Ground based follow-up for Gaia Science Alerts: First Results

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Many people involved…

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Gerry Gilmore

DPAC
Gaia
Data Processing & Analysis Consortium

See

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

gaia.ac.uk/selected-gaia-science-alerts

Alerts

The table can by sorted by Name, UTC timestamp, RA, Dec and AlertMag - click column heading to sort.

| Name	UTC timestamp	RA	Dec	AlertMag	HistMag	HistStdDev	Class	Comment	Published
Gaia14adj	2014-11-17 20:25:19	356.72155	23.14965	18.91	19.53	0.08	unknown	Early type galaxy with an extra source. Could be a foreground star. Imaging target	2 Dec 2014, 15:18
Gaia14adi	2014-11-07 01:05:09	168.47841	-23.01221	18.77	19.62	0.07	unknown	Fading source on top of 2MASS Galaxy (offset from bulge)	2 Dec 2014, 13:55
Gaia14adh	2014-11-05	168.69436	-13.88694	15.84	18.45	0.23	unknown	Blue in BP/RP and SDSS	25 Nov 2014

Methodology

- Search around known SDSS/DSS/2MASS sources

- For each epoch, sum flux of all Gaia sources within 4" into "superpixel"

- Search for Δmag > 0.5 (and at >5σ) over historic magnitude

- Plus present in next visit
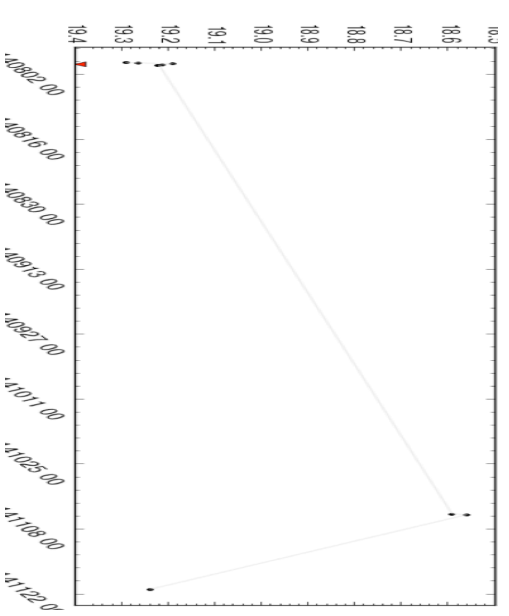
Reasons for followup

- Many transient science cases need higher cadence

- Or higher resolution spectroscopy...

