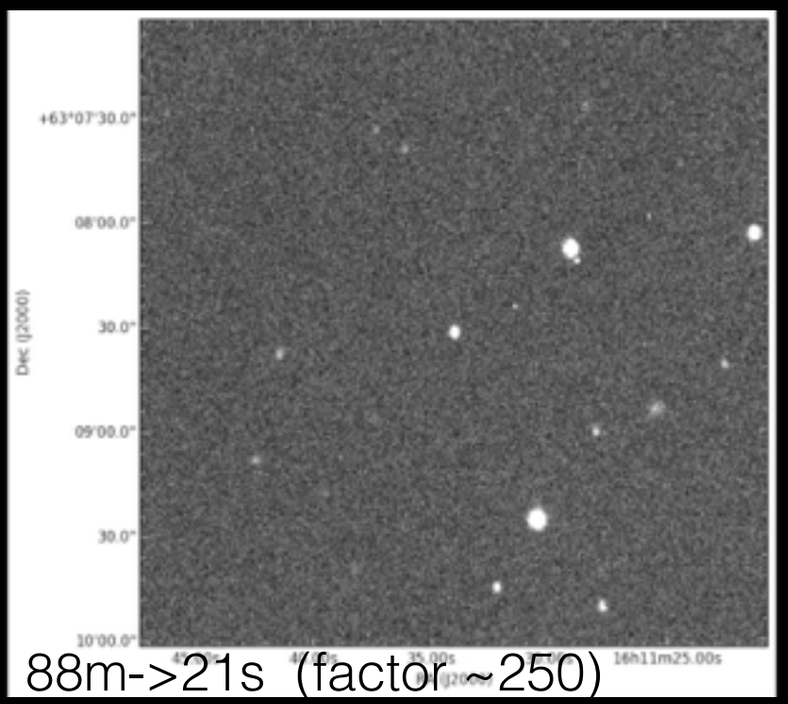
ASASSN-14cn, Gaia14aae



PIs : Gisella Clementini, Lukasz Wyrzykowski
Observers : Heather Campbell, Krzysztof Rybicki, Piotr Wielgórski, Giuseppe Altavilla + Support Astronomer
Reduction and observing strategy : Simon Hodgkin

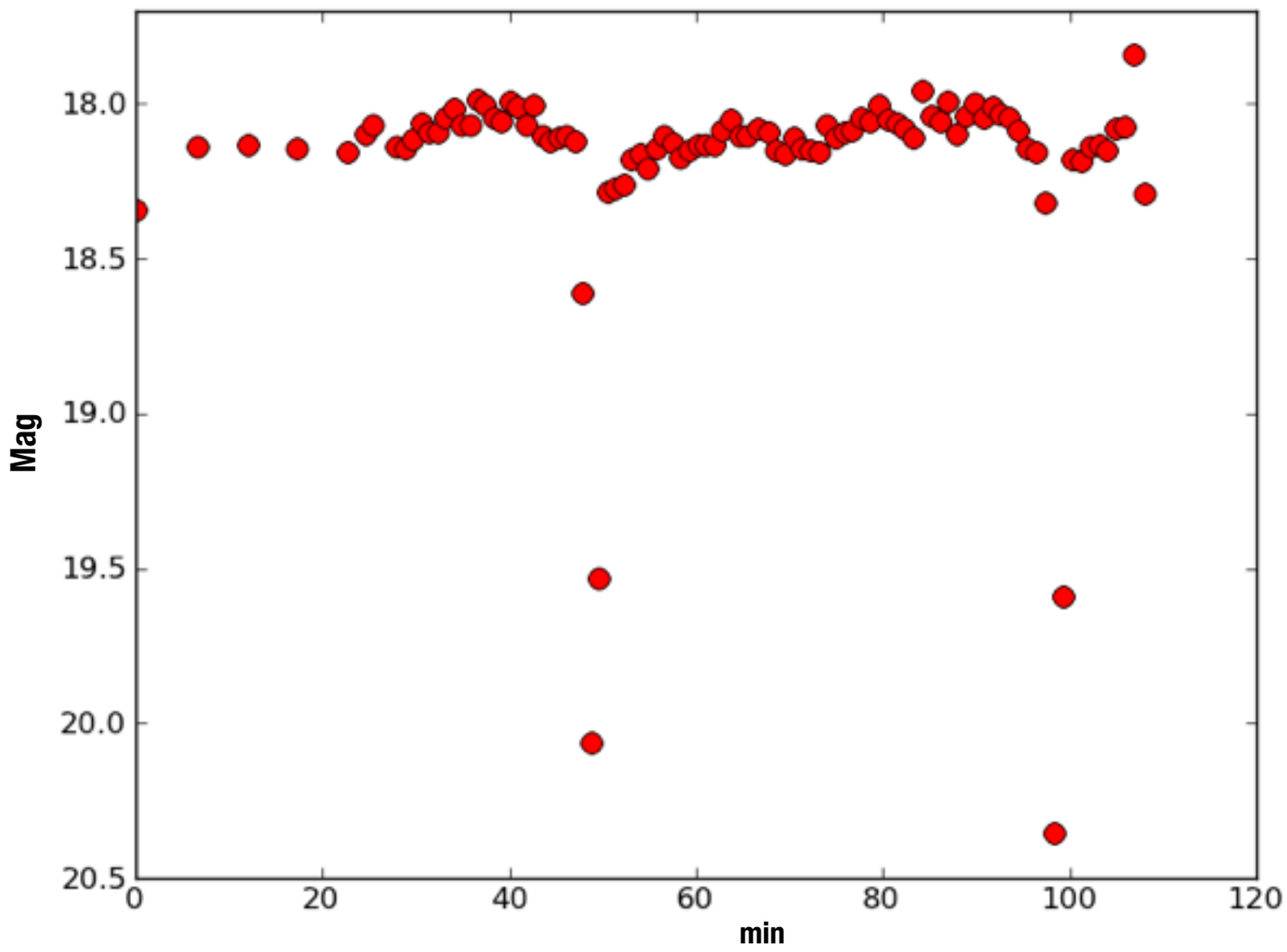
Gaia14aae: an eclipsing AM CVn

- Loiano Observatory (152cm Cassini Telescope)
- Additional CBA, WHT, Asiago data



88m->21s (factor ~250)

ASASSN-14cn, Gaia14aae



PIs : Gisella Clementini, Lukasz Wyrzykowski
Observers : Heather Campbell, Krzysztof Rybicki, Piotr Wielgórski, Giuseppe Altavilla + Support Astronomer
Reduction and observing strategy : Simon Hodgkin

Discovery of the 3rd known eclipsing AM CVn (candidate Ia progenitor)

- WHT LC cadence ~10s
- Period 49.71 min
- Eclipses 111 sec

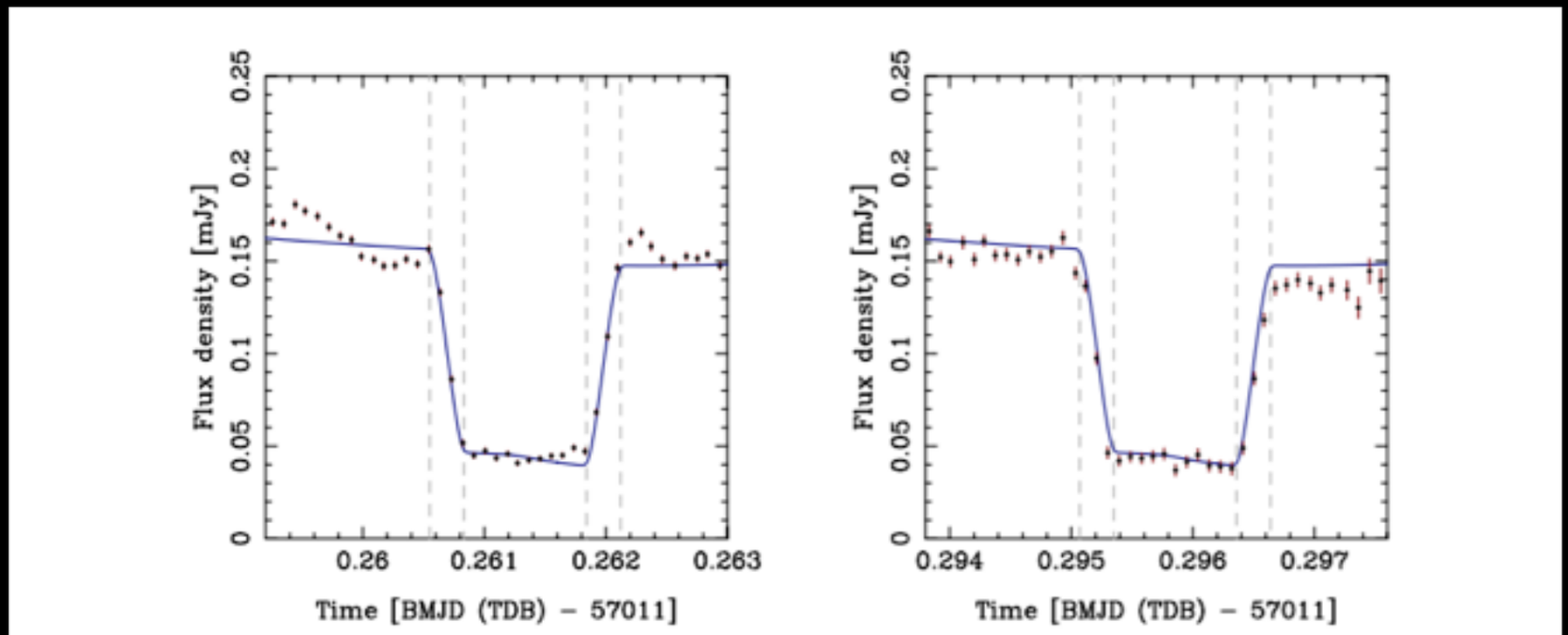
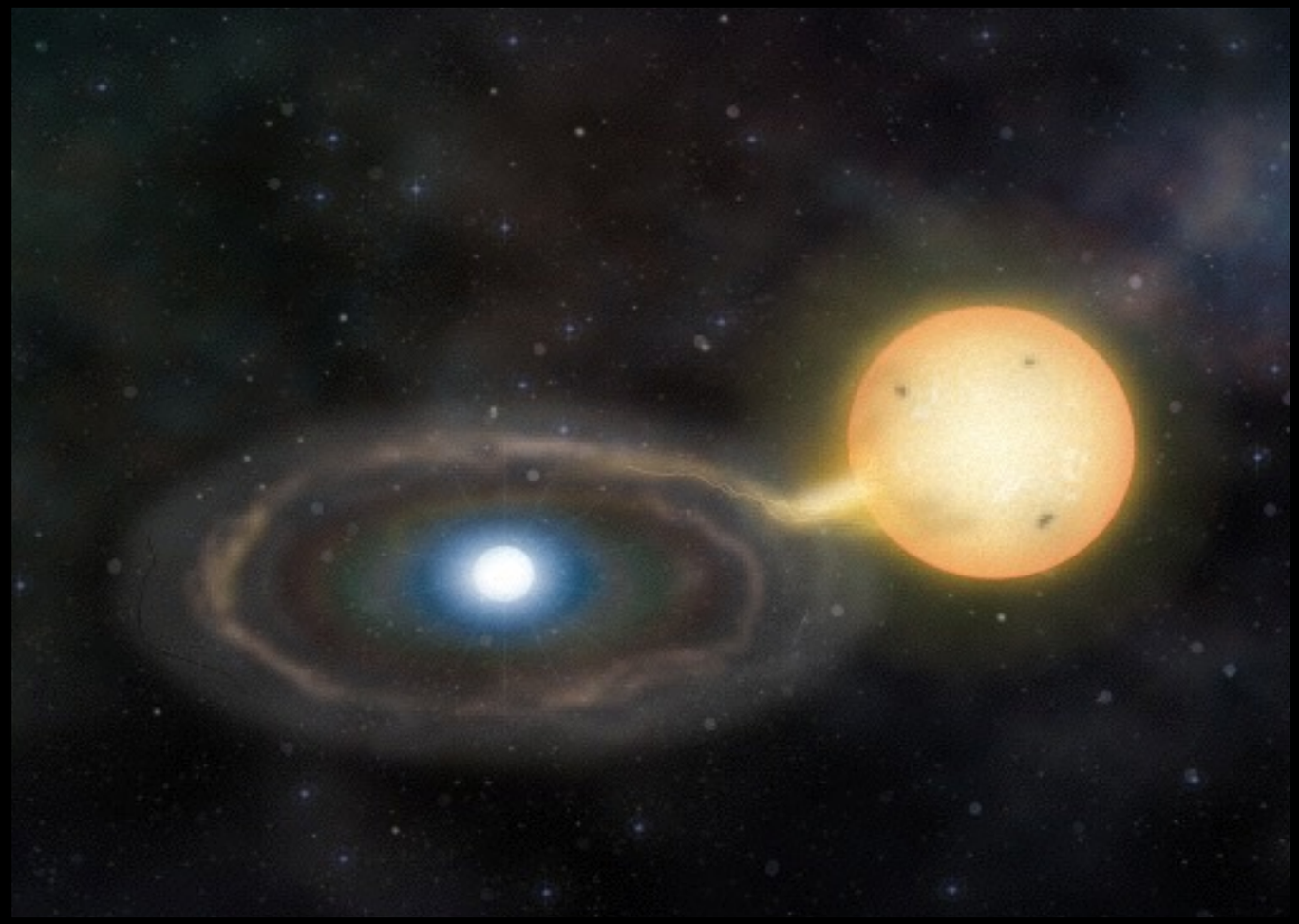


Figure 3. Top: Observed *r*-band WHT+ACAM light curve for Gaia14aae (points) with the best fitting model (lines) comprising of a WD (which is the main contributor to the light), accretion disc and bright-spot where the gas stream hits the disc. Bottom: Zoom in around the eclipses of the light curve shown above.

