



The Cambridge Photometric Calibration Server 2.0

new automatic tool for time domain astronomy

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Involved People

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Gaia Science Alerts Team

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N. Copernicus Astronomical Center (PL)

University of Wrocław (PL)

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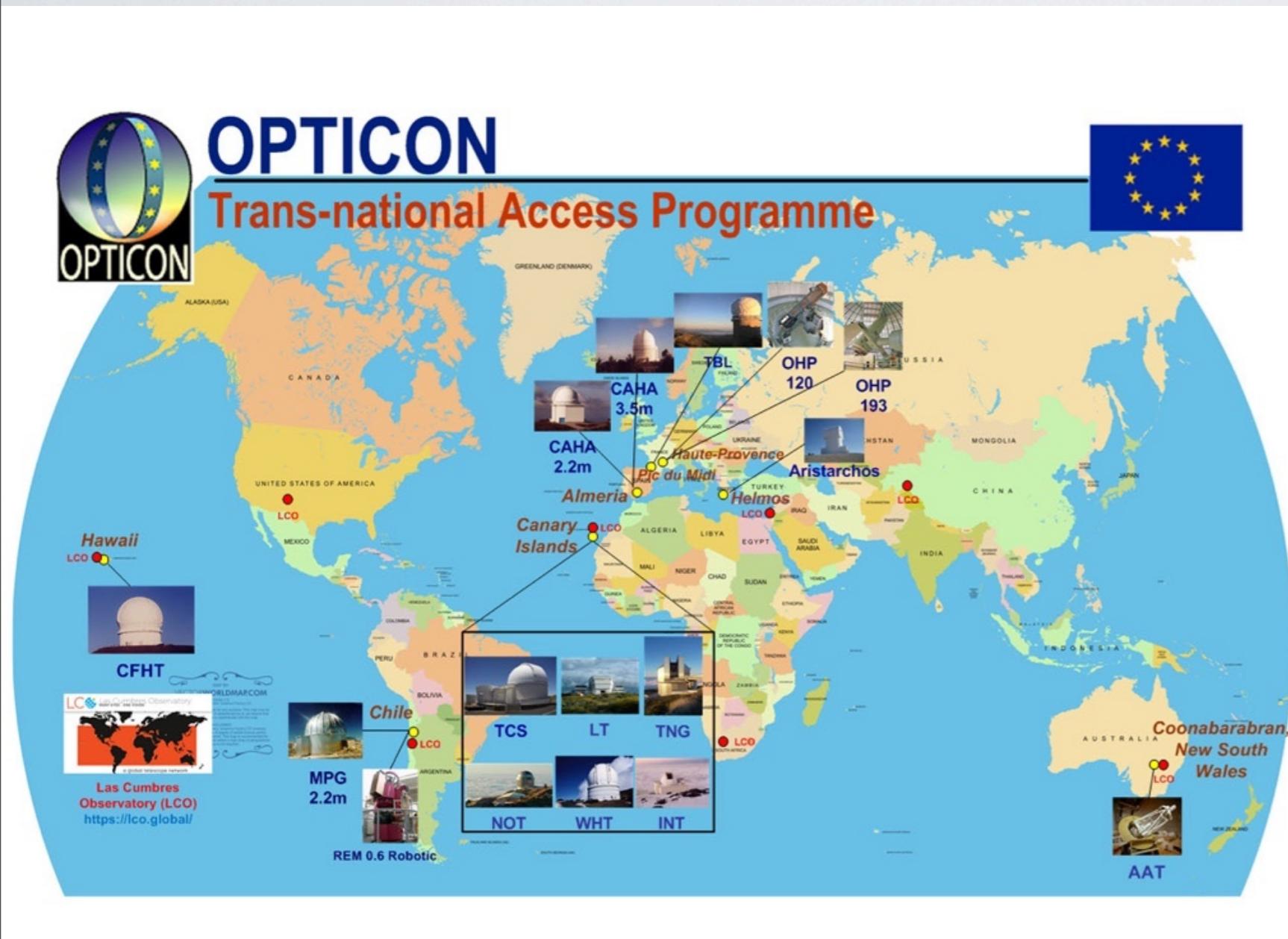
Warsaw University (PL)

University of Cambridge (UK)

~20 observatories spread over the world

OPTICON

Optical Infrared Coordination Network for Astronomy Horizon 2020



<http://www.astro-opticon.org/>

OPTICON - Time Domain Astronomy

- Networking Activity WP13: Time Domain Astronomy
- networking (workshops)
- coordination of scientific goals in time domain
- support in observations and data processing
- observing trips
- robotic telescopes in TNA support

Time Domain Astronomy? What is it?

