



First Season of the LCOGT Microlensing Key Project

*Image credit: Frank Cianciolo
McDonald Observatory*

Rachel Street and the RoboNet Team

LCOGT v1.0 – Operational May 1, 2015



6 sites operational

Haleakala, USA
Sedgwick, USA
CTIO, Chile
McDonald, USA
SAAO, South Africa
Siding Spring, Australia

12 telescopes

1 x 0.8m
9 x 1.0m
2 x 2.0m

5 instrument classes

SBIG imagers
Sinistro imagers **NEW**
Spectral imagers
Merope imagers
Floyds spectrograph

➔ **1 robotic network**

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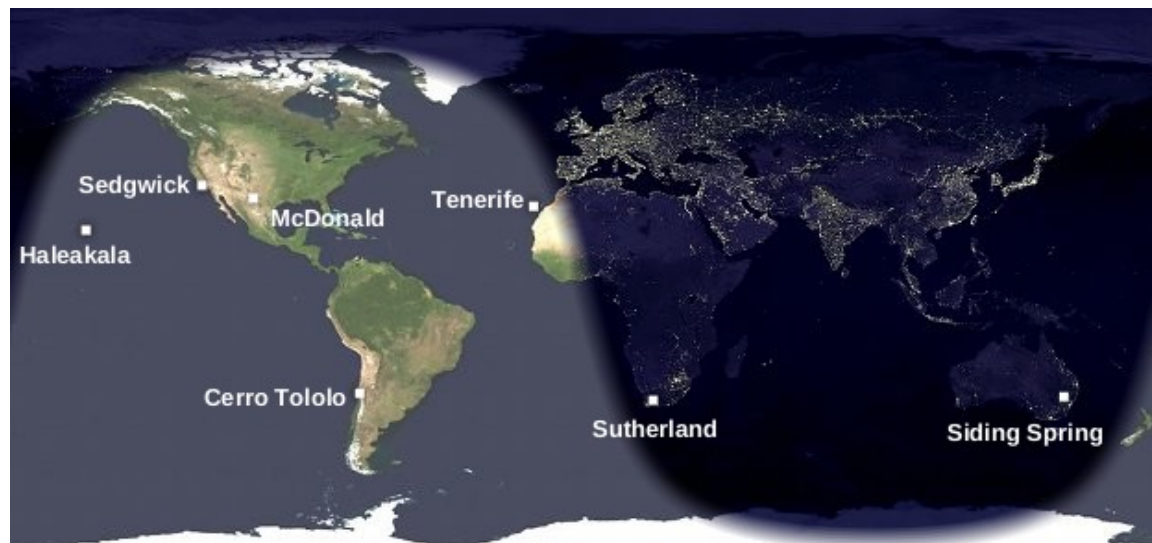
Major underlying changes = significant upgrades

- Completed new network control software
- Transitioned FTN and FTS to new TCS for network integration
- Commissioning of Sinistro cameras
- Commissioning of Floyds spectrographs
- Upgrades to LCOGT data pipeline
- Upgrades to full-network dynamic scheduler
 - Any target, any telescope, any time
 - Cadence series, more complex observations possible
 - Target of Opportunity override

Significant challenges:

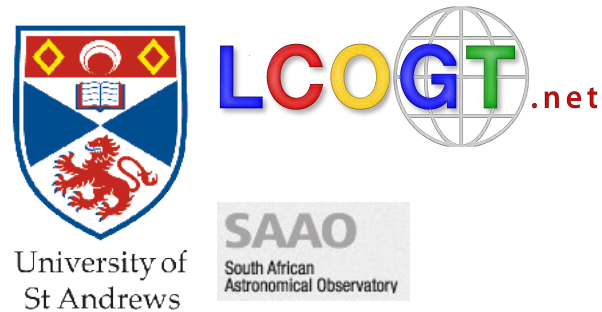
- Camera failures
- Collimation hold issues
- Flat fielding issues
- Focus issues
- Scheduling efficiency

...