- Lower limits on the masses of 0.78 and 0.015 M⊙ (q=0.019), sep=0.41 R⊙
- The White Dwarf is fully eclipsed (first example in an AM CVn)
- It showed 3 outbursts in 4 months
- Relatively long period for an outbursting system

Gaia14aae, ASASSN-14cn



Monthly Notices
of the
ROYAL ASTRONOMICAL SOCIETY

MNRAS 452, 1060–1067 (2015) doi:10.1093/mnras/stv1224

Total eclipse of the heart: the AM CVn Gaia14aae/ASSASN-14cn

H. C. Campbell,[1★] T. R. Marsh,[2★] M. Fraser,[1★] S. T. Hodgkin,[1] E. de Miguel,[3,4] B. T. Gänsicke,[2] D. Steeghs,[2] A. Hourihane,[1] E. Breedt,[2] S. P. Littlefair,[5] S. E. Koposov,[1] Ł. Wyrzykowski,[1,6] G. Altavilla,[7] N. Blagorodnova,[1] G. Clementini,[7] G. Damljanovic,[8] A. Delgado,[1] M. Dennefeld,[9] A. J. Drake,[10] J. Fernández-Hernández,[1] G. Gilmore,[1] R. Gualandi,[7] A. Hamanowicz,[6] B. Handzlik,[6] L. K. Hardy,[5] D. L. Harrison,[1,11] K. Ilkiewicz,[6] P. G. Jonker,[12,13] C. S. Kochanek,[14,15] Z. Kołaczkowski,[16] Z. Kostrzewa-Rutkowska,[6] R. Kotak,[17] G. van Leeuwen,[1] G. Leto,[18] P. Ochner,[19] M. Pawlak,[6] L. Palaversa,[20] G. Rixon,[1] K. Rybicki,[6] B. J. Shappee,[21] S. J. Smartt,[17] M. A. P. Torres,[12,13] L. Tomasella,[19] M. Turatto,[19] K. Ulaczyk,[2,6] S. van Velzen,[22] O. Vince,[8] N. A. Walton,[1] P. Wielgórski,[6] T. Wevers,[13] P. Whitelock,[23,24] A. Yoldas,[1] F. De Angeli,[1] P. Burgess,[1] G. Busso,[1] R. Busuttil,[25] T. Butterley,[26] K. C. Chambers,[27] C. Copperwheat,[28] A. B. Danilet,[29] V. S. Dhillon,[5] D. W. Evans,[1] L. Eyer,[20] D. Froebrich,[30] A. Gomboc,[31] G. Holland,[1] T. W.-S. Holoien,[15] J. F. Jarvis,[25] N. Kaiser,[27] D. A. Kann,[32] D. Koester,[33] U. Kolb,[25] S. Komossa,[34] E. A. Magnier,[27] A. Mahabal,[10] J. Polshaw,[17] J. L. Prieto,[35,36] T. Prusti,[37] M. Riello,[1] A. Scholz,[38] G. Simonian,[15] K. Z. Stanek,[15] L. Szabados,[39] C. Waters[27] and R. W. Wilson[26]

Affiliations are listed at the end of the paper

Accepted 2015 M

Campbell et al. 2015

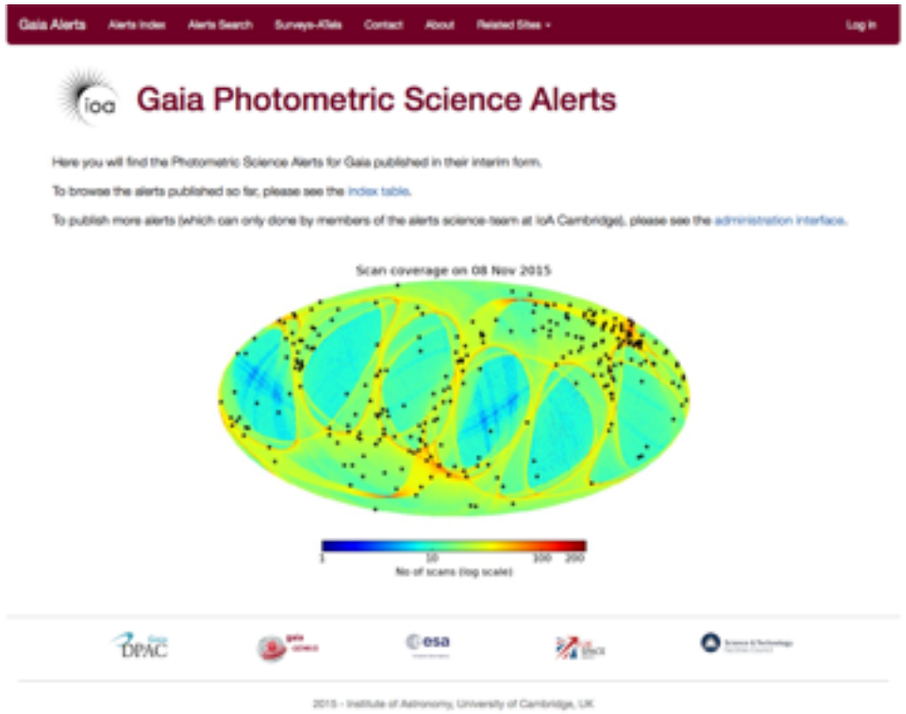
ABSTRACT

We report the discovery and characterization of a deeply eclipsing AM CVn-system, Gaia14aae (=ASSASN-14cn). Gaia14aae was identified independently by the All-Sky Automated Survey for Supernovae (ASAS-SN; Shappee et al.) and by the *Gaia* Science Alerts project, during two separate outbursts. A third outburst is seen in archival Pan-STARRS-1 (PS1; Schlafly et al.; Torry et al.; Magnier et al.) and ASAS-SN data. Spectroscopy reveals a hot, hydrogen-deficient spectrum with clear double-peaked emission lines, consistent with an accreting double-degenerate classification. We use follow-up photometry to constrain the orbital parameters of the system. We find an orbital period of 49.71 min, which places Gaia14aae at the long period extremum of the outbursting AM CVn period distribution. Gaia14aae is dominated by the light from its accreting white dwarf (WD). Assuming an orbital inclination of 90° for the binary system, the contact phases of the WD lead to lower limits of 0.78 and 0.015 $M_\odot$ on the masses of the accretor and donor, respectively, and a lower limit on the mass ratio of 0.019. Gaia14aae is only the third eclipsing AM CVn star known, and the first in which the WD is totally eclipsed. Using a helium WD model, we estimate the accretor's effective temperature to be 12 900 ± 200 K. The three outburst events occurred within four months of each other, while no other outburst activity is seen in the previous 8 yr of Catalina Real-time Transient Survey (CRTS; Drake et al.), Pan-STARRS-1 and ASAS-SN data. This suggests that these events might be rebrightenings of the first outburst rather than individual events.

Key words: binaries: eclipsing – novae, cataclysmic variables.

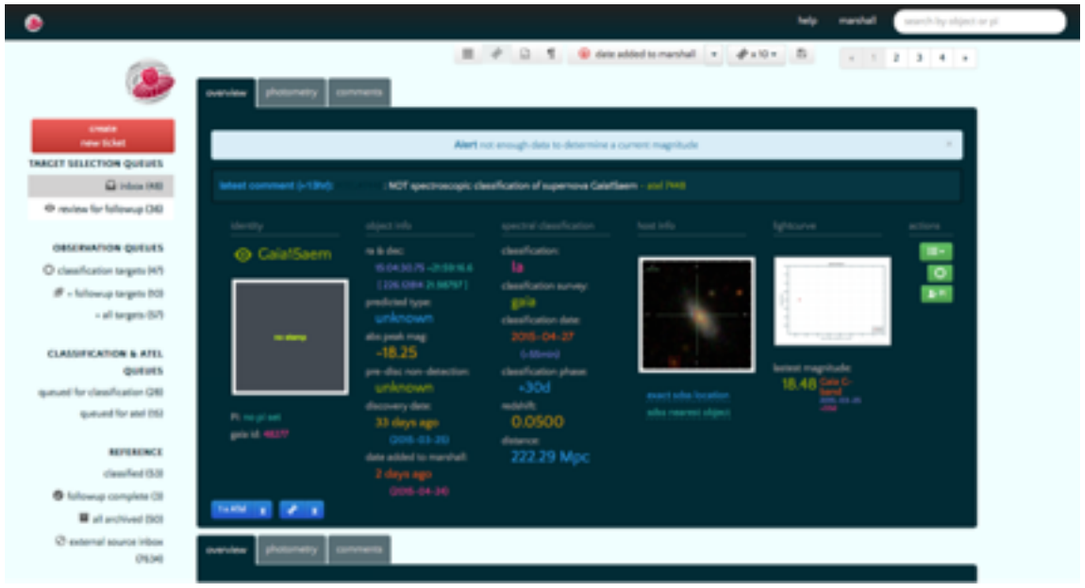
* E-mail: hcc@ast.cam.ac.uk (HCC); t.r.marsh@warwick.ac.uk (TRM); mf@ast.cam.ac.uk (MF)