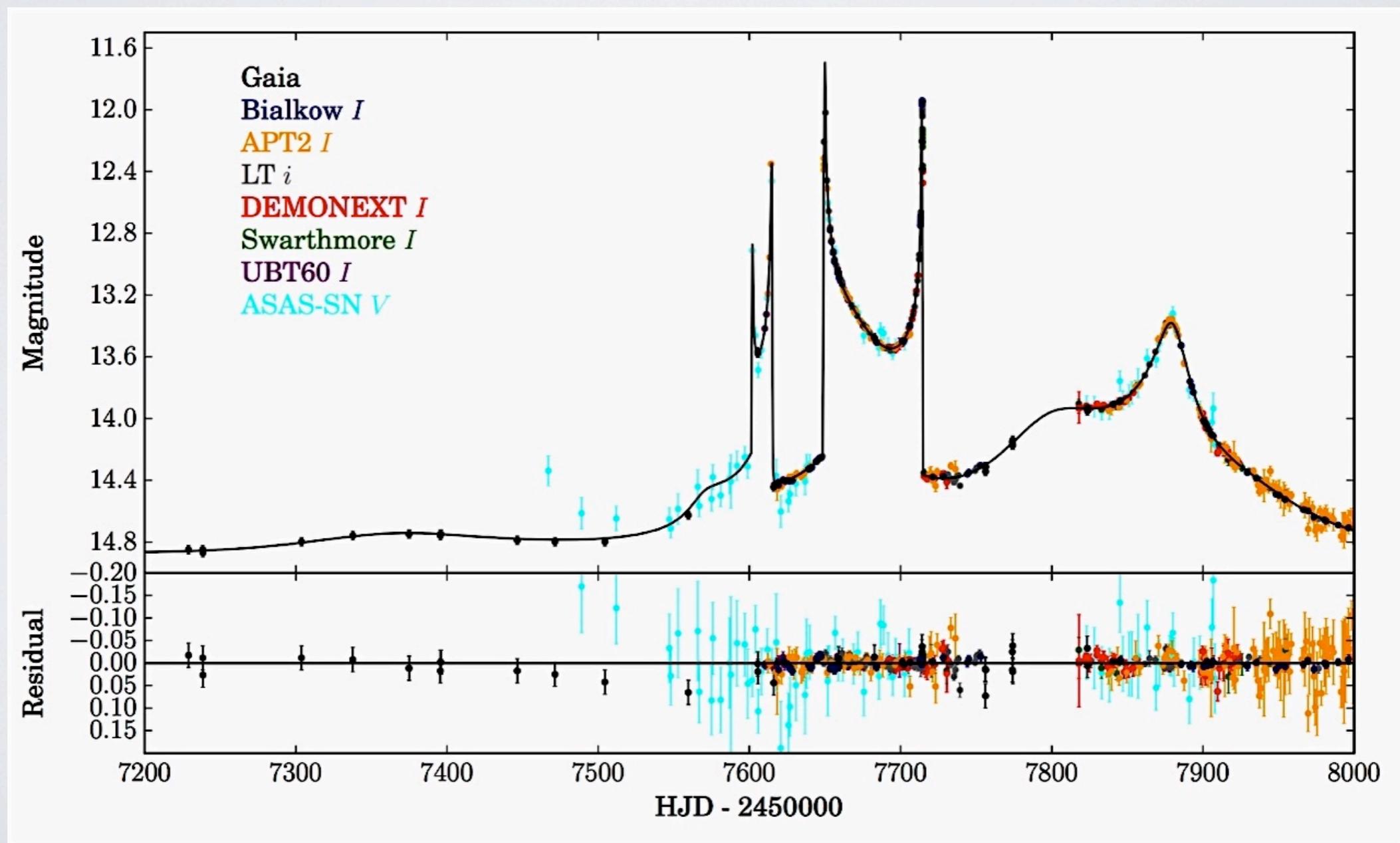
- Long-term monitoring programs of known or new, temporal objects
- Rapid follow-up observations (photometric or spectroscopic)
- Interesting targets:
 - periodic variables, exoplanets, CV, asteroids
 - transients: novae, supernovae, microlenses, TDEs, gravitational wave optical counterparts

Follow-up network



Gaia16aye

- first binary microlensing event in the Galactic disk
Wyrzykowski et al, in prep. (model by P. Mróz)
- more than 20 000 data points!!!



Cambridge Photometric Calibration Server (current version)

Welcome to the Cambridge Photometry Calibration Server (CPCS)

Not logged in

[Login](#) into the system

[List](#) of alerts (observed only)

[List](#) of followup data

[List](#) of observatories

[Upload](#) new followup data

[Enter](#) new event

[Delete](#) a followup point from the system

[Logout](#)

[Manual](#)

- gsaweb.ast.cam.ac.uk/followup/

- Input data - ASCII files with RA, DEC, Mag, MagErr

Cambridge Photometric Calibration Server (current version)

Upload done from IP 37.249.110.19

EventId : ivo://Gaia18bmt

Ra : 214.01478

Dec : -56.9134

Filter: APASS / r

Magnitude: 15.47 +/- 0.01 mag

ZP: -1.78 mag

Scatter: 0.12 mag

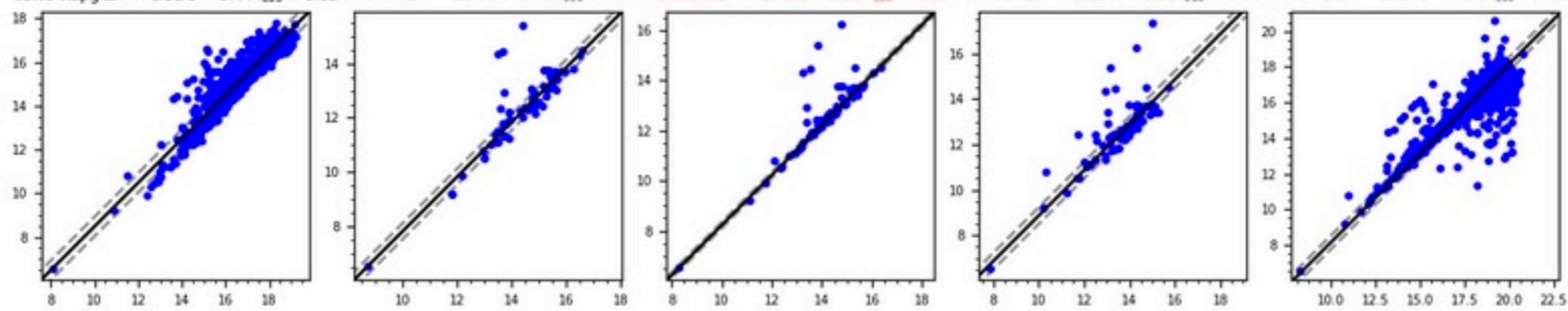
Number of datapoints used for calibration: 79

Outlier fraction: 0.15

Matching radius[arcsec]: 2.0

Dry run: True

USNO R1pg ZP = -1.52 σ = 0.44 f_{out} = 0.02 APASS V ZP = -2.16 σ = 0.29 f_{out} = 0.07 APASS r ZP = -1.78 σ = 0.12 f_{out} = 0.15 APASS i ZP = -1.13 σ = 0.36 f_{out} = 0.12 GAIA G ZP = -1.84 σ = 0.38 f_{out} = 0.05

