Year 1985.000

Sergey Koposov

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



Gaia Alerts: Status Report

Simon Hodgkin Guy Rixon Arancha Delgado Diana Harrison Goska van Leeuwen Floor van Leeuwen Abdullah Yoldas

CAMBRIDGE

OPAC

Lukasz Wyrzykowski Zuzanna Kostrzewa-Rutkowska Nadejda Blagorodnova Morgan Fraser



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- Manuel Torres
- Yiannis Tsapras
- Massimo Turatto
- Nic Walton
- Thomas Wevers
- Sjoert van Velzen





Scanning Law





Gaia as a transient survey

	Gaia	ASAS	OGLE-IV	Catalina Sky	PTF	LSST (from 2020??)
deg ² day ⁻¹	≈ 1230	~20,000	150	1200	1000	5000
Avg Cadence	4.5s-30 dy	I-3dy	20m-5dy	l4dy	5dy	4dy
Limiting mag	G=20.7	V=14	22	19.5	21	r=24.7
f _{sky}	all sky	all sky	0.07	0.6	0.2	<0.48



Gaia Focal Plane

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Sampling of light curve



BP/RP spectra: classification

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Simon Hoagkin, GSAVVZU10, Utrecht



Timeline for Data Flow



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

New windows on transients across the universe, April 23-24 2012, Royal Society

Time to publish

- Can occasionally reach 1 day
- Good periods where we hover around 1-3 days
- Outliers need investigation, but factors include:
 - faint objects held onboard
 - downtime at DPCI (<1 day in 6 months for software failure. No hardware failures in last 6 months. 4 weeks out for IDT-catalogue change)
 - downtime at DPCE



Science Alerts: Overview



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Simon Hodgkin, GSAW2016, Utrecht

Alert Detection: Daily





Detection

Use all data down to G=22 (fainter values are not included in LCs, recall detection limit for Gaia is 20.7)

For a source to generate an Alert, either:

- 1. median of historic transits must have G<=19.0, or
- 2. one of the alerting transits must be $G \le 19.0$

Old Sources must change brightness by either:

1 mag, or

3 x sigma(historic) AND 0.3 mag

New sources must reach 19th mag



Operations

	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013												Launch
2014								YEAR1				
2015								YEAR2				
2016												



Simon Hodgkin, EWASS 2016, Athens

Year 1: in a nutshell



273 published alerts (1.1/dy)

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



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Filtering: Year 1



Why so many candidates?

- Spurious new sources (diffraction spikes) [reduced]
- Spurious transits (VPU duplicates) [gone]
- Wrong light curves (bad source-transit matching) [reduced/avoided]
- Running without calibration [implemented]
- SSOs, periodic variables not robustly excluded [better]
- Internal mistakes with scan coverage [fixed]





blacklist + low quality flag



* A lot of the kept alerts are *new* (no history) or have few point in their historical light curves



Main Changes

- Photometric Calibration now implemented
- Improvements to Detectors and Classifiers
 - robust statistics
 - astrometric scatter<0.1 arcsec
 - near neighbour rejection criteria
 - better use of detector properties and stricter handling of bad CCD-fluxes
- Led to the removal of the density rejection mask

Source Density Mask



22% area masked due to high source density, including a strip around the ecliptic plane.



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Main Changes

- Rematch to new (GDR1) catalogue when IDT switched over (~1 month).
- Still need two FOV transits for an Alert but these can be split over different IDT runs (and separated by ~40 days)
- Automated rejection/classification of SSOs from CU4 tables
- Improved xmatch against existing surveys and automated submission to TNS, App, VOEvent



Filtering: Since Jan '16

We have:

iog 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: Operational. Now you can receive alerts on your phone or tablet. Get the iOS app at AppStore

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).

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 10 \$ entries

Search:

\}≣ Name	Ubserved	RA ↓↑ (deg.)	Dec. ∥↑ (deg.)	lî Mag.	Historic 11 mag.	Historic 11 scatter	$\lim_{l \to \infty} l ^2$	Published 1	Comment
Gaia16akn	2016-04-07 16:42:26	314.93640	-51.09012	15.52			unknown	2016-04-09 22:17:49	>4mag outburst of a source with previously known outbursts in CRTS and ASAS. Candidate CV
Gaia16akm	2016-04-06 10:45:35	325.24161	-47.74288	18.94			unknown	2016-04-09 22:12:26	Candidate SN
Gaia16akl	2016-04-07 03:39:56	254.43923	-4.73485	18.80			unknown	2016-04-09 22:10:10	Hostless transient, previously seen in CRTS (CV?)
Gaia16akk	2016-04-06 19:46:00	137.46295	47.89666	18.78			unknown	2016-04-08 10:09:26	Blue flare on the centre of SDSS galaxy
Gaia16akj	2016-04-05 16:45:15	327.14739	-45.60787	18.88			unknown	2016-04-08 10:08:17	Candidate SN
Gaia16aki	2016-04-06 03:15:51	239.79400	14.64151	18.52			unknown	2016-04-08 10:06:09	Candidate SN in SDSS J155910.36+143829.4 GSTEC predicts SN Ia
Gaia16akh	2016-04-05 17:03:14	241.60592	14.26907	18.67			unknown	2016-04-07 19:47:35	very short (<1min) flare on SDSS star (possibly faint galaxy)
Gaia16akg	2016-04-03 21:09:47	121.11547	29.12771	18.50			unknown	2016-04-05 10:07:32	Blue transient 0.8 arcsecs from centre of starforming galaxy SDSS J080427.74+290739.2 z=0.059)
Gaia16akf	2016-04-04 09:10:54	239.91236	19.08474	18.44			SN Ib	2016-04-05 10:06:19	Transient near centre of star forming galaxy SDSS J155938.96+190504.9 (z=0.031) aka PS16bkm
Gaia16ake	2016-04-02 12:53:26	102.16941	8.46212	18.12			unknown	2016-04-05 10:00:48	Candidate CV

Showing 1 to 10 of 547 entries

Previous 1 2 3 4 5 ... 55 Next

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		Gaia /	Alerts	Alerts In	dex	Alerts	Search	Surveys	-ATels	Contac	ct /	About	Related Sites	ş -					Logi	in	
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						gsaweb.ast.cam.ac.uk Č									Ċ						

Gaia14aaa

Other surveys detections None Comments None ATels None

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

<

Detections
Alert
Scans

Get lightcurve data

<< previous next >>

below to display the co	prresponding 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

Click and scroll down and select one row in the table

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Gaia14aaa

Other surveys detections None Comments None ATels None

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

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Detections
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Get lightcurve data

below to display the c	orresponding spectrur	n.
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
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2014-09-15 00:47:42	2456915.53	17.99
2014-09-15 02:34:16	2456915.61	18.06
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2014-11-08 16:05:41	2456970.17	18.85

Click and scroll down and select one row in the table

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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

Detections
Alert
Scans

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

Gaia Alerts	Alerts Index	Alerts Search	Surveys-ATels	Contact	About	Related Sites -				Log in
Gaia15	عما								<< previous	next >>
Details	Follow-up		no	VV V	vith	follov	v-up			
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The figure shows the Gaia lightcurve combined with photometric follow-up photometry generously provided by the astronomical community using the Cambridge Photometry Calibration Server (CPCS). Multiple filters are shown in one figure and can be toggled on/off using the legend on the side. Click and drag in the chart to zoom in. Clicking on datapoints provides additional information of the observation.

Access to these photometric data may be requested from the individuals who took the data. Please contact us if you would like to ask for access and we will pass on your request.

Warning: The follow-up data is obtained using rough calibrations and we can not guarantee its complete correctness at this stage.

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Tools

Stay Up-To-Date

2015 - Institute of Astronomy, University of Cambridge, UK

Classification:

RA - DEC: 09:52:51.19 -11:22:20.14 148.2133 -11.37226

Magnitude: 18.22

Go to full alert web page

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All-Sky Gaia Alerts

\$

More info

Gaia16aau

15.13

RCrB

12.5446 -69.73271

2016-01-25 18:25:07

00:50:10.70 -69:43:57.76

Go!

Go!

Gaia Alerts

Login Requ	ired	
Username		
Password		
	Login	
		J

2015 - Institute of Astronomy, University of Cambridge, UK

Abrir "wuffles.ast.private.cam.ac.uk:8080/publisher/home" en una pestaña nueva

☆ Urgent follow-up (5)

The following alerts need urgent actions:

Photometry: Gaia16aqi - Gaia16apy - Gaia16apw - Gaia16apt -

Spectroscopy: Gaia16aqi - Gaia16apw -

Classify: Gaia16apz - Gaia16apy -

C Latest Modifications

Classified alerts:: Gaia16aga -

Comments: Gaia16aqa - Gaia16apt - Gaia16apu - Gaia16aqj -

Updates: Gaia16apt - Gaia16aqa - Gaia16aqd -

Photometry Requested (9)

List of alerts which require to obtain photometric observations.