Microensing Key Project

- Time allocation on whole LCOGT network ~2500hrs annually for 3 years
Target of Opportunity now available
- Complemented by St. Andrews-led proposals to the Liverpool Telescope
- Collaboration between LCOGT Partner Institutions
- We welcome new collaborators from Heidelberg and IAP

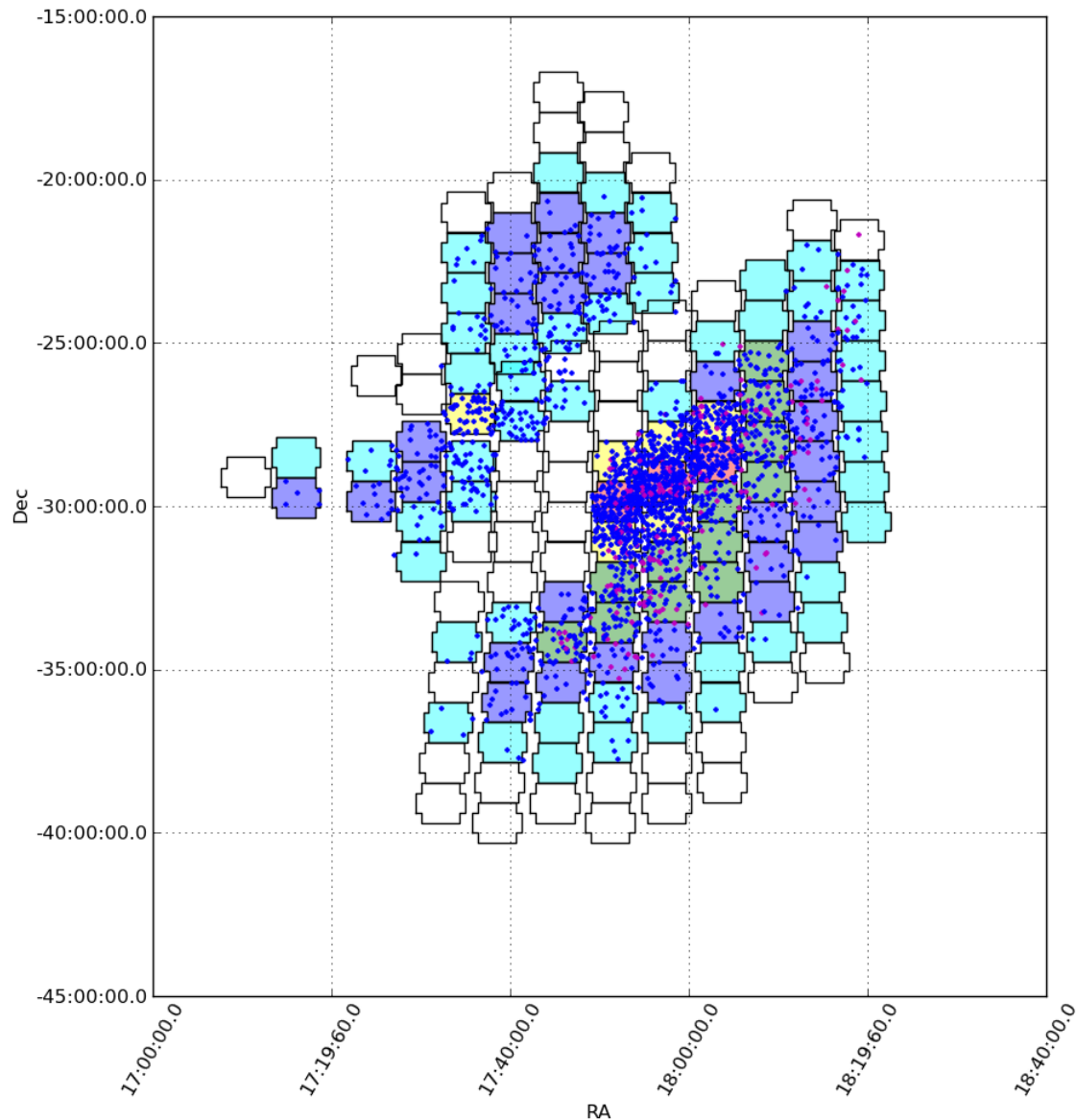


Observing Strategy

- Select events to maximize planet detection probability
- Prioritize events from low cadence zones
- Building tile reference fields