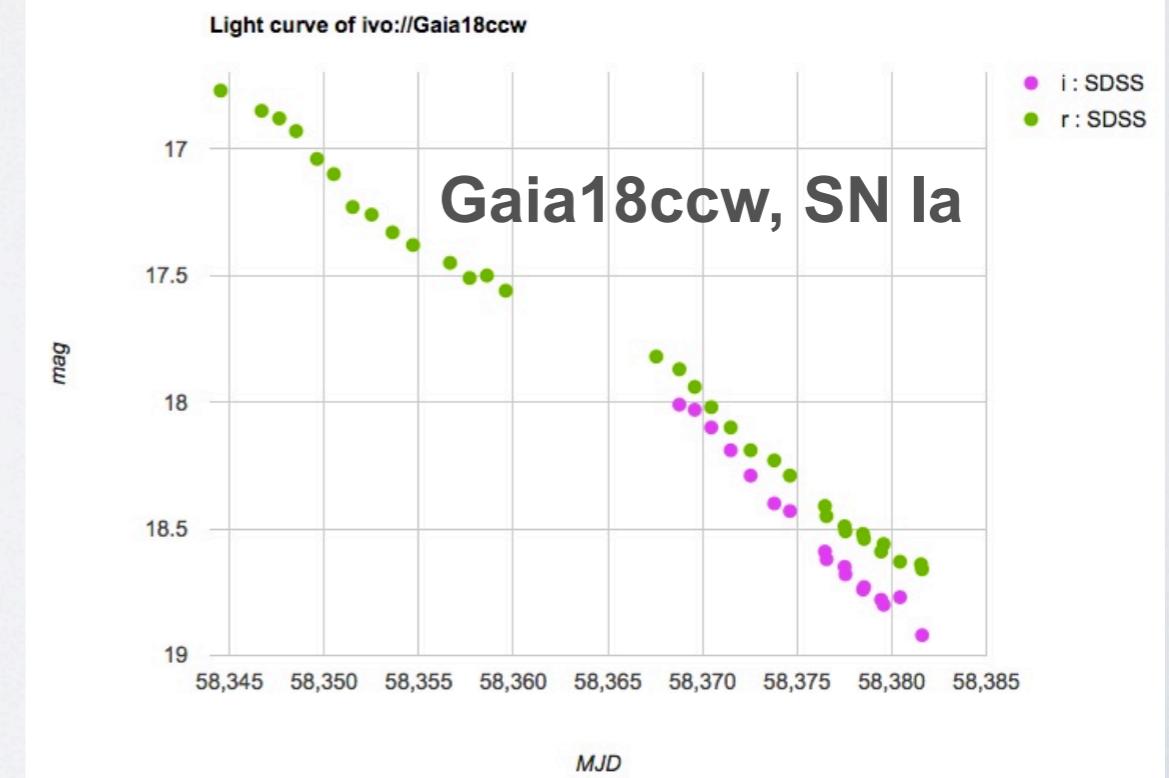
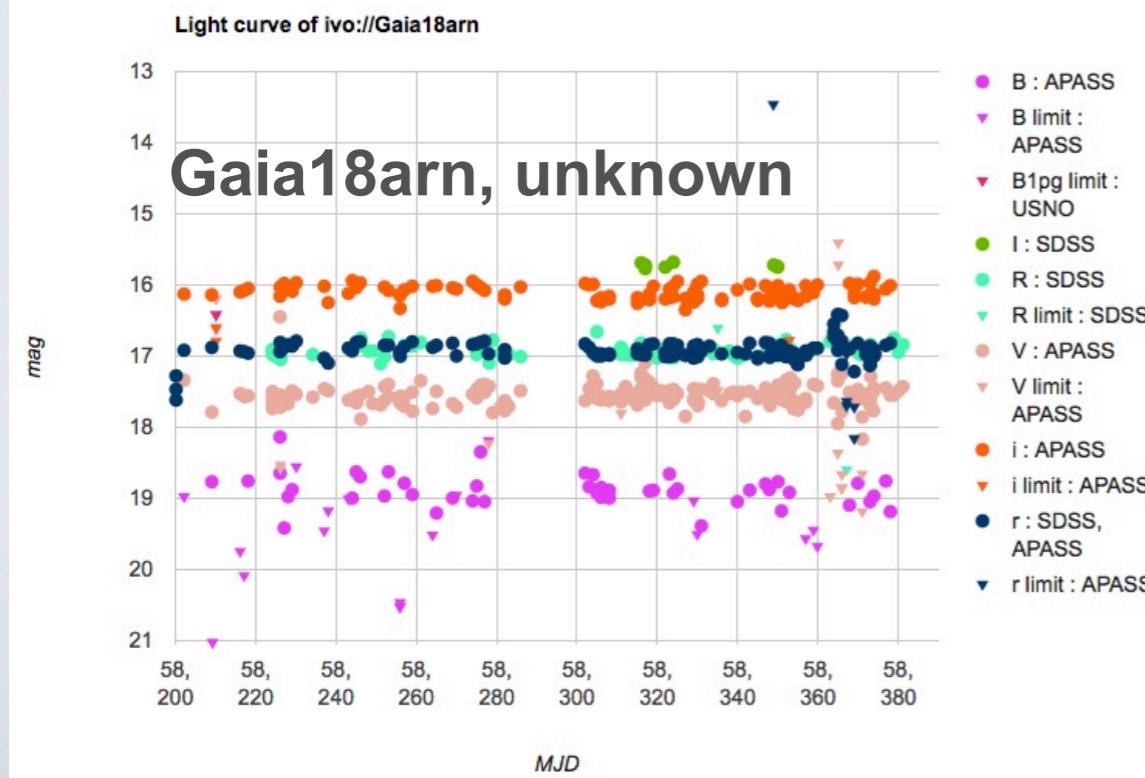