- Fainter targets will not get BP/RP spectra

- Validation of BP/RP spectra, training set

- Validation of alerts

Gaia

Ground

Wavelength (angstroms)
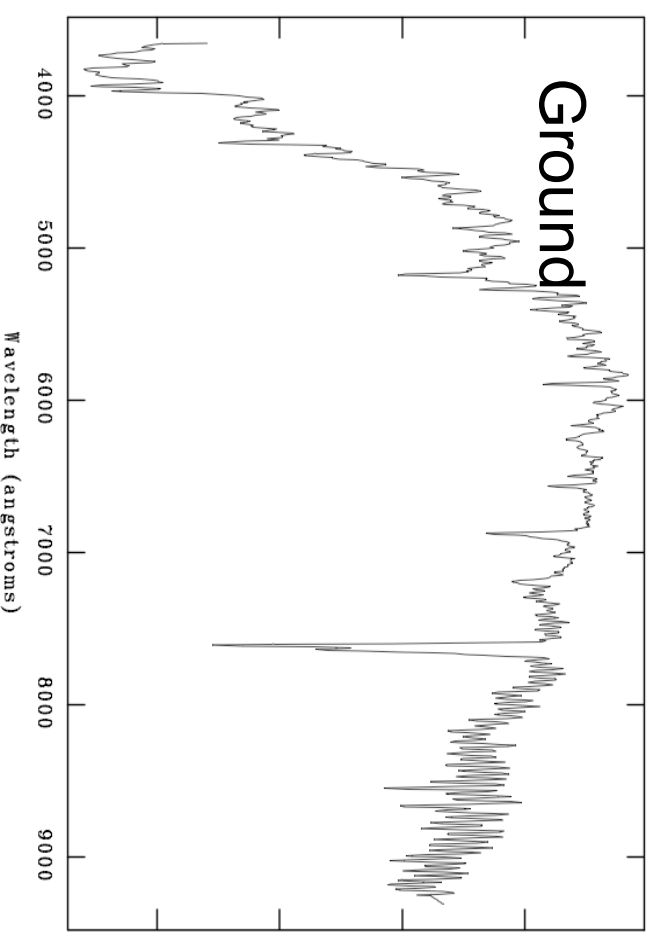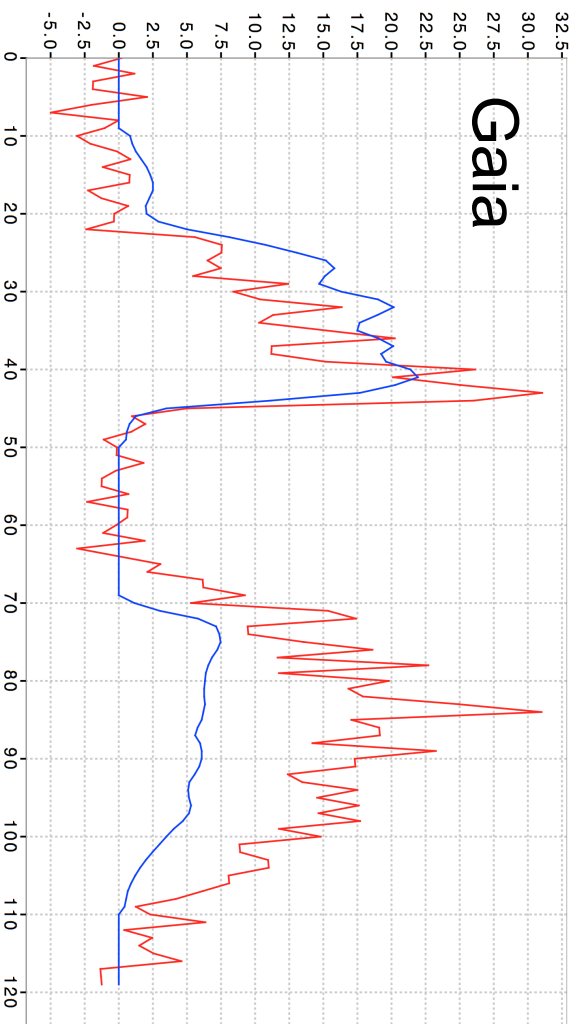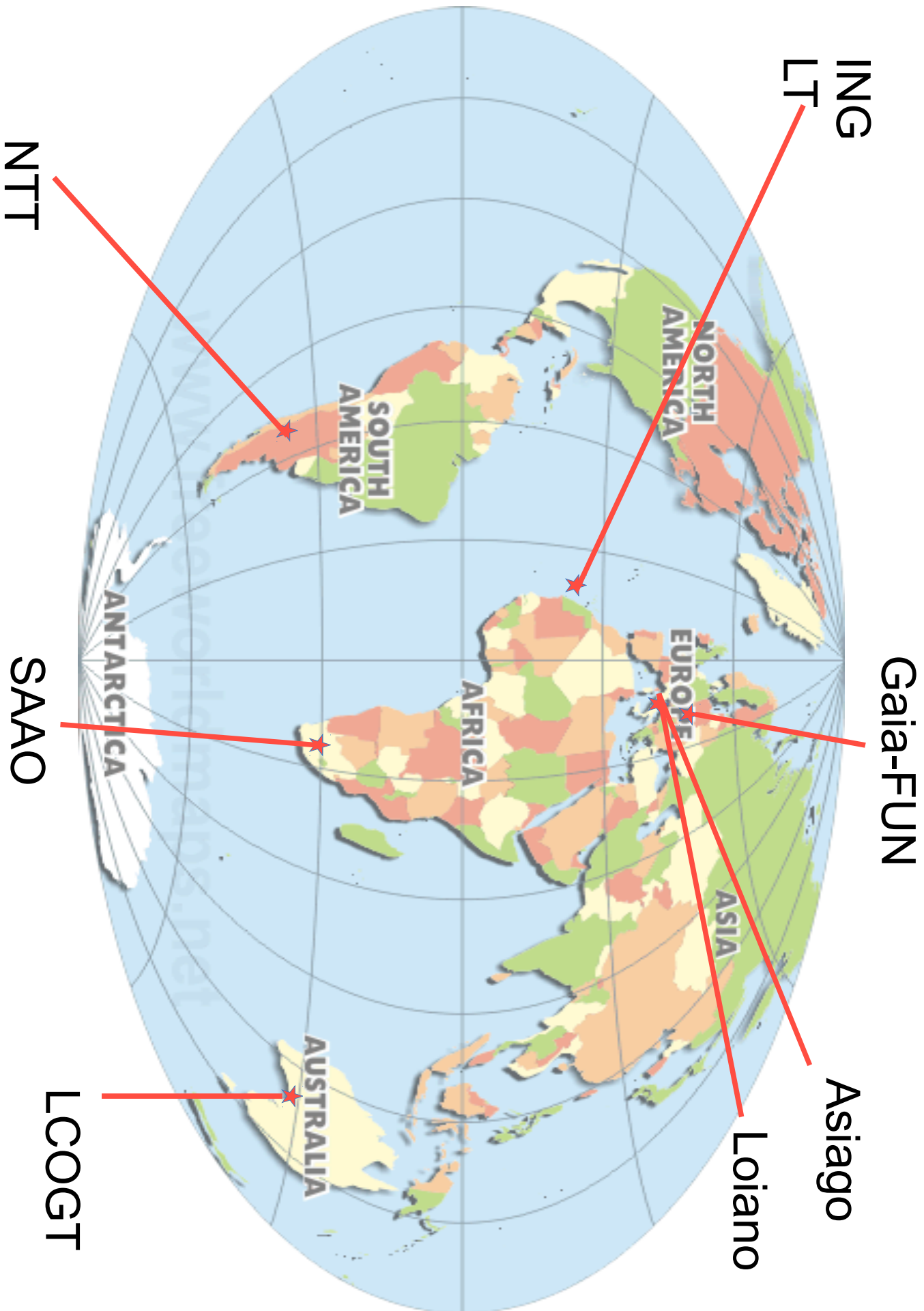
Welcome to the Cambridge Photometry Calibration Server (CPCS)