The New Gaia Alerts Interfaces



Alerts Publisher

http://gsaweb.ast.cam.ac.uk/alerts/



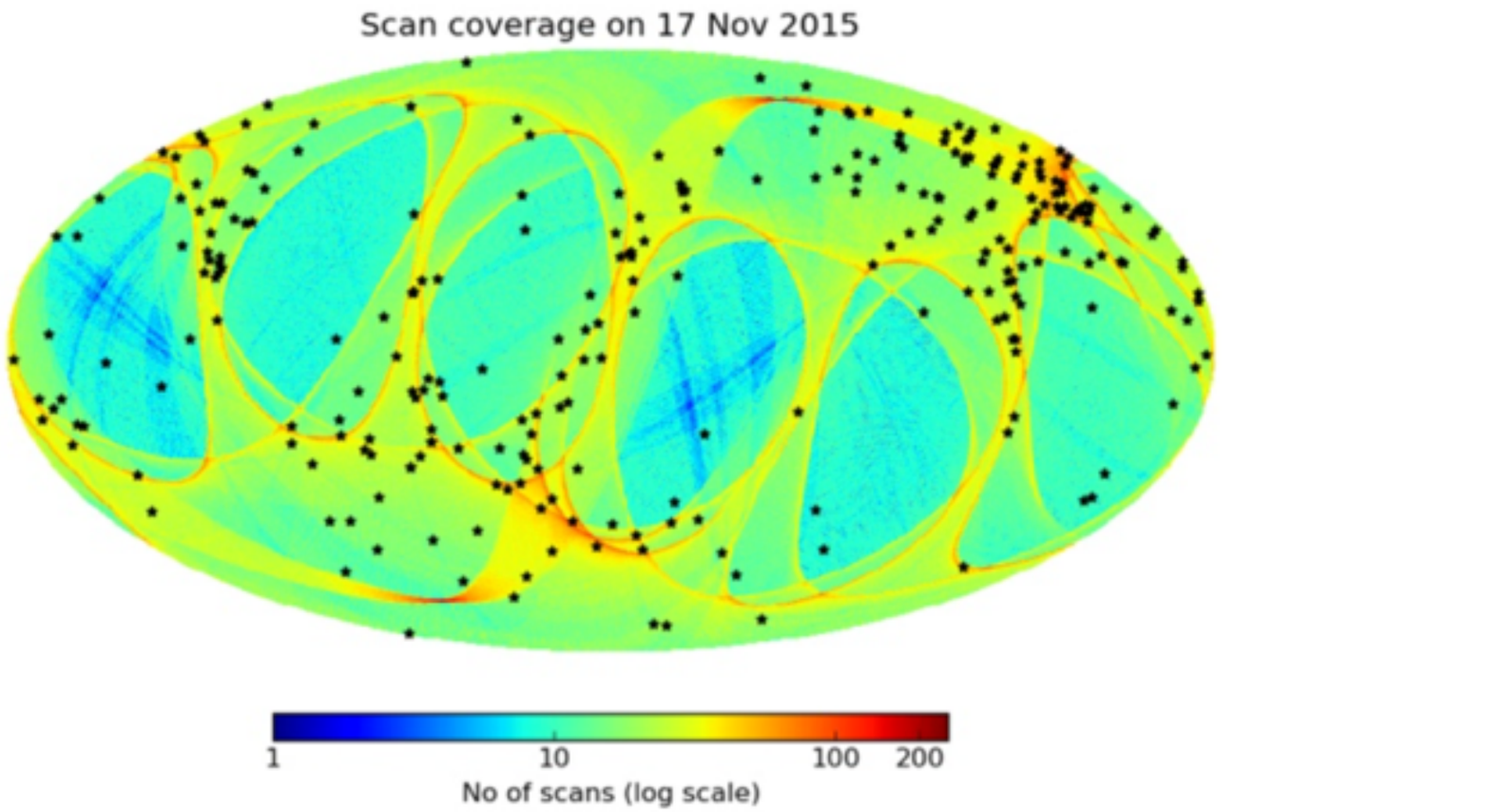
Gaia Marshall

gaiamarshall@ast.cam.ac.uk

Gaia Photometric Science Alerts

To browse the alerts published so far, please see the Alert Index tab. The table provides links to the per-source alert pages, including lightcurves and BP/RP spectra.

Status: Alerts are not currently being published while we are in development and testing. We plan to start publishing new Alerts in January 2016.



Index to Gaia Photometric Alerts

If you publish any results based on these Gaia discoveries, we would appreciate an acknowledgement along the lines of: *We acknowledge ESA Gaia, DPAC and the Photometric Science Alerts Team (http://gsaweb.ast.cam.ac.uk/alerts).*

These are all the alerts raised to date. You might wish to view or download these as a table in CSV format.

See here for an explanation of the columns.

Show 25 entries

Search:

Name	Observed	RA (deg.)	Dec. (deg.)	Mag.	Historic mag.	Historic scatter	Class	Published	Comment
Gaia16aij	2016-03-13 12:42:19	275.68115	-61.62311	18.07			unknown	2016-03-18 18:37:22	Source which disappeared for the last year or more has suddenly reappeared
Gaia16aii	2016-03-16 06:00:16	308.89025	-26.15666	17.08			unknown	2016-03-18 10:11:58	CV candidate, hostless transient
Gaia16aih	2016-03-17 06:28:40	310.98422	-52.24089	17.72			unknown	2016-03-18 10:09:07	SN candidate near DSS galaxy. GSTEC predicts SNIIP, z=0.05, +112dy
Gaia16aig	2016-03-13 22:38:32	291.45361	-48.20771	18.28			unknown	2016-03-18 10:01:04	SN candidate et edge of galaxy 2MASX J19254847-4812244. GSTEC predicts SN Ia, z=0.06, -8dy
Gaia16aif	2016-03-13 13:42:37	110.09090	46.46877	18.19			unknown	2016-03-18 09:56:55	SN candidate at edge of galaxy. GSTEC predicts SNIa, z=0.04, +7dy (aka AT 2016aym)
Gaia16aie	2016-03-12 09:33:00	309.54142	10.77937	18.51			unknown	2016-03-16 21:44:13	Candidate SN
Gaia16aid	2016-03-14 13:24:04	122.73939	27.25347	14.07			SSO	2016-03-16 16:06:47	Candidate CV. Followup suggests it is actually a known asteroid, Botolphia (with incorrect position)
Gaia16aic	2016-03-11 01:56:23	78.50278	55.36606	18.55			unknown	2016-03-16 16:04:19	Candidate SN aka AT2016ayl
Gaia16aib	2016-03-09 01:00:36	114.64210	4.12073	16.97			unknown	2016-03-15 12:17:09	1mag brightening on stellar-like object
Gaia16aia	2016-03-14 02:33:17	350.85745	69.98131	16.86			unknown	2016-03-15 12:15:26	>3mag brightening on faint star near Galactic Plane
Gaia16ahz	2016-03-10 18:42:23	128.16340	-12.19893	18.47			unknown	2016-03-15 12:13:31	Candidate SN GSTEC predicts SN Ia
Gaia16ahy	2016-03-13 23:27:29	199.27990	-74.91311	17.42			unknown	2016-03-15 12:11:42	Candidate SN
Gaia16ahx	2016-03-12 16:01:02	300.48151	-14.60408	16.02			unknown	2016-03-14 11:23:27	Candidate CV: blue transient on faint smudge in DSS2, aka ASASSN-15nb

Index to Gaia Photometric Alerts

If you publish any results based on these Gaia discoveries, we would appreciate an acknowledgement along the lines of: *We acknowledge ESA Gaia, DPAC and the Photometric Science Alerts Team (http://gsaweb.ast.cam.ac.uk/alerts).*

These are all the alerts raised to date. You might wish to view or download these as a table in CSV format.

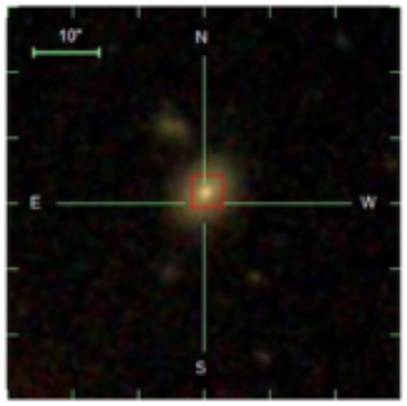
See here for an explanation of the columns.

Show 25 entries

Search:

Name	Observed	RA (deg.)	Dec. (deg.)	Mag.	Historic mag.	Historic scatter	Class	Published	Comment
Gaia15aan	2014-12-19 09:14:21	241.44997	24.09196	13.03	19.41	0.12	CV	2015-01-24 15:01:35	Very blue object - huge outburst. Reported as ASASSN-14mo. Possible AM CVn, TCP J16054809+2405338
Gaia16aid	2016-03-14 13:24:04	122.73939	27.25347	14.07			SSO	2016-03-16 16:06:47	Candidate CV. Followup suggests it is actually a known asteroid, Botolphia (with incorrect position)
Gaia16aft	2016-02-22 16:44:28	312.85930	44.08995	14.08			YSO	2016-02-24 18:12:38	Outburst >6mag of V2492Cyg - known eruptive star
Gaia16agv	2016-02-29 13:04:14	83.69805	-5.96583	14.32			YSO	2016-03-02 14:31:05	> 1 mag decline in YSO YY Ori (Herbig Ae/Be star)
Gaia16aau	2016-01-25 18:25:07	12.54460	-69.73271	15.13			RCrB	2016-01-30 13:46:16	5mag change in 400days in Carbon Star [MH95]580, but spectrum rather blue. Candidate RCrB ?
Gaia16adj	2016-02-11 12:48:51	13.58985	-47.86297	15.17			unknown	2016-02-12 10:49:30	candidate dwarf nova with repeat outbursts (aka ASASSN 14eg)
Gaia14acx	2014-10-27 09:33:08	240.01542	33.18725	15.24	20.20	0.02	unknown		blue SDSS star r=19.9
Gaia15abf	2014-11-21 02:29:09	348.96815	27.17704	15.28	19.72	0.07	unknown	2015-02-09 21:37:06	aka CSS100610:231552+271037 (outburst in November, back to 20th mag in Feb)
Gaia16afz	2016-02-24 17:18:34	191.13587	-23.95583	15.30			CV	2016-02-26 10:24:29	5 mag rise in CV LSQ 14vr
Gaia15aeu	2015-04-30 23:01:22	165.15771	-11.94656	15.48			unknown	2015-05-14 22:34:22	aka ASASSN-15hm (magnitude 13.45)
Gaia15aag	2015-01-02 09:02:08	263.17942	28.89005	15.55	16.09	0.07	star	2015-01-09 11:48:37	Probably a variable star; got brighter and bluer
Gaia16ads	2016-02-13 12:09:48	116.59379	-77.78796	15.64			unknown	2016-02-14 11:06:24	candidate cv, also discovered as ASASSN-16bi and designated 000-BLW-019 in VSX
Gaia14ack	2014-10-21 18:49:53	197.55814	36.56027	15.65	16.28	0.11	unknown		

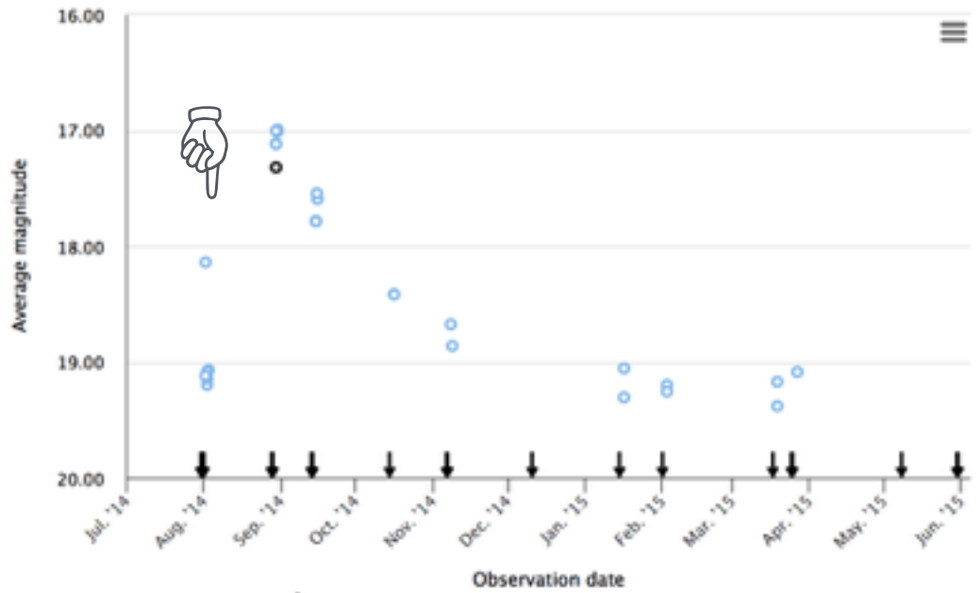
Gaia14aaa



RA - DEC
200.25961 45.53943
13:21:02.3 45:32:21.9

Alerting date
2014-08-30 02:22:31
Julian date
2456899.60
Alerting magnitude
17.32
Historic magnitude
19.22
Historic StdDev
0.42
Class
SN Ia
Publication date
not available