Spectroscopy Requested (7)

List of alerts which require the obtention of spectra.

Classification Requested (7)

List of alerts ready to be classified.

New Alerts (409)

List of new published alerts which need selecting actions to be taken.

Active Alerts (15)

List of alerts which are being actively followed-up.

Classified alerts (167)

List of alerts already classified. Follow-up might not be completed.

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Gaia Ale	rts Alerts Index	All-Sky	Alerts Search	Surveys-ATels	Tools	About	Related Sites -	MARSHALL			mdelgado	Log out
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*	Urgent follow-	up (5)					C Latest Mc	Now Alarta				
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Spe	ctroscopy: Gaia16aq ssify: Gaia16apz - Ga	i - Gaia16a aia16apy -	pw -				Updates: Gaia16aj	Archived	-			

Photometry Requested (9)

List of alerts which require to obtain photometric observations.

Spectroscopy Requested (7)

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List of alerts which are being actively followed-up.

Classified alerts (167)

List of alerts already classified. Follow-up might not be completed.

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Urgent Follow-up

Here is the list of alerts to urgently follow-up and the required actions per objects. For going directly to the lists of alerts that require an specific observational technique, please click on the following links: Urgent Photometry - Urgent Spectroscopy - Urgent Classification

About

Show 10 \$ entries

Name 11	Actions 17	RA II	Dec 11	Alerting Time 11	Alert Mag. $\downarrow\uparrow$	Last Detection	Last Detection Mag. $$\mathbb{I}$$	Classification	Predicted
Gaia16apw	Photometry Spectroscopy	191.70352	30.37098	2016-05-19 01:05:11	18.64	2016-05-19 02:05:45	18.36	unknown	-
Gaia16aqi	Photometry Spectroscopy	35.59048	-16.99653	2016-05-27 05:05:32	18.56	2016-05-27 09:05:13	18.60	unknown	-
Gaia16apy	Photometry Classify	15.58365	-22.24128	2016-05-20 05:05:19	17.98	2016-05-20 09:05:00	17.83	unknown	-
Gaia16apt	Photometry	189.25673	-22.43604	2016-05-20 01:05:55	18.30	2016-05-26 12:05:53	18.34	unknown	-
Gaia16apz	Classify	343.59640	61.84157	2016-05-22 02:05:39	20.04	2016-05-22 04:05:14	19.90	unknown	-

Showing 1 to 5 of 5 entries

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Search:

Gaia Alerts	Alerts Index	Alerts Search	Surveys-ATels	Contact	About	Related Sites -	MARSHALL -		mdelgado	Log out
Gaia16	aax Follow-up	Observations	Classification Updat	e Comm	ents				<< previ	ious next>>
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Classificat Classificat (UTC) Classificat Redshift	tion Type tion Date tion Phase	Photometry 2016-12-06 hh	21 📀 mm 18 🕞 ss	59 🗘		Predicted Classification Comment	- AGN 🗢 Classification added	Probability Last classification: unknown		
Observer	(TCB)	Delgado	12 📀 mm 25 🕞 ss	03		Save data			8	

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Gaia Alerts	Alerts Index	All-Sky	Alerts Search	Surveys-ATels	Tools	About	Related Sites -	MARSHALL	mdelgado	Log out
Gaia16	<previous next<br="">Gaia16aax</previous>									
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Simon Hodgkin 06 Dec 2016, 21:12 Reply Sed pellentesque, ipsum ac semper faucibus, sem elit vestibulum justo, vel efficitur lorem mauris at ligula.										
cancel Post Reset										

2015 - Institute of Astronomy, University of Cambridge, UK

Gaia Marshall

- We will email users of the previous Marshall
- Register interest via gaiaalerts@ast.cam.ac.uk

Next Steps

- Retraction of unpublished Alert Candidates so that they can re-trigger (e.g. marginal cases become more convincing)
- Addition of GS-TEC classification for all Alert Candidates
- Swap to new hardware (currently setting up tests to improve performance - and check reliability of lightcurve histories)

- Setup/installed
- Run 2 systems in parallel
- `Painless' changeover

www.ast.cam.ac.uk

Dutreach web-site

gsamarshall

marshall