Light curve of ivo://GaiaVerif14ahk

Legend:
- B1pg : USNO
- Ipg : USNO
- R2pg : USNO
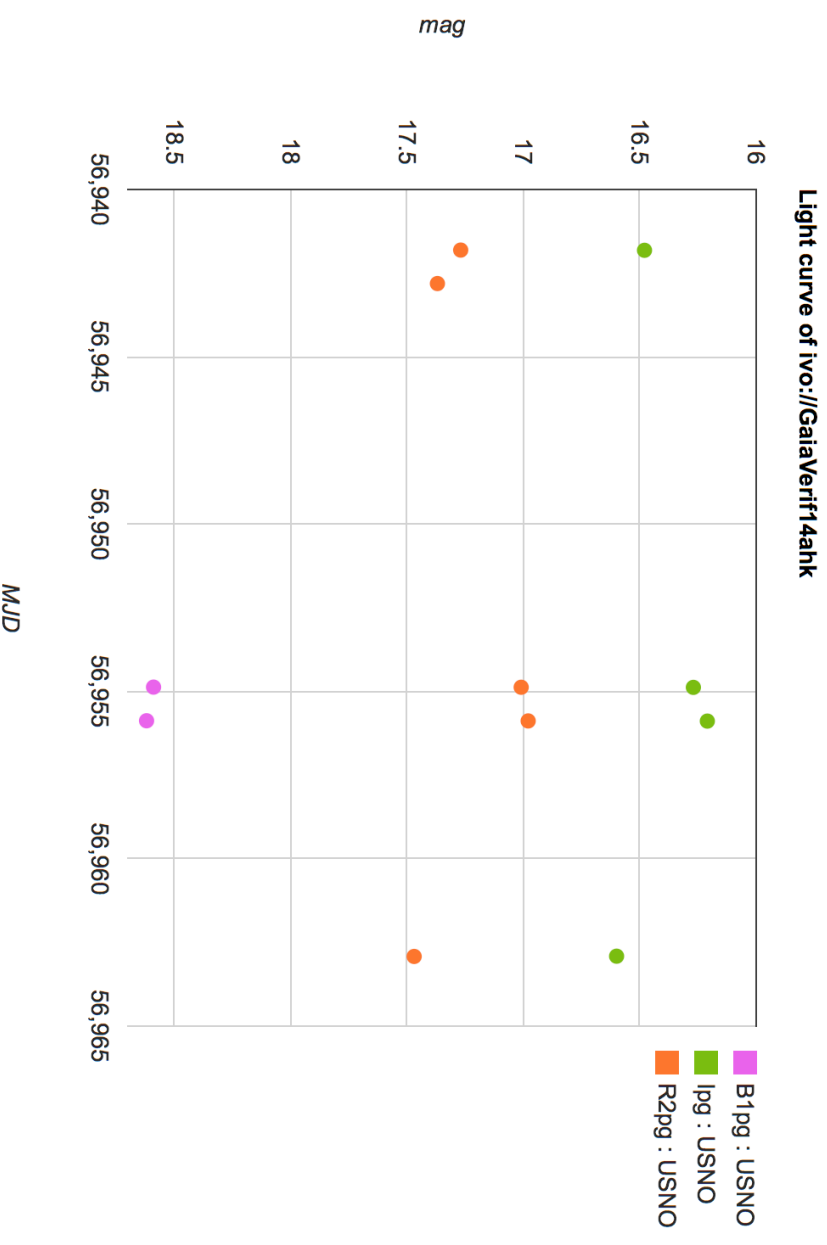
La Palma telescope time