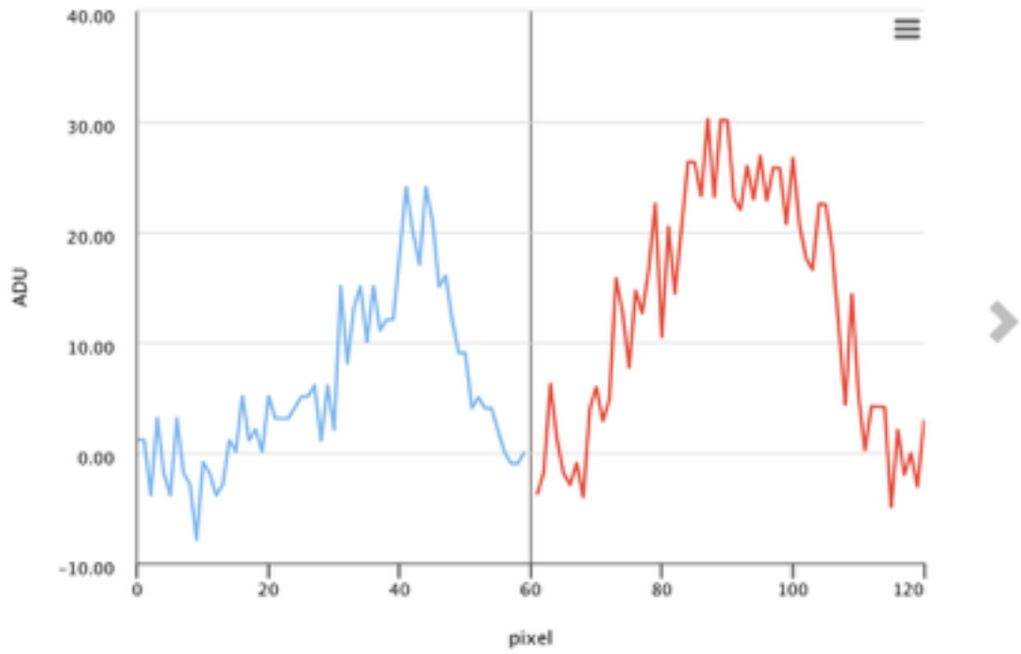
Other surveys detections
None
Comments
None
ATels
None



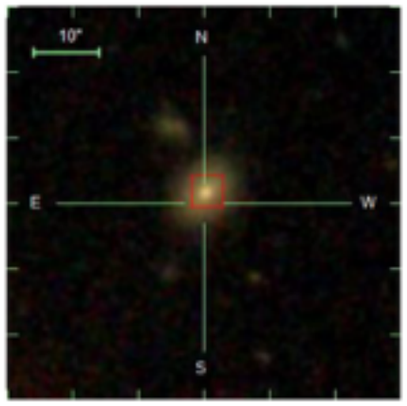
Get lightcurve data

Click and scroll down and select one row in the table below to display the corresponding spectrum.

2014-08-02 07:51:49	2456871.83	19.06
2014-08-30 00:35:54	2456899.52	17.28
2014-08-30 02:22:28	2456899.60	17.32
2014-08-30 06:36:08	2456899.78	17.26
2014-08-30 08:22:43	2456899.85	17.32
2014-09-15 00:47:42	2456915.53	17.99
2014-09-15 02:34:16	2456915.61	18.06
2014-09-15 06:47:56	2456915.78	17.96
2014-09-15 08:34:30	2456915.86	18.11
2014-11-08 16:05:41	2456970.17	18.85



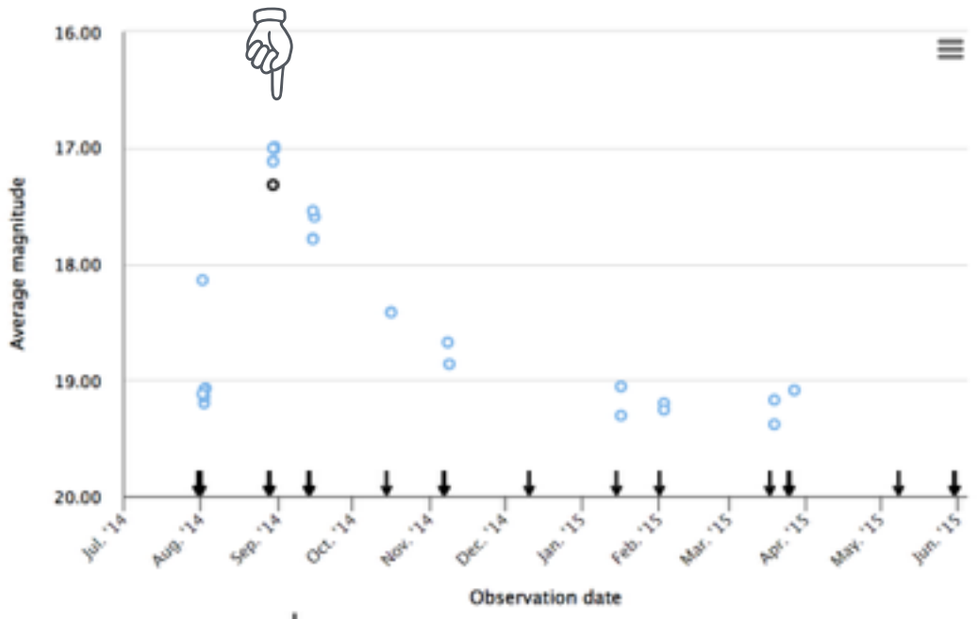
Gaia14aaa



Other surveys detections
None
Comments
None
ATels
None

RA - DEC
200.25961 45.53943
13:21:02.3 45:32:21.9

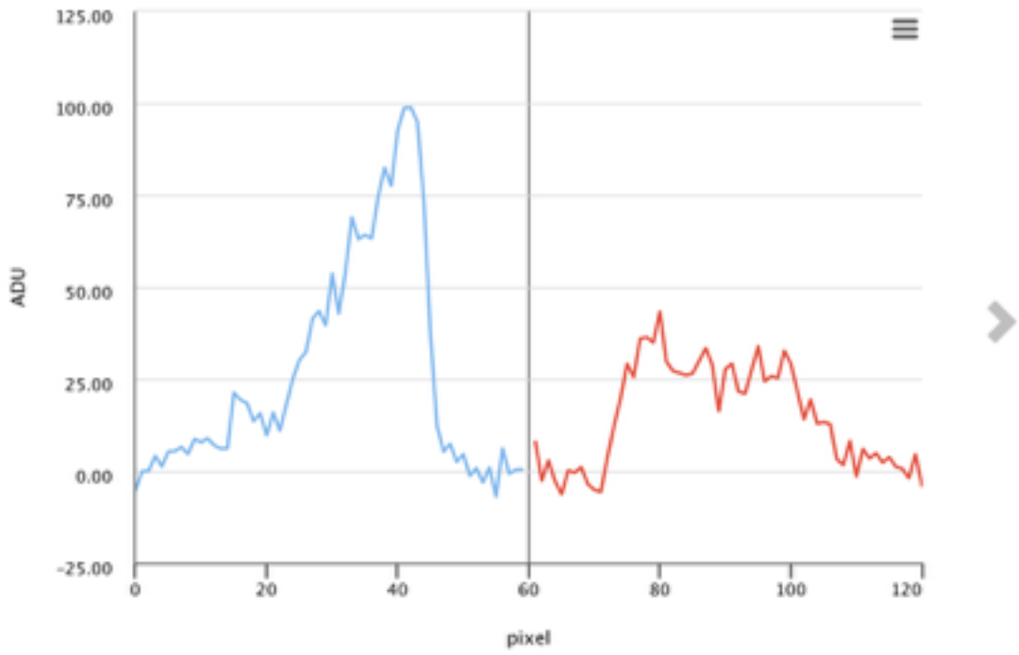
Alerting date
2014-08-30 02:22:31
Julian date
2456899.60
Alerting magnitude
17.32
Historic magnitude
19.22
Historic StdDev
0.42
Class
SN Ia
Publication date
not available



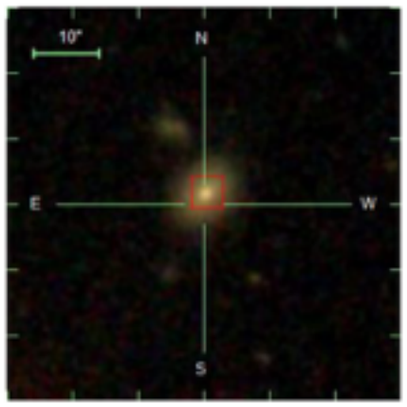
Get lightcurve data

Click and scroll down and select one row in the table below to display the corresponding spectrum.

2014-08-30 00:35:54	2456899.52	17.28
2014-08-30 02:22:28	2456899.60	17.32
2014-08-30 06:36:08	2456899.78	17.26
2014-08-30 08:22:43	2456899.85	17.32
2014-09-15 00:47:42	2456915.53	17.99
2014-09-15 02:34:16	2456915.61	18.06
2014-09-15 06:47:56	2456915.78	17.96
2014-09-15 08:34:30	2456915.86	18.11
2014-11-08 16:05:41	2456970.17	18.85



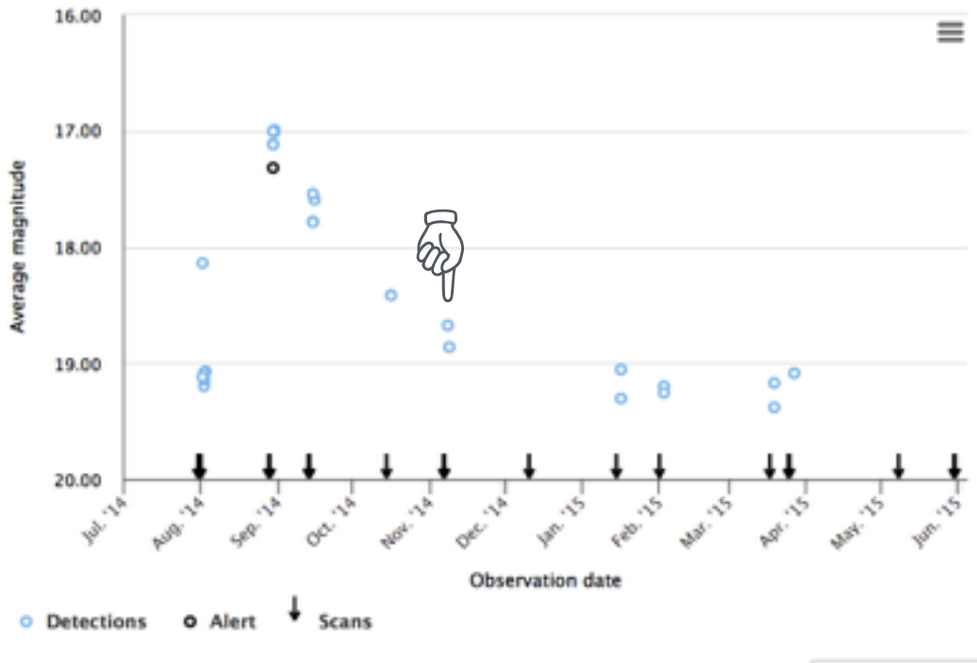
Gaia14aaa



Other surveys detections
None
Comments
None
ATels
None

RA - DEC
200.25961 45.53943
13:21:02.3 45:32:21.9

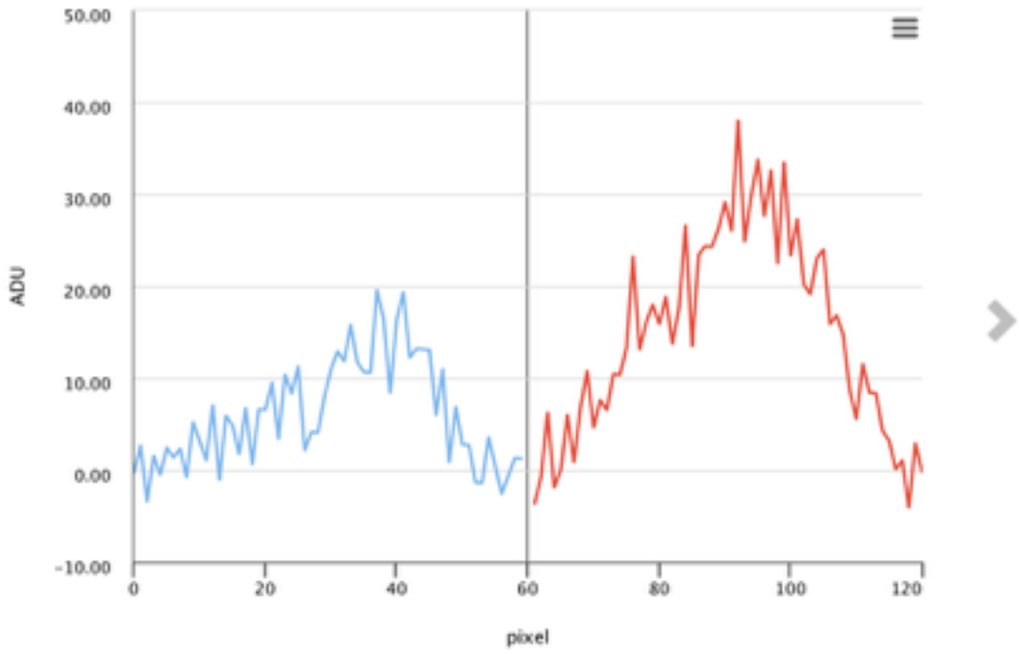
Alerting date
2014-08-30 02:22:31
Julian date
2456899.60
Alerting magnitude
17.32
Historic magnitude
19.22
Historic StdDev
0.42
Class
SN Ia
Publication date
not available



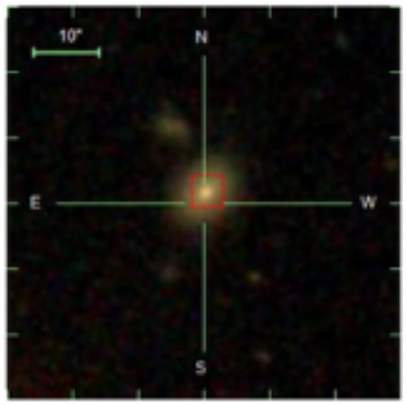
Get lightcurve data

Click and scroll down and select one row in the table below to display the corresponding spectrum.