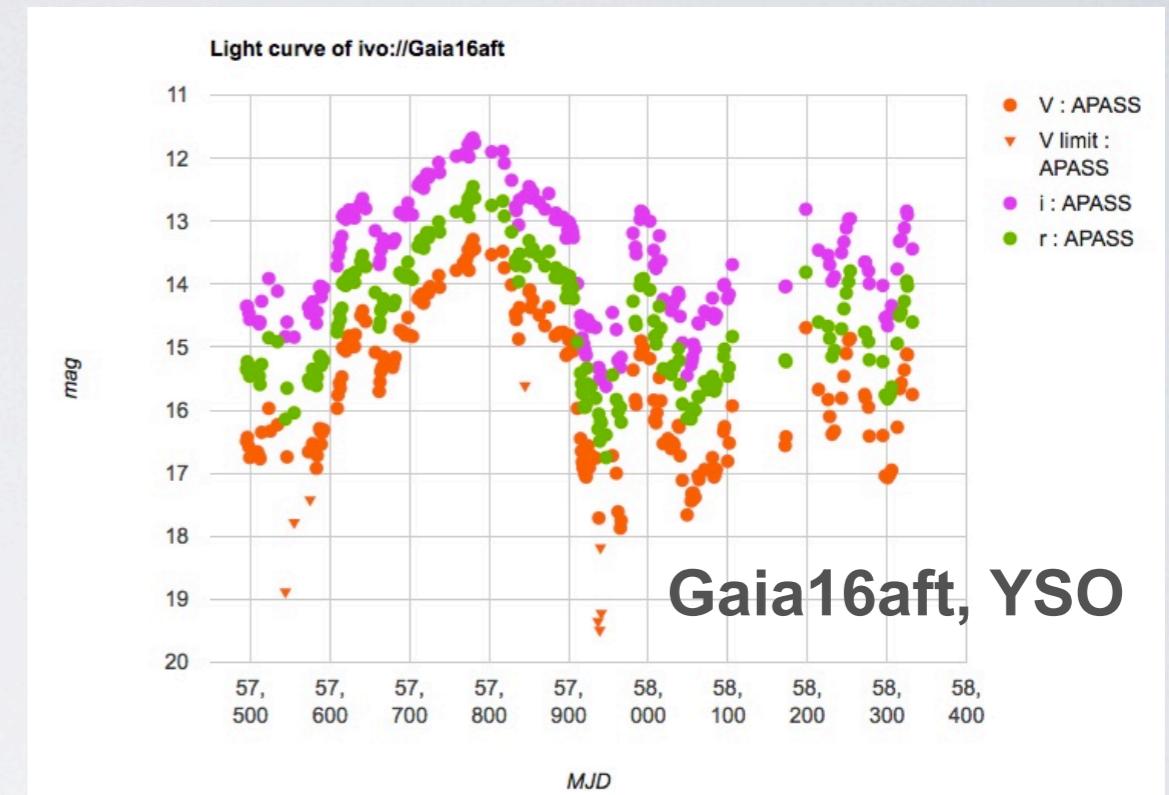
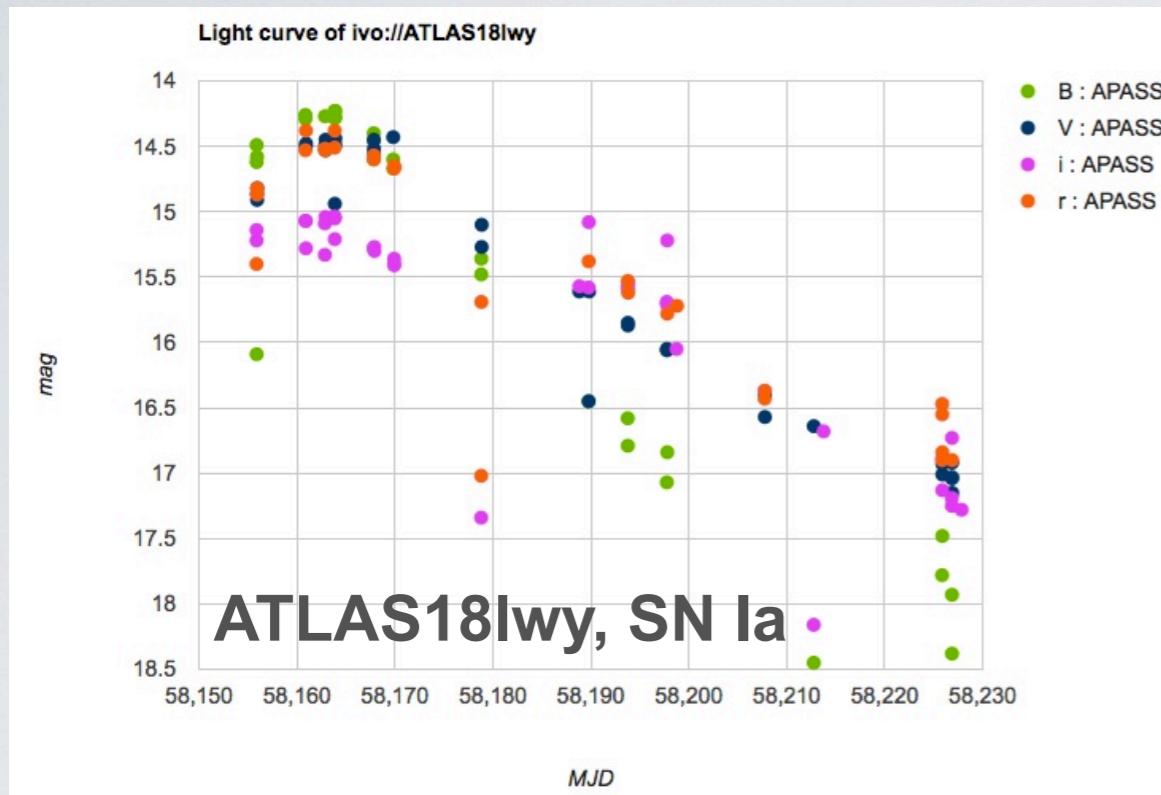