Large amount of spectroscopic time during 2014B semester:

PI	Country	Program	Telescope	Allocation
Fraser	UK	P29	WHT+ISIS,ACAM	9n
Van Velzen	NL	N15	WHT+ISIS,ACAM	6n
Hodgkin	UK	P14	INT+IDS	18n
Wevers	NL	N7	INT_IDS	12n
Fraser	UK	JL14B06, PL14B14	LT+IO,FRODOSpec	92hr
Campbell	ITP	ITP2014-02	INT, Mercator, LT	

Pipelines

```
$ python int_fastspec.py r1035253.fit
```
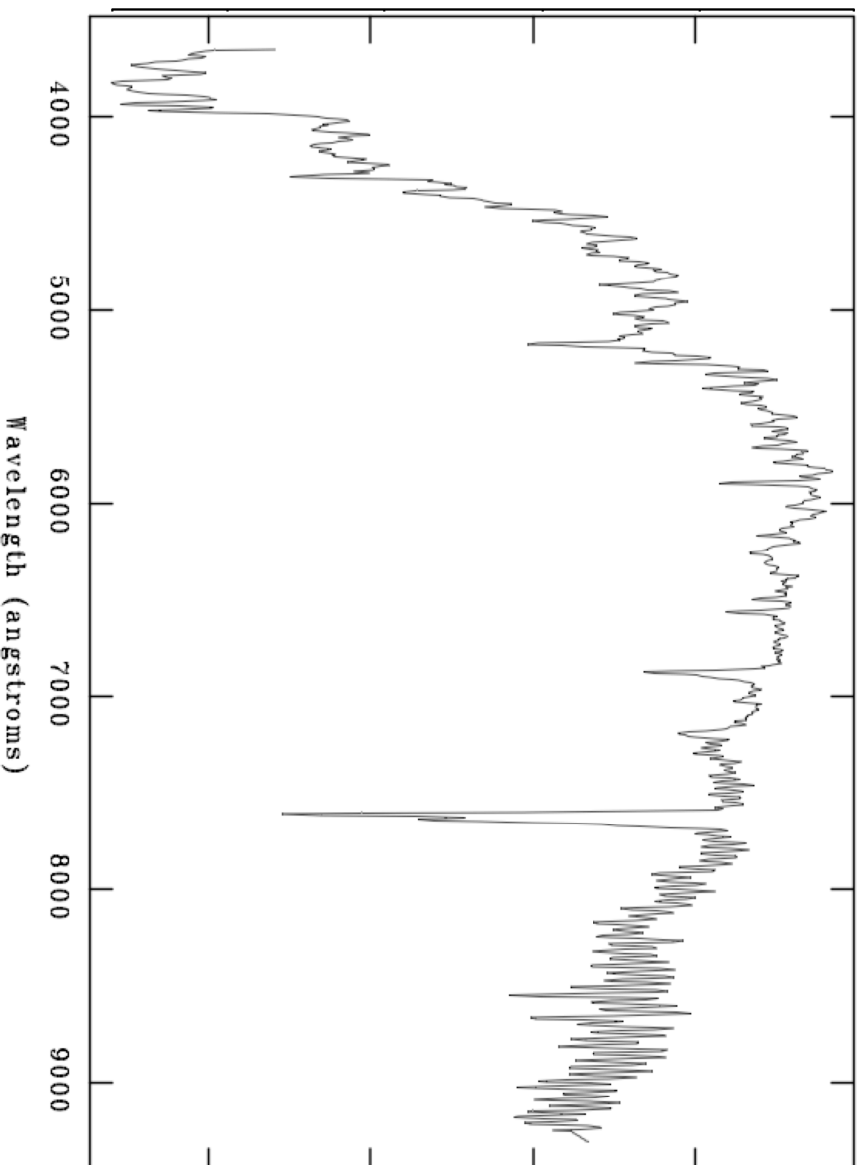
Based on IRAF/Pyraf/Python