2014-08-30 00:35:54	2456899.52	17.28
2014-08-30 02:22:28	2456899.60	17.32
2014-08-30 06:36:08	2456899.78	17.26
2014-08-30 08:22:43	2456899.85	17.32
2014-09-15 00:47:42	2456915.53	17.99
2014-09-15 02:34:16	2456915.61	18.06
2014-09-15 06:47:56	2456915.78	17.96
2014-09-15 08:34:30	2456915.86	18.11
2014-11-08 16:05:41	2456970.17	18.85



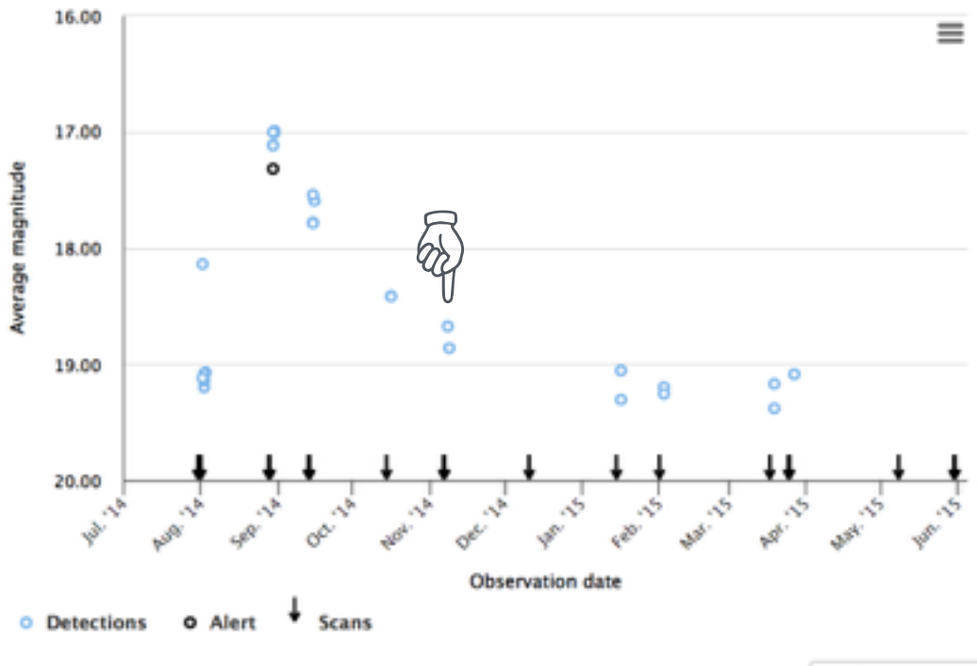
Gaia14aaa



RA - DEC
200.25961 45.53943
13:21:02.3 45:32:21.9

Alerting date
2014-08-30 02:22:31
Julian date
2456899.60
Alerting magnitude
17.32
Historic magnitude
19.22
Historic StdDev
0.42
Class
SN Ia
Publication date
not available

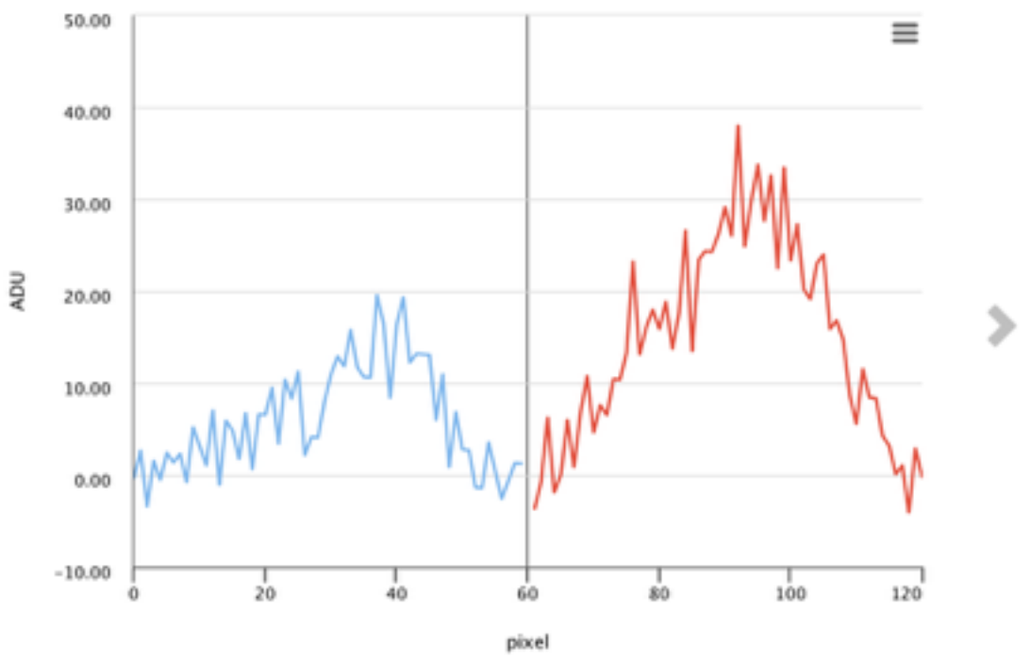
Other surveys detections
None
Comments
None
ATels
None



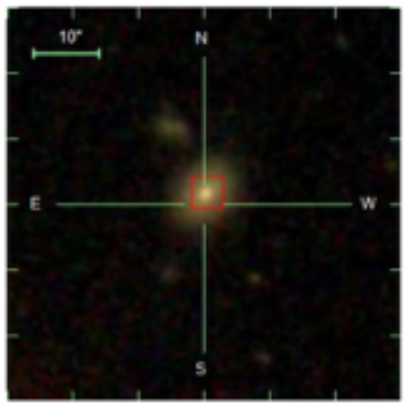
Get lightcurve data

contemporaneous spectra for transients is unique

2014-08-30 08:22:43	2456899.85	17.32
2014-09-15 00:47:42	2456915.53	17.99
2014-09-15 02:34:16	2456915.61	18.06
2014-09-15 06:47:56	2456915.78	17.96
2014-09-15 08:34:30	2456915.86	18.11
2014-11-08 16:05:41	2456970.17	18.85



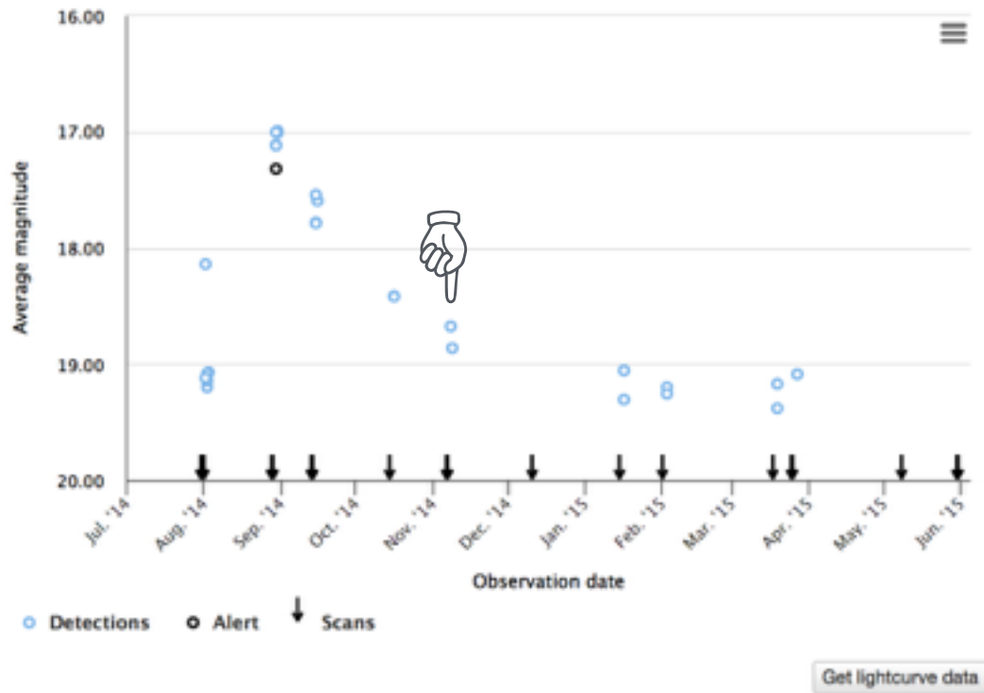
Gaia14aaa



RA - DEC
200.25961 45.53943
13:21:02.3 45:32:21.9

Alerting date
2014-08-30 02:22:31
Julian date
2456899.60
Alerting magnitude
17.32
Historic magnitude
19.22
Historic StdDev
0.42
Class
SN Ia
Publication date
not available

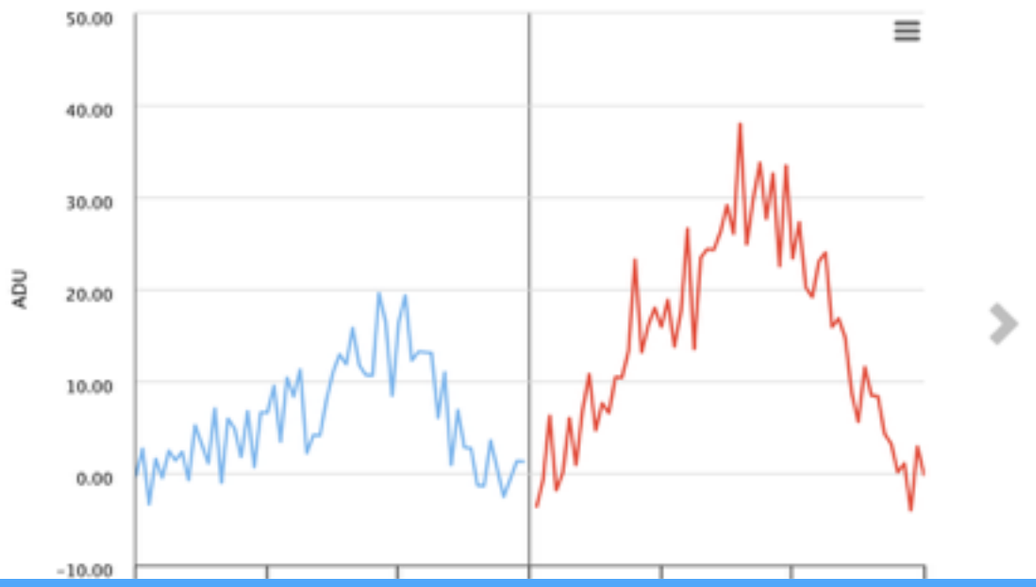
Other surveys detections
None
Comments
None
ATels
None



Get lightcurve data

contemporaneous spectra for transients is unique

2014-08-30 08:22:43	2456899.85	17.32
2014-09-15 00:47:42	2456915.53	17.99
2014-09-15 02:34:16	2456915.61	18.06
2014-09-15 06:47:56	2456915.78	17.96
2014-09-15 08:34:30	2456915.86	18.11