Time spent calibrating 2.48750901222 s

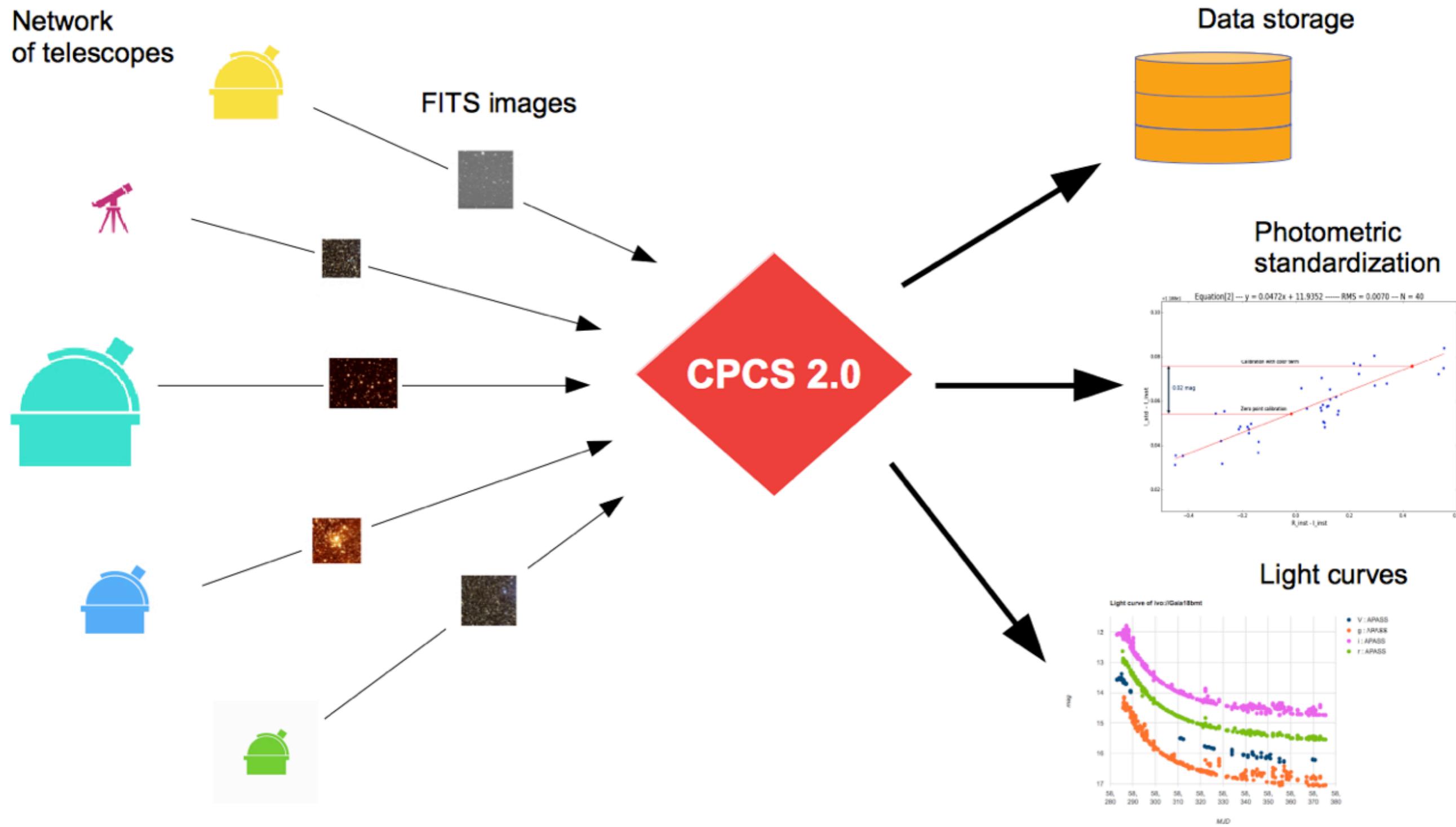
- Photometric standardization from instrumental magnitudes
- Calibration plot for each filter founded in catalogues

Cambridge Photometric Calibration Server

(current version)



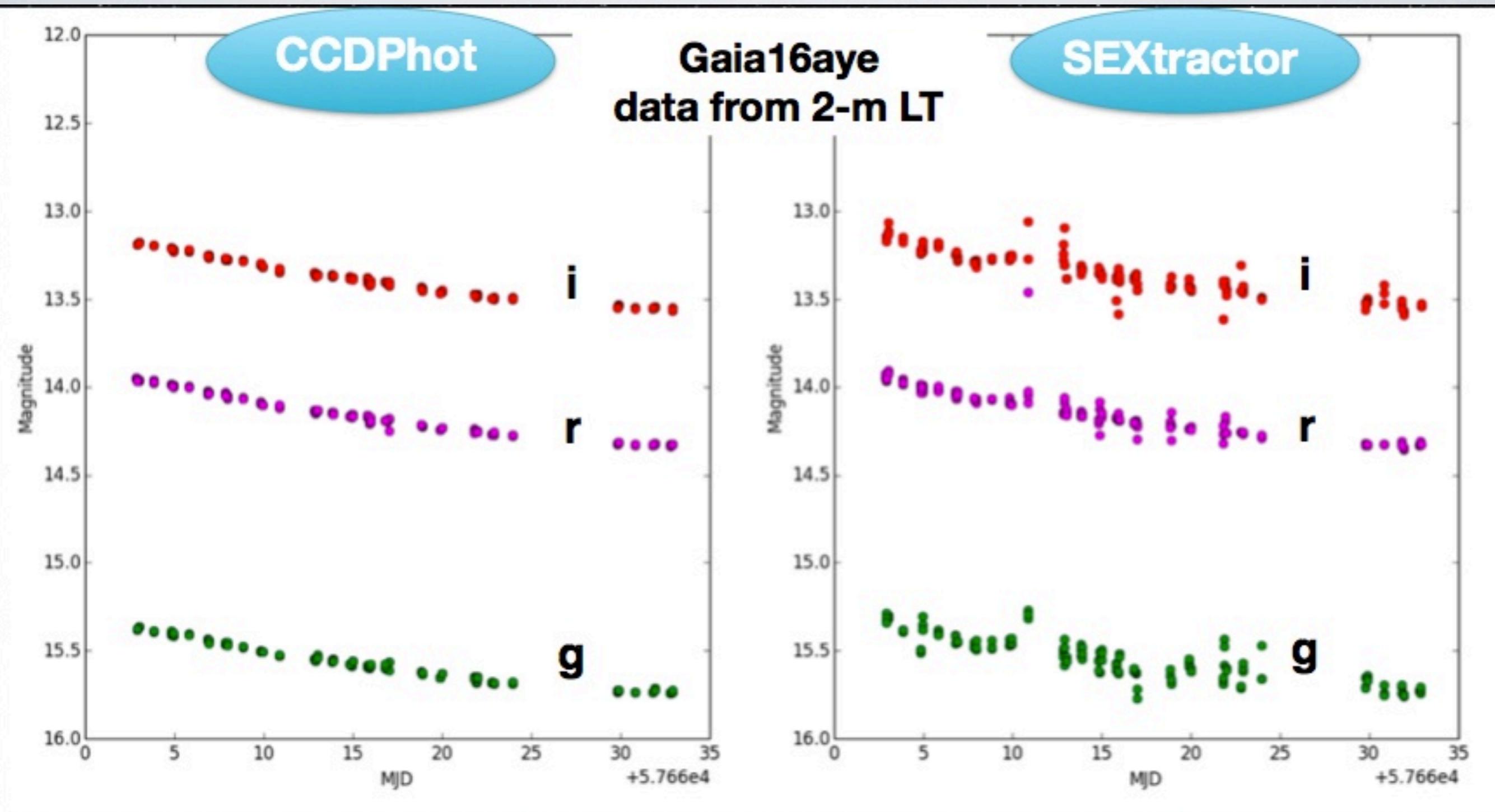
Cambridge Photometric Calibration Server 2.0