Can be run at the telescope on a single, raw spectral frame.

Uses archival calibrations only
- Bias removed with overscan
- No flat-fielding
- Archival dispersion solution
- Wavelength shift using sky lines
- Fixed sensitivity curve

Wavelength (angstroms)

4000   5000   6000   7000   8000   9000

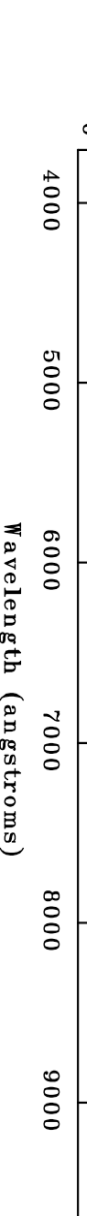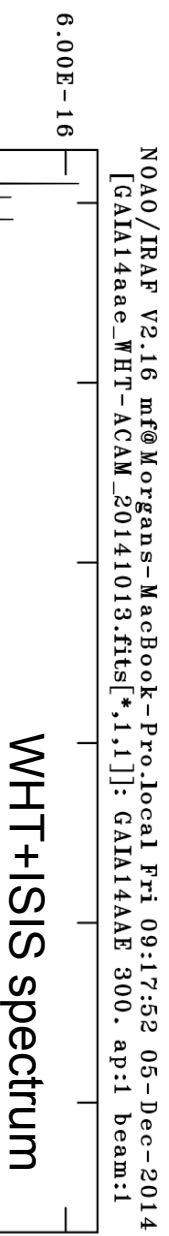Three fast pipelines (for INT+IDS, WHT+ACAM, WHT+ISIS)

Pipelines

We are also working on a "full" pipeline (including telluric, cosmic ray corrections etc.)

All pipelines will be released (including sources and documentation) when ready.

Gaia14aae

AM CVn system seen by Gaia (independently discovered by ASASSN)

| Gaia14aae | 2014-08-11 13:43:26 | 242.89156 | 63.14217 | 16.04 | 17.56 | 0.20 | CV | GALEX 2679054677788594106. Double peaked He emission lines at z=0, no H, AM CVn, aka ASASSN-14cn | 13 Oct 2014, 16:29 |

NOAO/IRAF V2.16 mf@Morgans-MacBook-Pro.local Fri 09:17:52 05-Dec-2014
[GAIA14aae_WHT-ACAM_20141013.fits[*,1,1]]: GAIA14AAE 300. ap:1 beam:1

WHT+ISIS spectrum

Wavelength (angstroms)