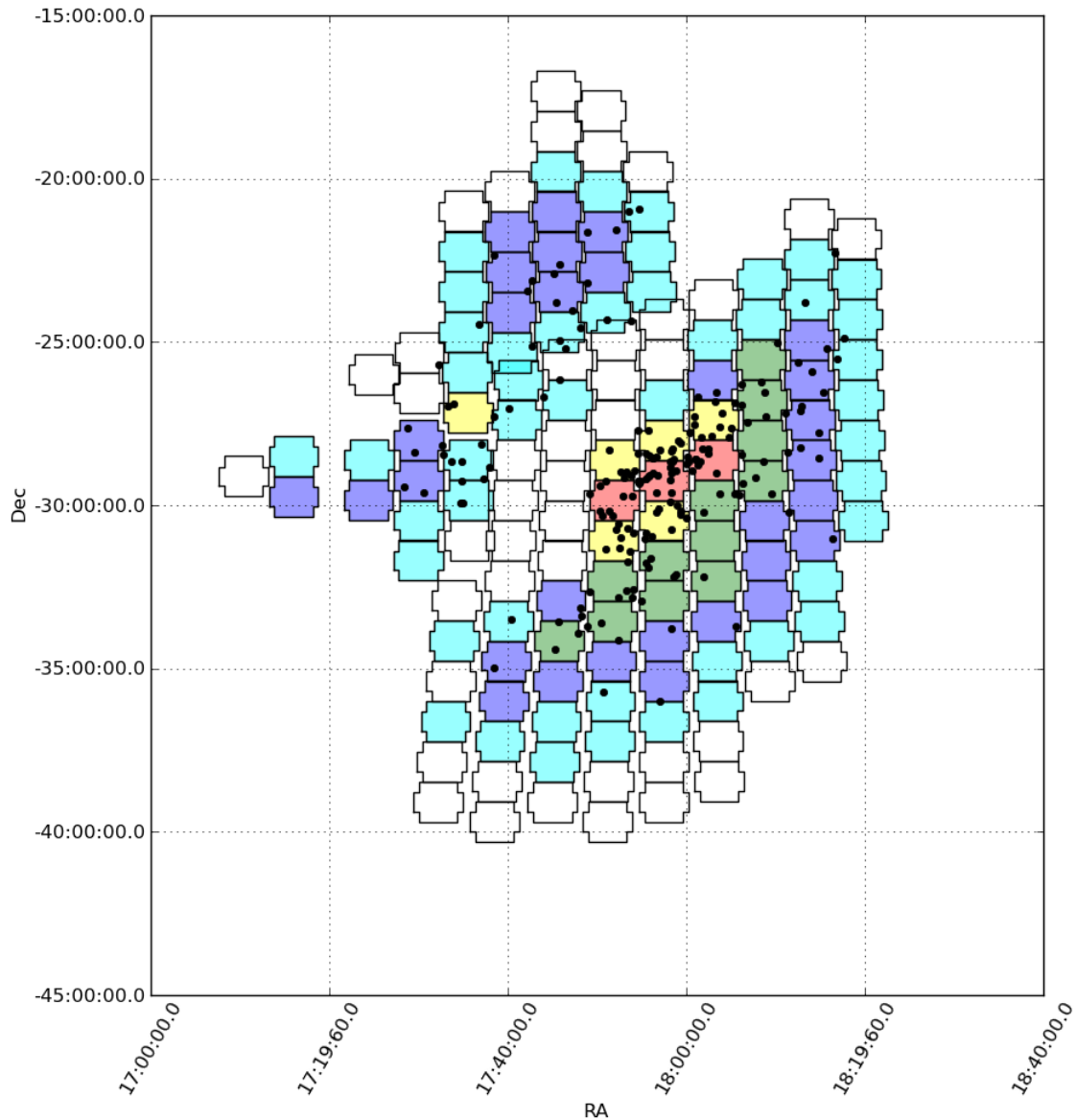
*Detailed description in prep, see
Hundertmark et al. 2015*