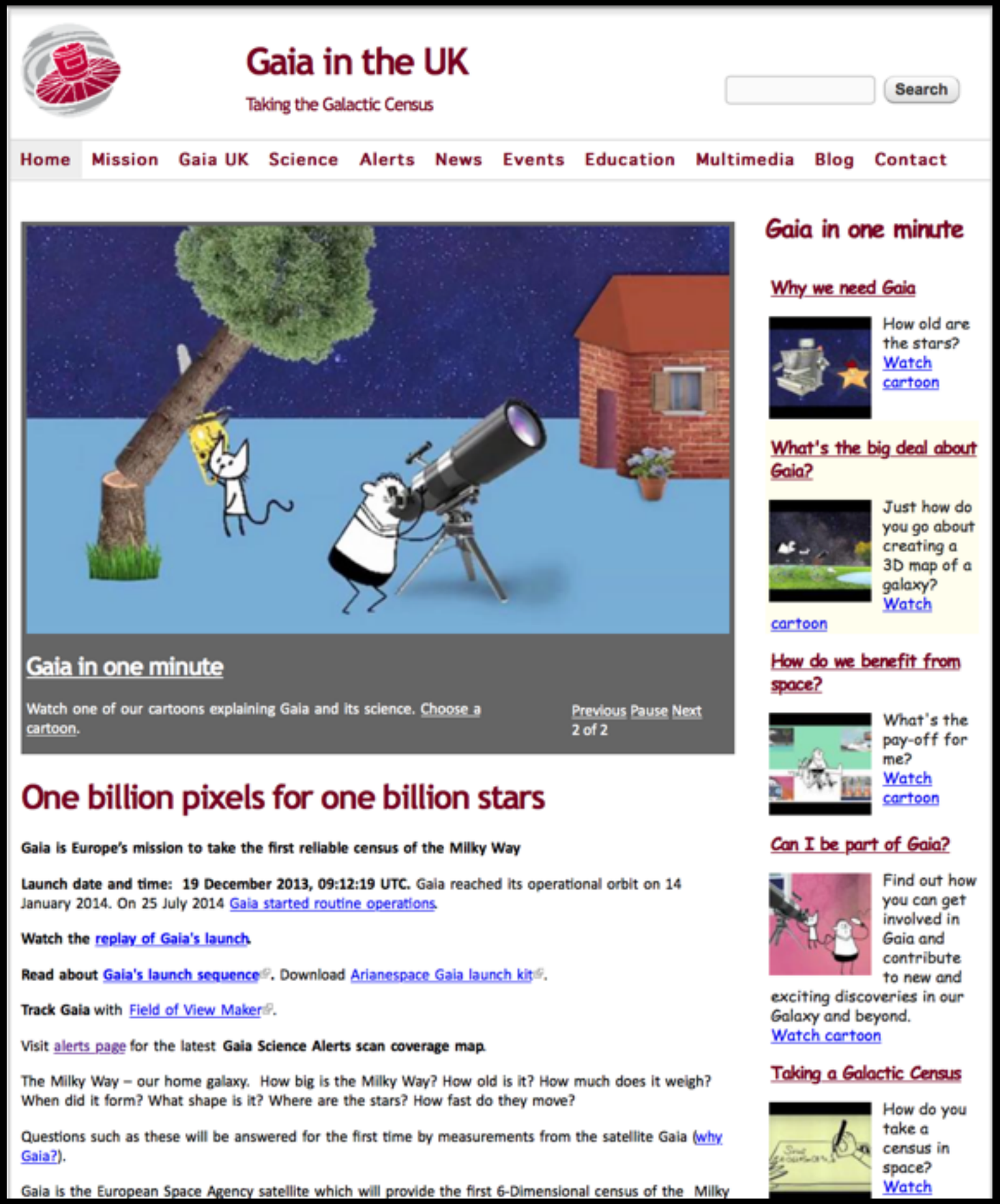


please send comments

Gaia Data Release Schedule

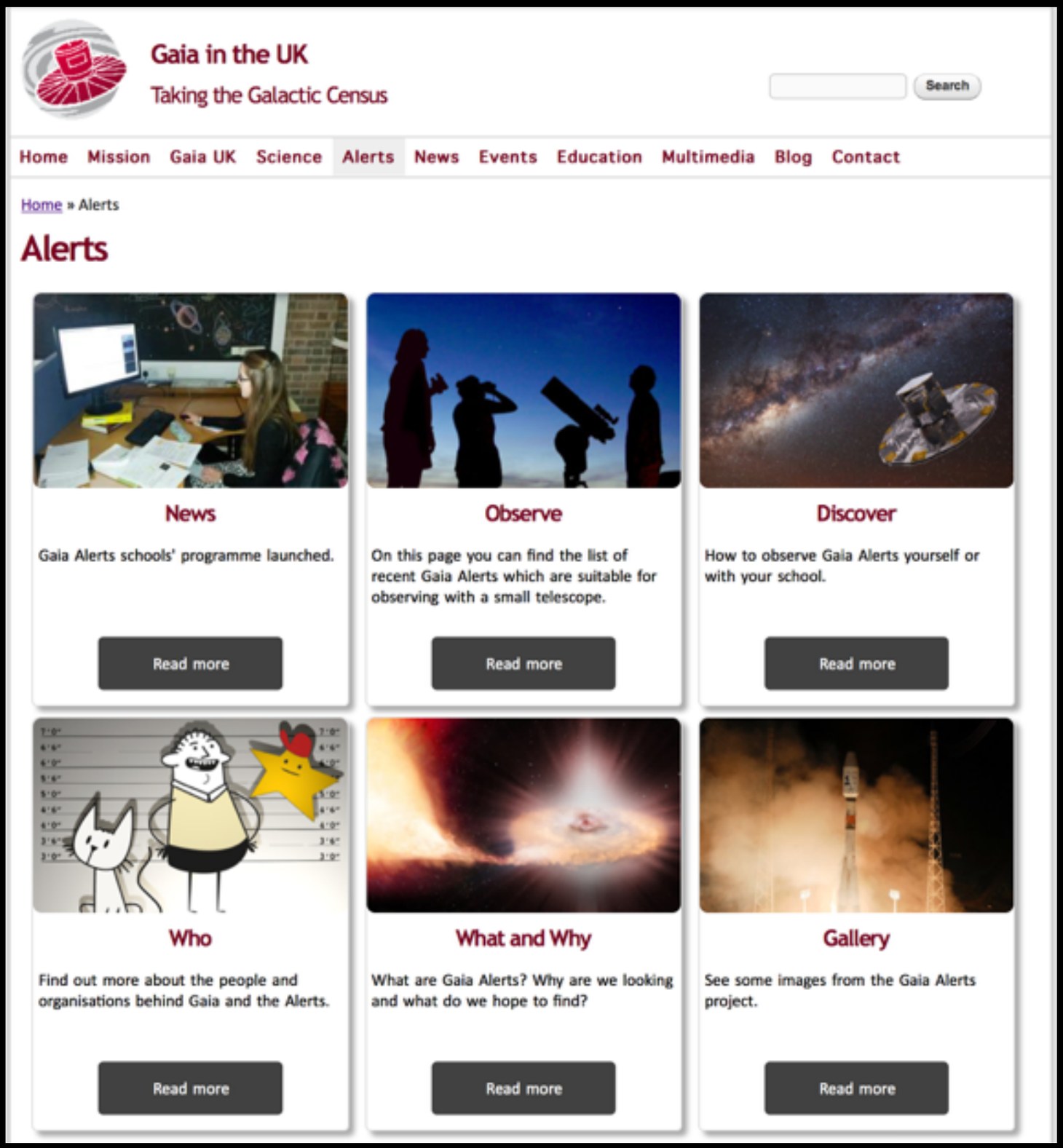
- 1st: LATE SUMMER 2016: Positions and G-magnitudes, EPSL data
- 2nd: EARLY 2017: 5-parameter astrometric solutions (Ra, Dec, Proper Motions, Parallaxes), Integrated BP/RP photometry and mean radial velocities (where no variation)
- 3rd: 2017/2018 TBC: RV orbits, classifications and parameters, BP/RP and RVS spectra
- 4th: 2018/2019 TBC: photometric variables and photometry. SSO orbits and epoch measurements.
- Final: 2022 TBC: All data and derived catalogues

Outreach and Education



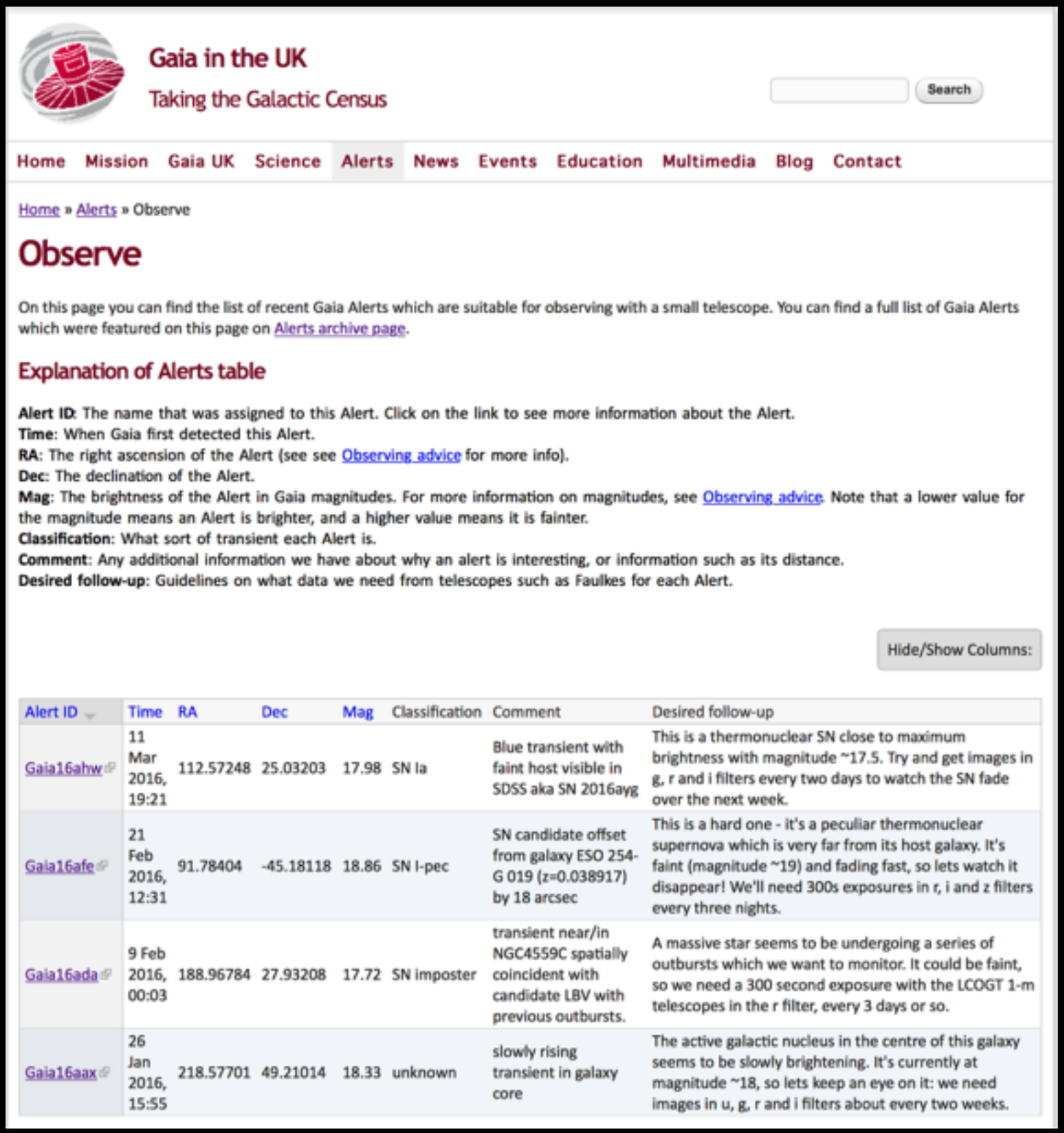
gaia.ac.uk

- This is home for the Gaia Science Alerts outreach effort
- Gives access to
  - Alerts
  - Supporting Educational Materials
  - Background and Context
  - Activities



gaia.ac.uk/alerts

- This is home for the Gaia Science Alerts outreach effort
- Gives access to
  - Alerts
  - Supporting Educational Materials
  - Background and Context
  - Activities