Cambridge Photometric Calibration Server 2.0

- Web-based tool to get photometric and astrometric solutions from FITS images
- Precision of **photometric** measurements **~0.01 mag**,
astrometric measurements **~0.01 arcsec**
- **CCDPhot** as a kernel of CPCS 2.0
it uses DAOphot, WCStools, IRAF/PyRAF, SEXtractor, SCAMP
- Scripts for standardisation of FITS headers
- Scripts for automatic selection of PSF stars
- Scripts for transformation of instrumental magnitudes to standard system, reference catalogues: APASS, SDSS, PS1, DES, 2MASS
- Astrometric references: URAT-1, UCAC-4, USNOB1 and Gaia-DR2
- Automatic uploading of the data possible (by using shell scripting)

Precise photometry of CCDPhot

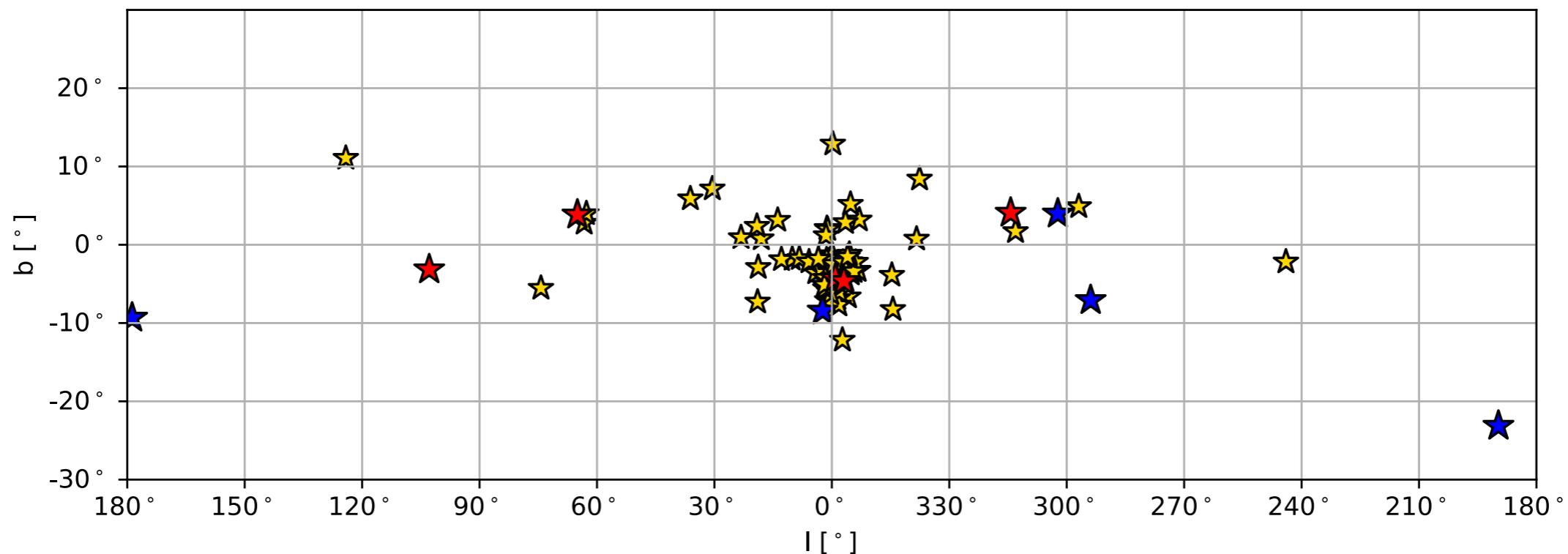


Photometric microlensing - searching for BH

- data from Gaia, ASAS-SN arrives, alert candidates published
- interesting targets identified (microlensing, TDEs)
- information on the mailing list
Gaia Science Alerts Working Group #10 - Photometric Follow-up
- observers monitor the targets
- follow-up observations going to the CPCS