Gaia14aae

Gaia Alerts classified at the William Herschel Telescope

ATel #6593; *G. Rixon, M. Fraser, S. Koposov, N. Blagorodnova, H. Campbell, S. T. Hodgkin, G. van Leeuwen, N. Walton (University of Cambridge), L. Wyrzykowski (Warsaw Observatory), T. Wevers, P. Jonker, S. van Velzen (RU Nijmegen) S. Benetti (Padova Observatory), E. Breedt (University of Warwick), G. Busso (University of Cambridge), R. Busuttil (Open University), C. Davis (Liverpool John Moores), F. De Angeli (University of Cambridge), M. Dennefeld (Institut d'Astrophysique de Paris), N. Elias-Rosa (Padova Observatory), D. W. Evans (University of Cambridge), D. Froebrich (University of Kent), B. Gaensicke (University of Warwick), G. Gilmore (University of Cambridge), A. Gomboc (University of Ljubljana), A. Hamanowicz (Warsaw University Observatory), B. Handzlik (Warsaw University Observatory), L. Hardy (University of Sheffield), K. Ilkiewicz (Warsaw University Observatory), M. Irwin (University of Cambridge), J. F. Jarvis (Open University), D. A. Kann (TLS Tautenburg), U. Kolb (Open University), S. Komossa (MPifR), Z. Kostrzewa-Rutkowska, S. Littlefair (University of Sheffield), A. Mahabal (Caltech), P. O'Brien (University of Leicester), P. Ochner (Padova Observatory), M. Riello (University of Cambridge), M. Pawlak (Warsaw University Observatory), A. Piguiski (University of Wroclaw), R. Pretorius (University of Oxford), K. Rybicki (Warsaw University Observatory), A. Scholz (University of St. Andrews), M. Sitek (Warsaw University Observatory), D. Steeghs (University of Warwick), L. Tomasella (Padova Observatory), M. Turatto (Padova Observatory), K. Ulaczyk (Warsaw University Observatory), F. van Leeuwen (University of Cambridge), T. Prusti (ESA)*

on 19 Oct 2014; 14:48 UT

Credential Certification: Morgan Fraser (mf@ast.cam.ac.uk)

Subjects: Optical, Binary, Cataclysmic Variable, Star, Transient, Variables
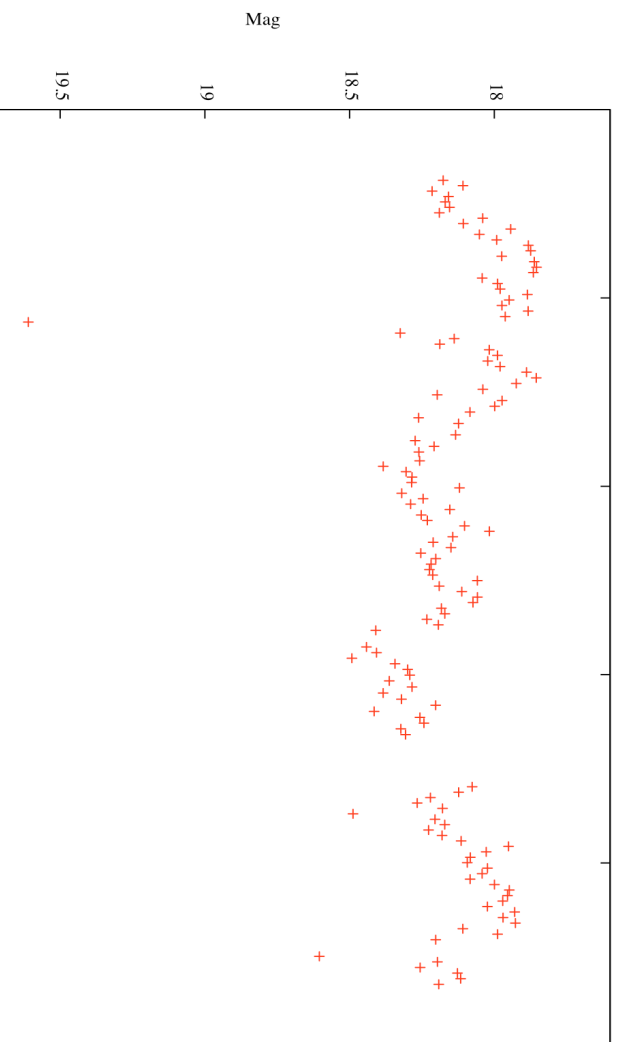
Referred to by ATel #: 6626, 6640, 6641, 6646, 6750