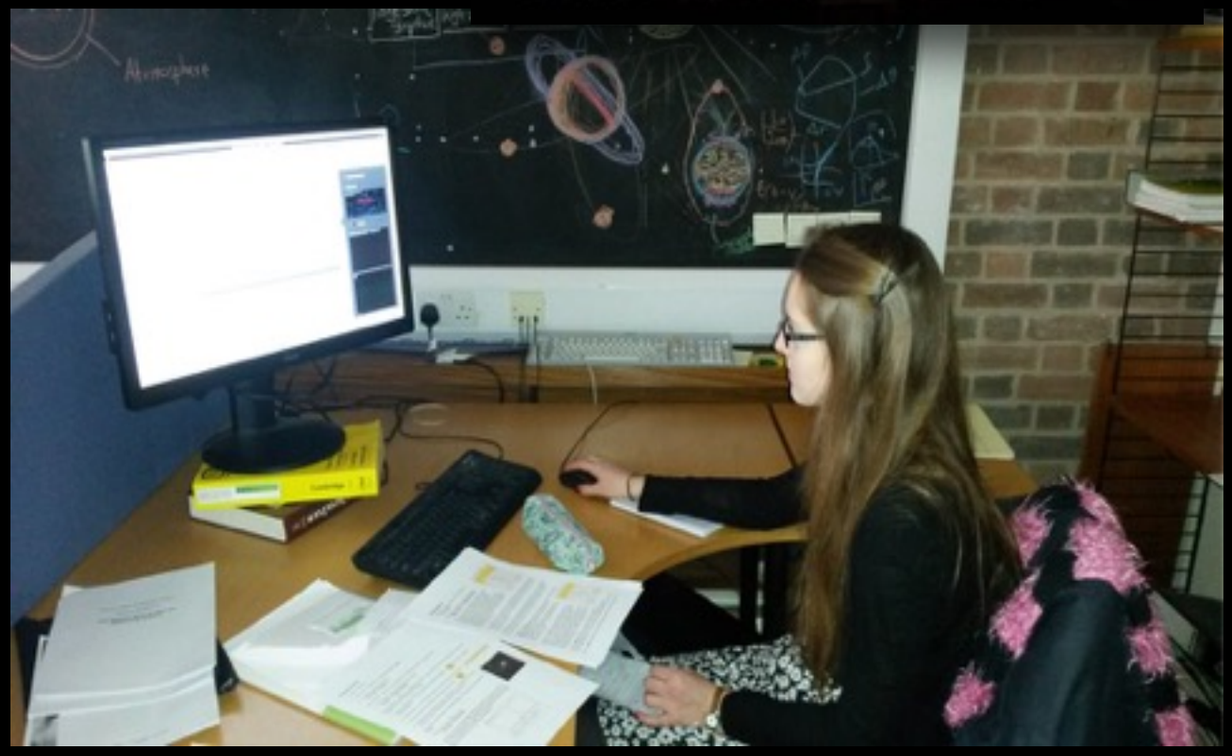
gaia.ac.uk/alerts

- This is home for the Gaia Science Alerts outreach effort
- Gives access to
  - Alerts
  - Supporting Educational Materials
  - Background and Context
  - Activities

Photometric followup: robotic telescopes

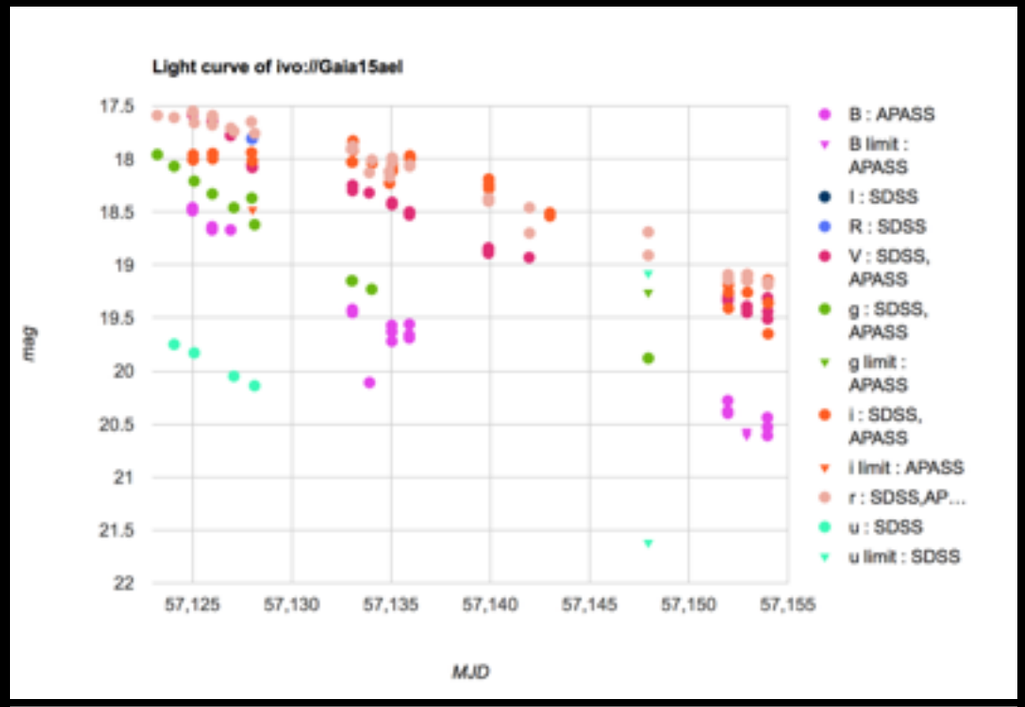
- Gaia sampling is
- sparse: need help to get more data and classify Alerts

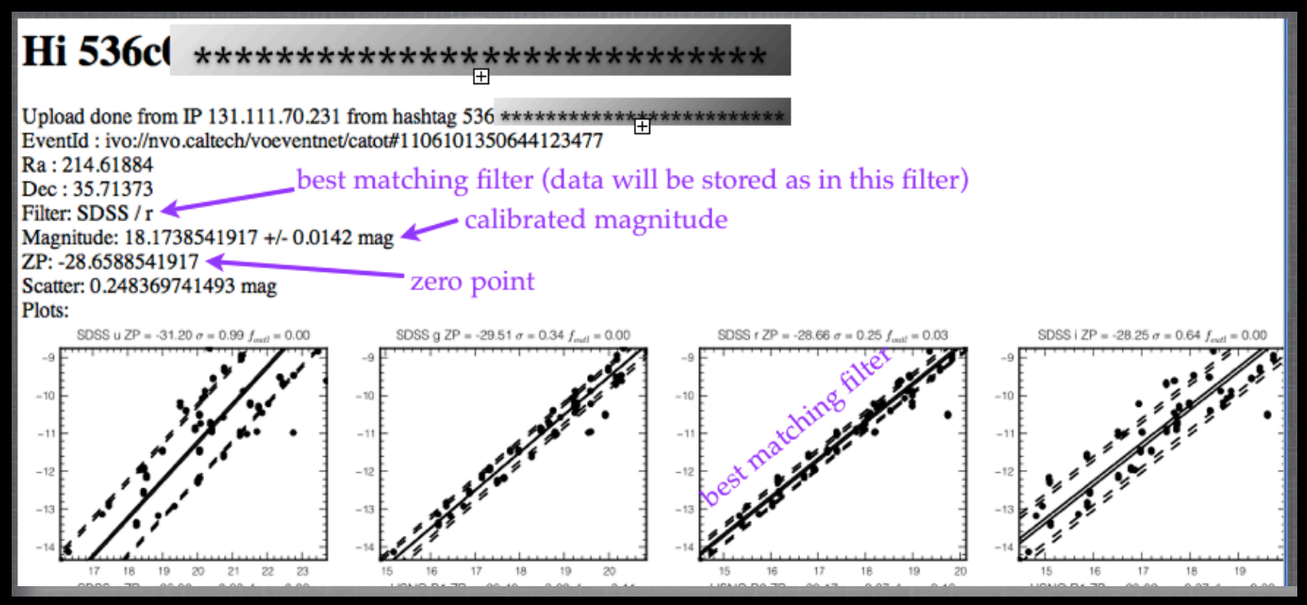
- Target: schools/amateurs
- Using:
  - Faulkes Telescope/ LCOGT
  - National Schools' Observatory/LivTel
  - Bradford telescope
  - PIRATE Telescope (universities)