Microlensing candidates

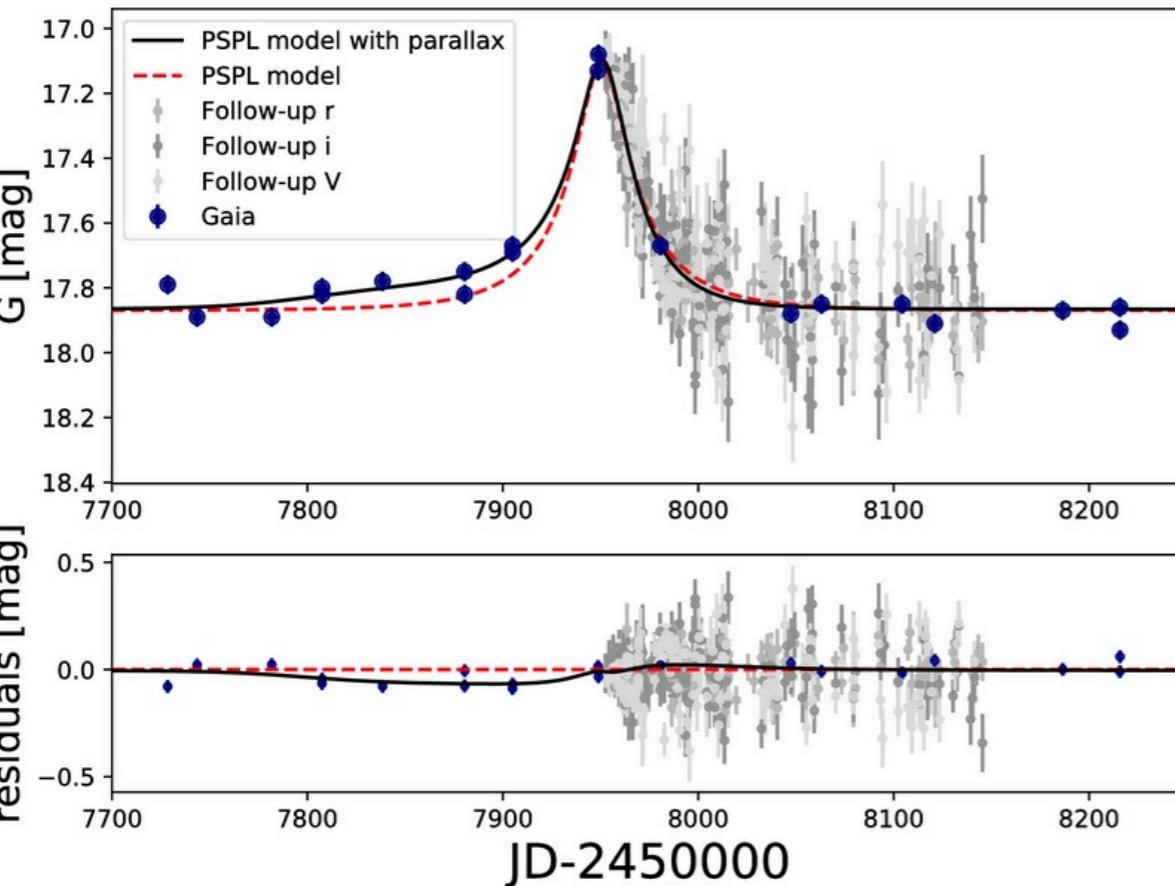
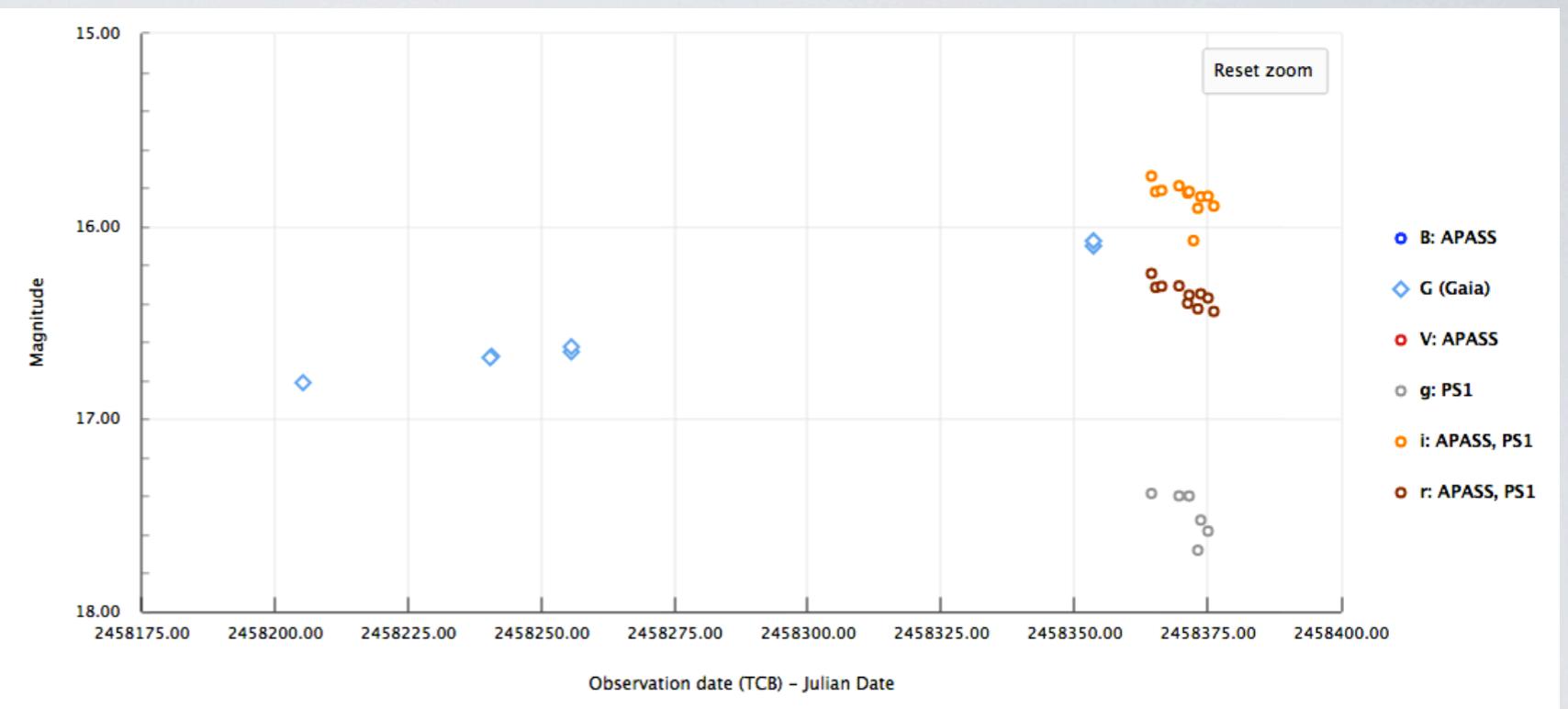
Events gallery



- ★ All candidates (68)
- ★ Candidates brighter than $G=16.5$ mag (5)
- ★ Non-Gaia Candidates (5)