We report spectroscopic confirmation and classifications for reported Gaia Photometric Science Alerts (http://gaia.ac.uk/selected-gaia-science-alerts). All spectra were taken at the 4.2m William Herschel Telescope on La Palma, over the nights of 13-15 October 2014. Low to intermediate resolution spectra were taken using ISIS-R300B/R158R and ACAM+V400, and reduced and calibrated spectra are available for download (http://gaia.ac.uk/sites/default/files/file_attach/FUGA_WHT_20141013-15.tar.gz)

Name	RA	Dec	Instrument	Date of spectrum
GAIA14AAE	242.89856	63.14217	ACAM	2014-10-13.9
GAIA14AAF	244.25381	62.00685	ACAM	2014-10-13.9/15.8
GAIA14AAI	23.88339	-20.40796	ACAM	2014-10-14.0
GAIA14AAT	52.76852	17.42784	ACAM	2014-10-14.0
GAIA14AAU	237.94493	16.62637	ACAM	2014-10-13.8
GAIA14ABG	262.69947	50.00445	ACAM	2014-10-13.9
GAIA14ABQ	58.59016	-11.31998	ISIS	2014-10-15.2/16.0
GAIA14ABR	59.38013	-9.65999	ACAM	2014-10-15.2
GAIA14ABY	55.51929	-22.17277	ISIS	2014-10-15.1

658	
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662	
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664	
664	
671	
671	
675	
675	

Gaia14aae

Loiano photometry reveals system to be eclipsing!

Also see LC from Enrique de Miguel, amateurs...
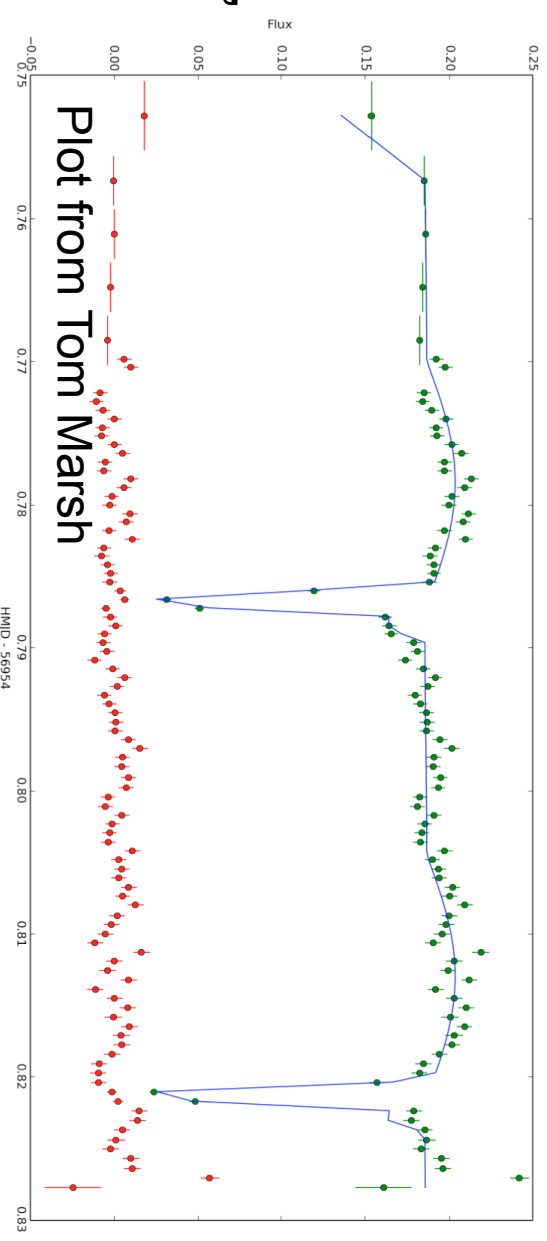
Modelling (in progress) gives orbital parameters, mass ratio etc..

Plot from Tom Marsh

Heather Campbell (IoA) leading followup campaign

Mag

20   19.5   19   18.5   18

-0.5   0   0.5   1

Hours

Flux

-0.05   0.00   0.05   0.10   0.15   0.20   0.25

0.75   0.76   0.77   0.78   0.79   0.80   0.81   0.82   0.83

HMJD - 56954

Summary

- Gaia Alerts are flowing
- Some ad-hoc solutions for now, but will get better, and on fairly short timescales
- Already finding interesting transients
- The first science from Gaia!

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