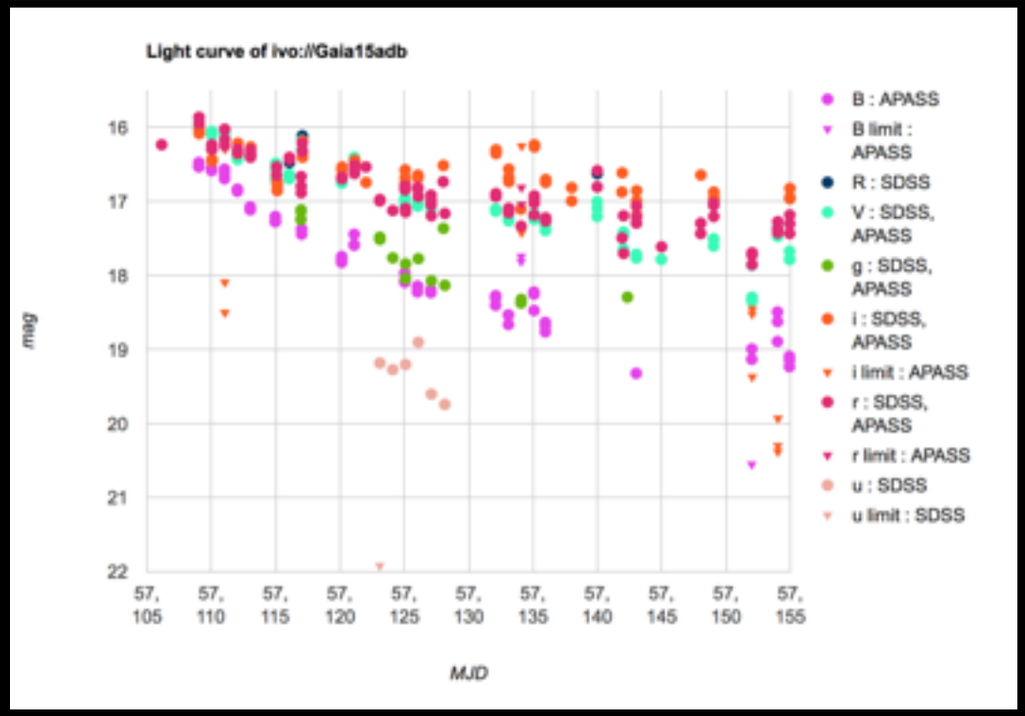


Calibration Server

- http://www.ast.cam.ac.uk/ioa/wikis/gsawgwiki/index.php/Calibration_Server



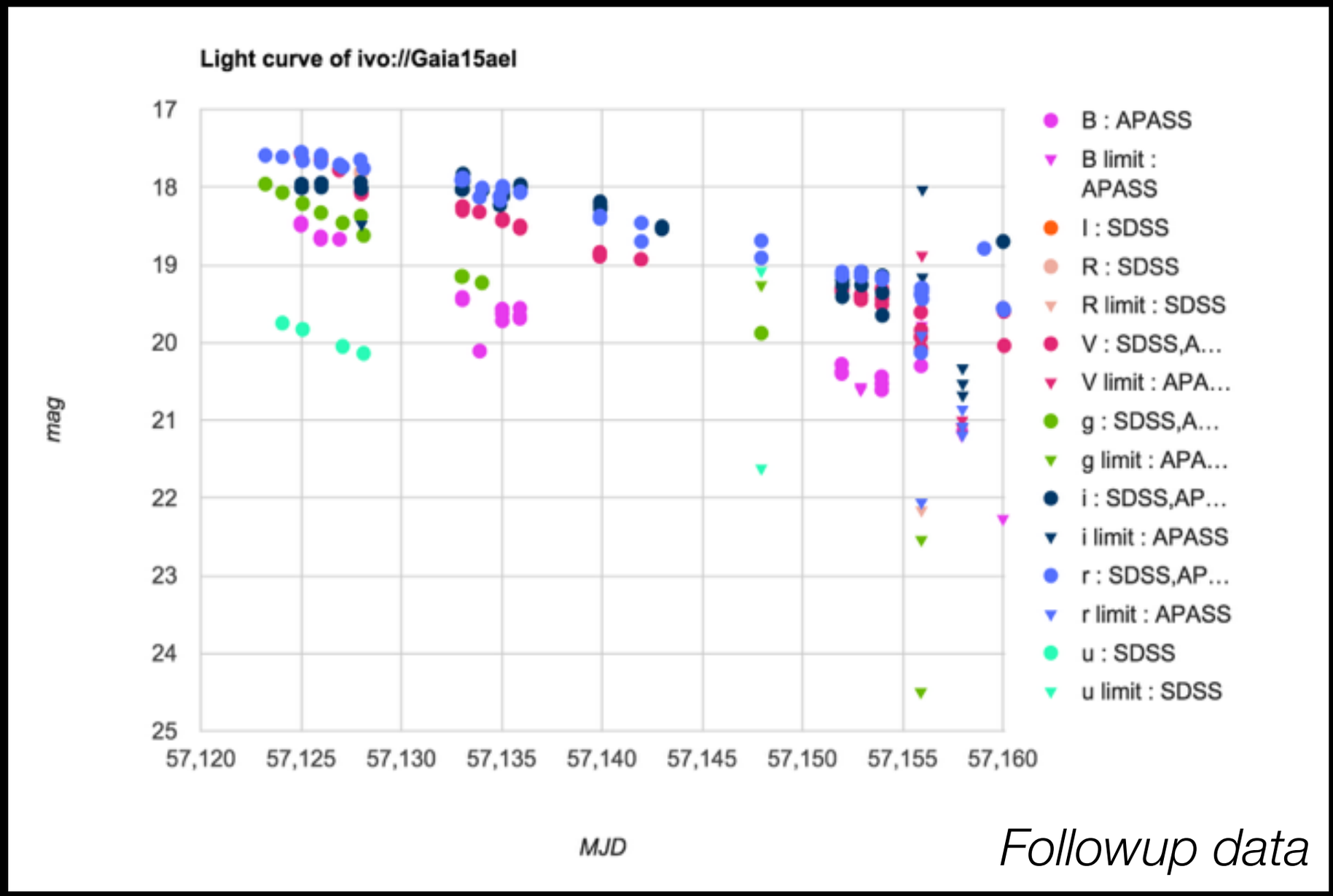




Combined light curves with follow-up data

The calibration server tags the data points in the light curve for accreditation.

76 registered users, 43 of whom have contributed almost 18000 data points in total so far for 269 Alerts

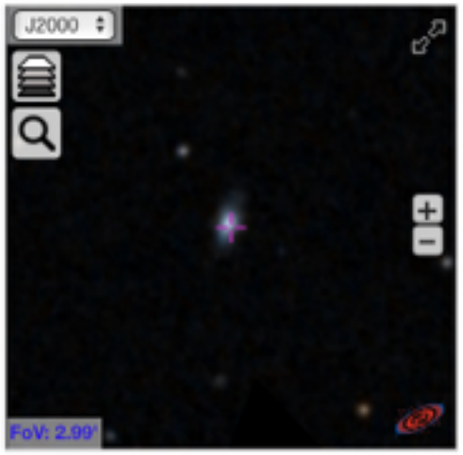


Followup data

S. Koposov, L. Wyrzykowski

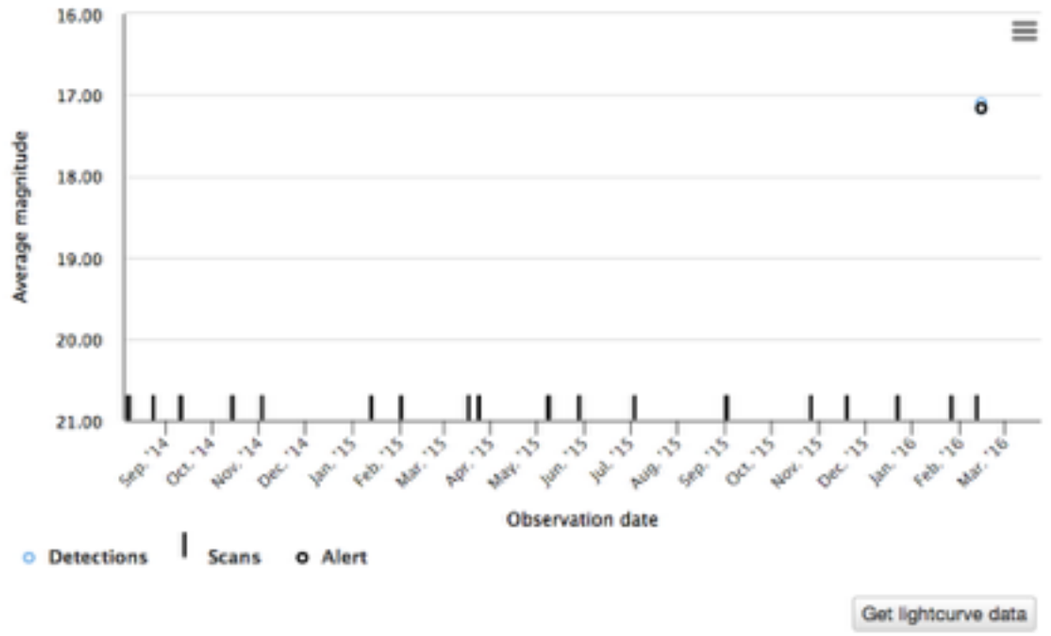
Gaia16ady

Details | Follow-up



RA - DEC
26.07022 -41.89365
01:44:16.9 -41:53:37.1

Alerting date
2016-02-14 12:56:02
Julian date
2457433.04
Alerting magnitude
17.16
Historic magnitude
None
Historic StdDev
None
Class
unknown
Publication date
Feb. 16, 2016, 10:07 a.m.

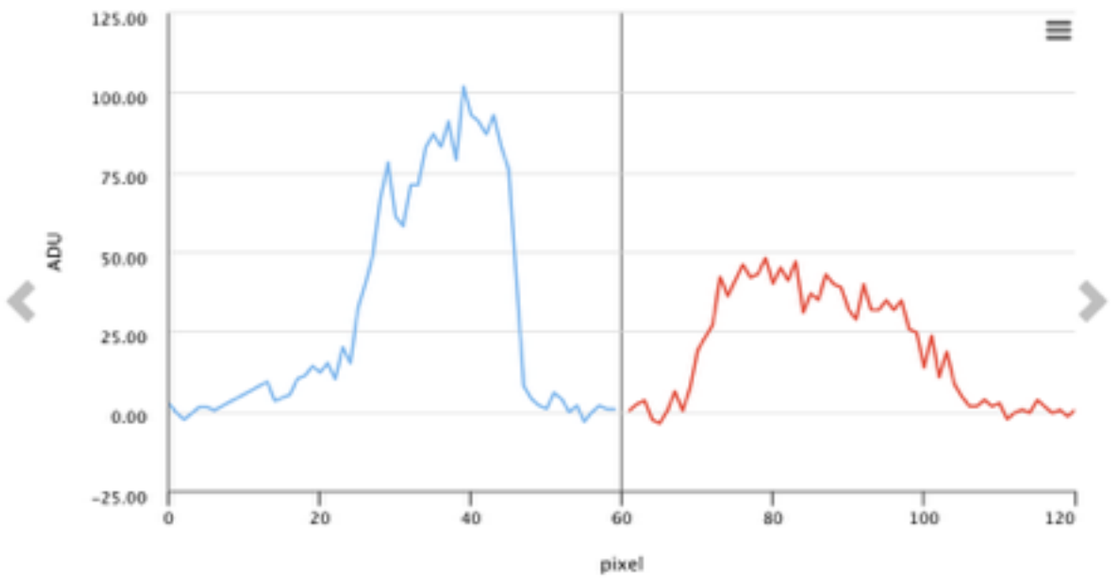


Get lightcurve data

Other surveys detections
ASASSN-16bv (3.45 arcsec)
Comments
Candidate SN in galaxy LCRS B014209.4-420839.
GSTEC predicts SN Ia pre-peak
ATels
8703 8708

Click and scroll down and select one row in the table below to display the corresponding spectrum.

Date	JD	Average Mag.
2016-02-14 12:56:02	2457433.04	17.16
2016-02-14 14:42:36	2457433.11	17.10

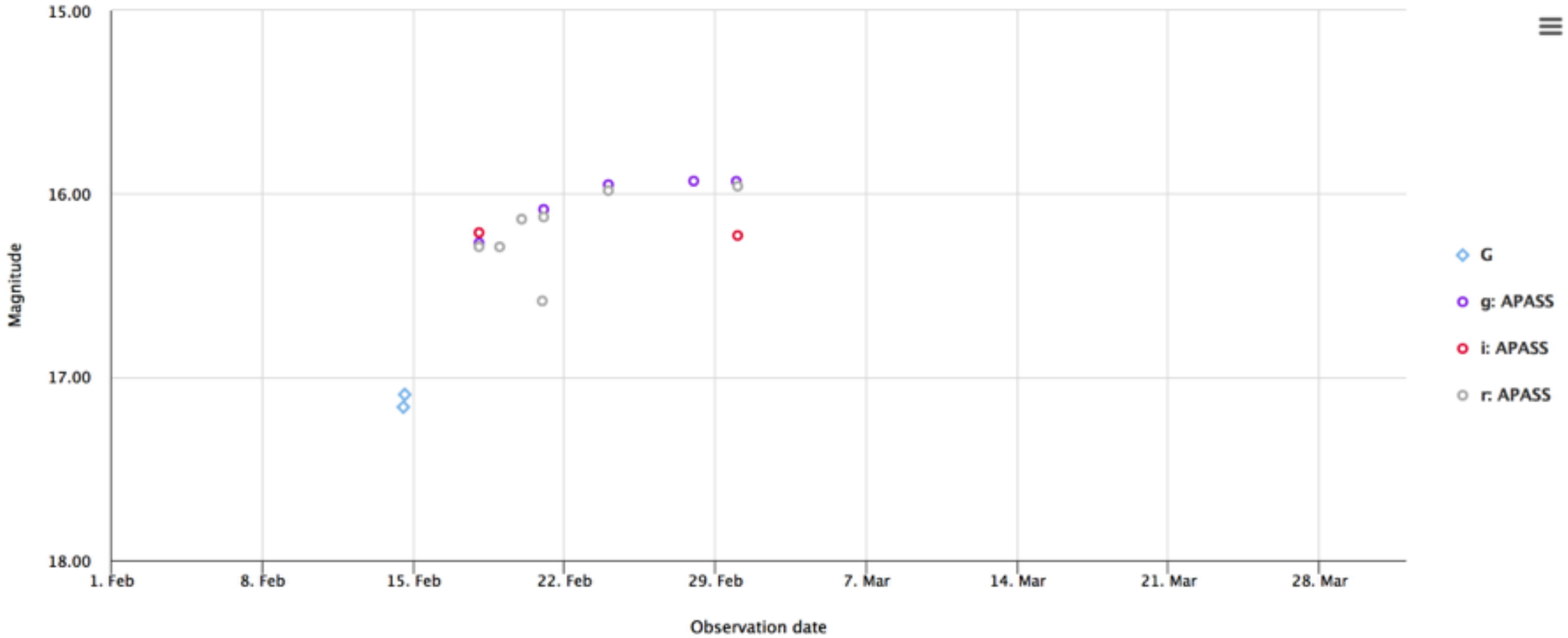


Gaia Alerts | Alerts Index | Alerts Search | Surveys-ATels | Contact | About | Related Sites | Log in

<< previous next >>

Gaia16ady

Details | Follow-up



Thank you all !

Data release scenario

- Based on assumption of smooth development and operations!
- Each release updates the previous and contains significant new additions
- Science alerts started already

Mid-2016 Positions + G magnitude ($\sim$ all sky, single stars)

- Includes more often scanned Ecliptic pole regions
- Hundred Thousand Proper Motions (Hipparcos-Gaia, ~ 50 μas/yr)

Early 2017 radial velocities for bright stars, two-band photometry, and full astrometry (α, δ, ϖ, $\mu_{\alpha*}$, μ_δ) where available.

2017/2018 (TBC) full astrometry, orbital solutions for short period binaries, ($G_{\rm BP} - G_{\rm RP}$), BP/RP Spectrophotometry and astrophysical parameters , radial velocities, RVS spectra

2018/2019 (TBC) Updates on previous release — including more sources, source classifications, multiple astrophysical parameters, variable star solutions and epoch photometry for them, solar system results

2022 (TBC) Everything