Microlenses - BH candidates

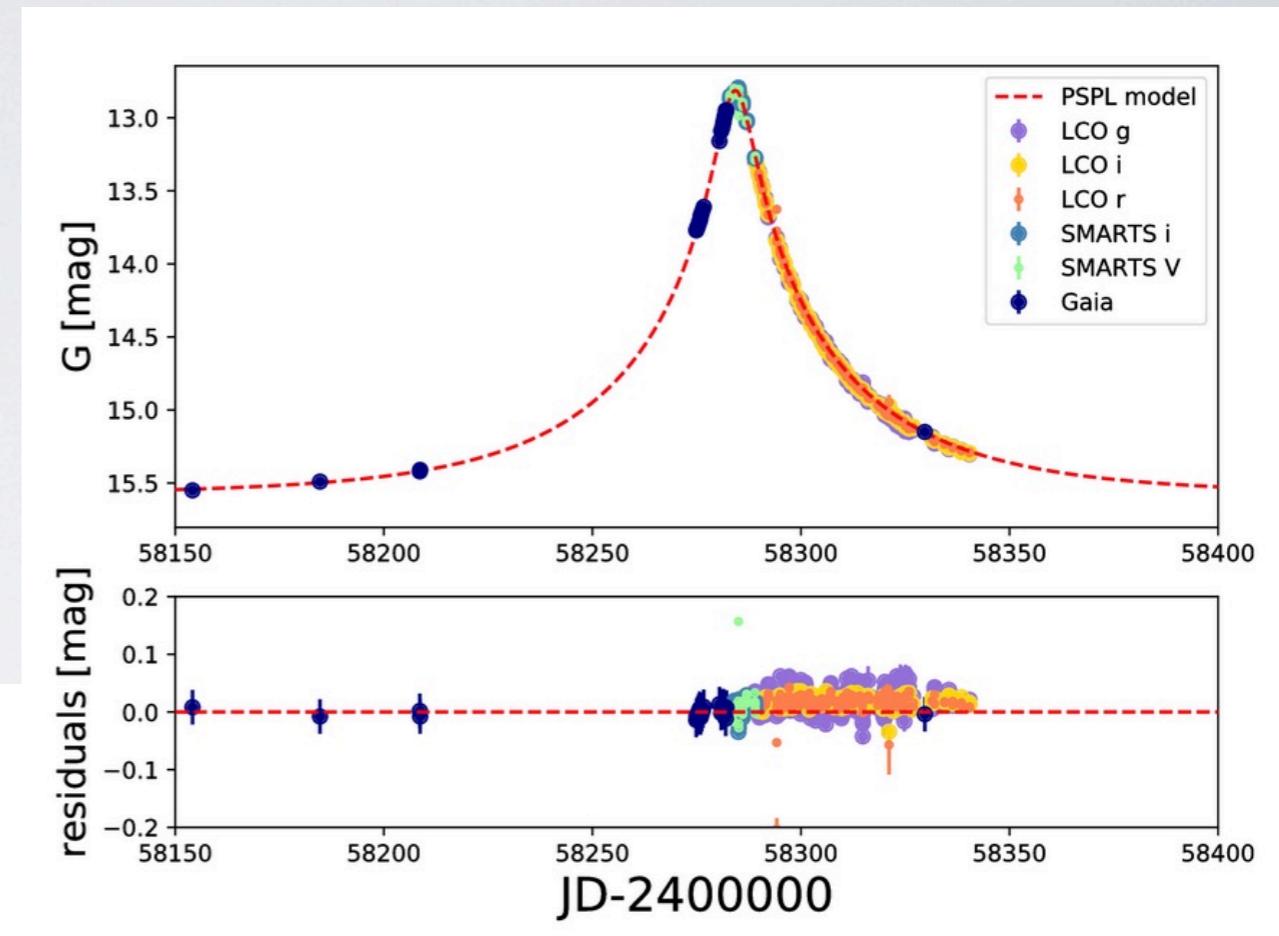
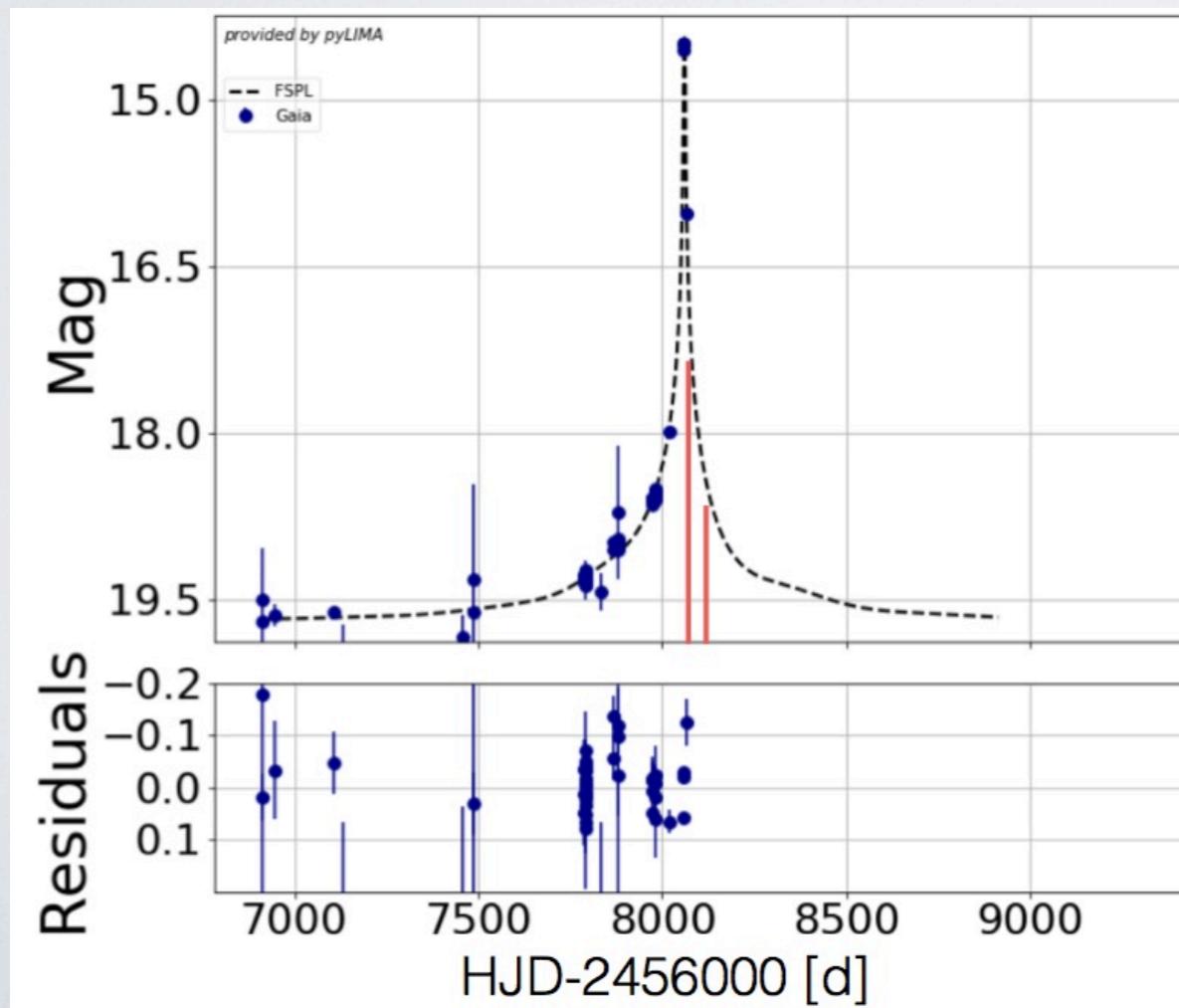
Gaia18cjk - long term
brightening of ~ 1 mag source
in Galactic plane



Gaia17bts - source near Galactic
plane brightens by ~ 0.7 mag
(model by K. Rybicki)

Microlenses - BH candidates

Gaia18bmt - >2 mag rise on a red star in the Galactic plane
(model by K. Kruszyńska)



Gaia17ctl - source near Galactic plane brightens by 4.5 mag
(model by K. Kruszyńska)

Summary

- **CPCS 2.0** is tested on various data from different telescopes/instruments, old website rebuilt, work in progress...
- Feel invited to cooperation in the follow-up network!
- Join our mailing list GSAWG#10 - Photometric Follow-up contact **Łukasz Wyrzykowski**: lw@astrouw.edu.pl
- You can use it for your own research independently!

Thank you!

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