Focus on Low Cadence Zone



2285 events in total
1043 in high cadence zone
1242 in low cadence zone

Focus on Low Cadence Zone



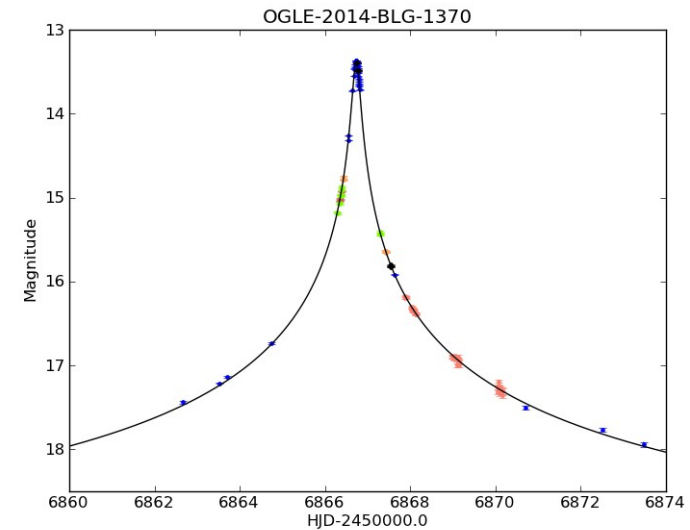
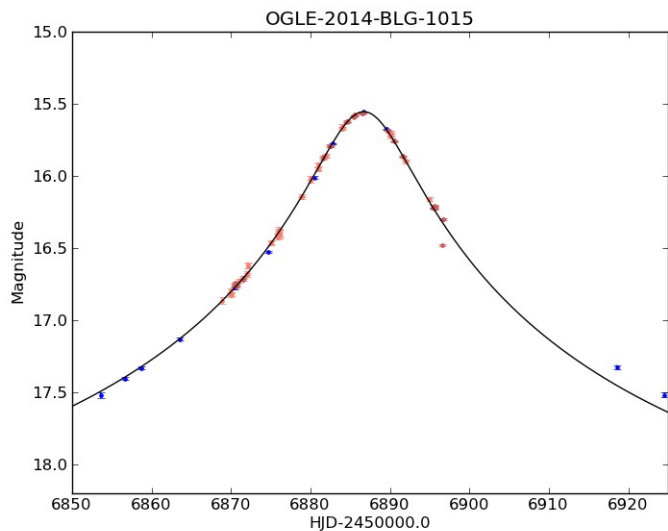
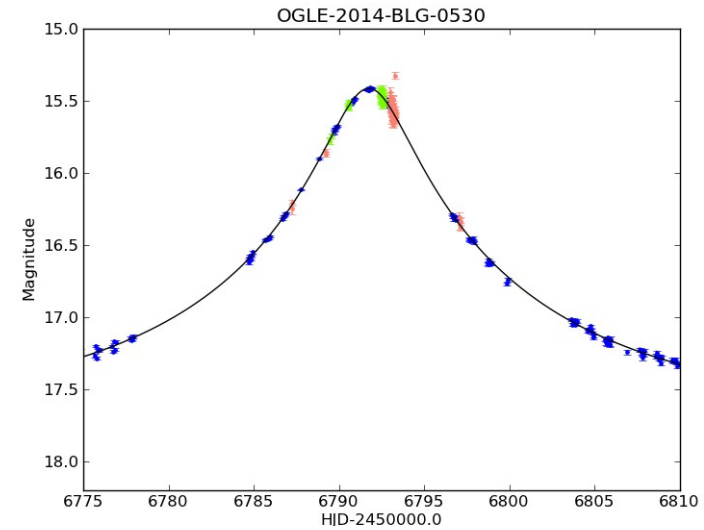
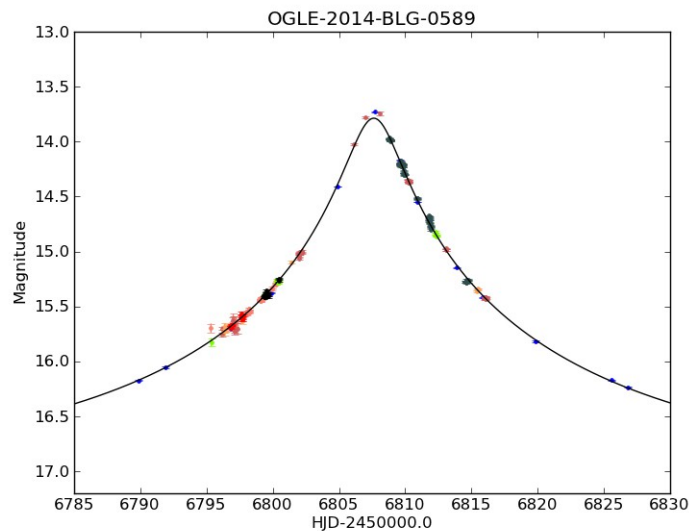
Observed 191 events

87 high cadence fields
104 low cadence fields

Distribution of events \neq time spent

Monitoring Events

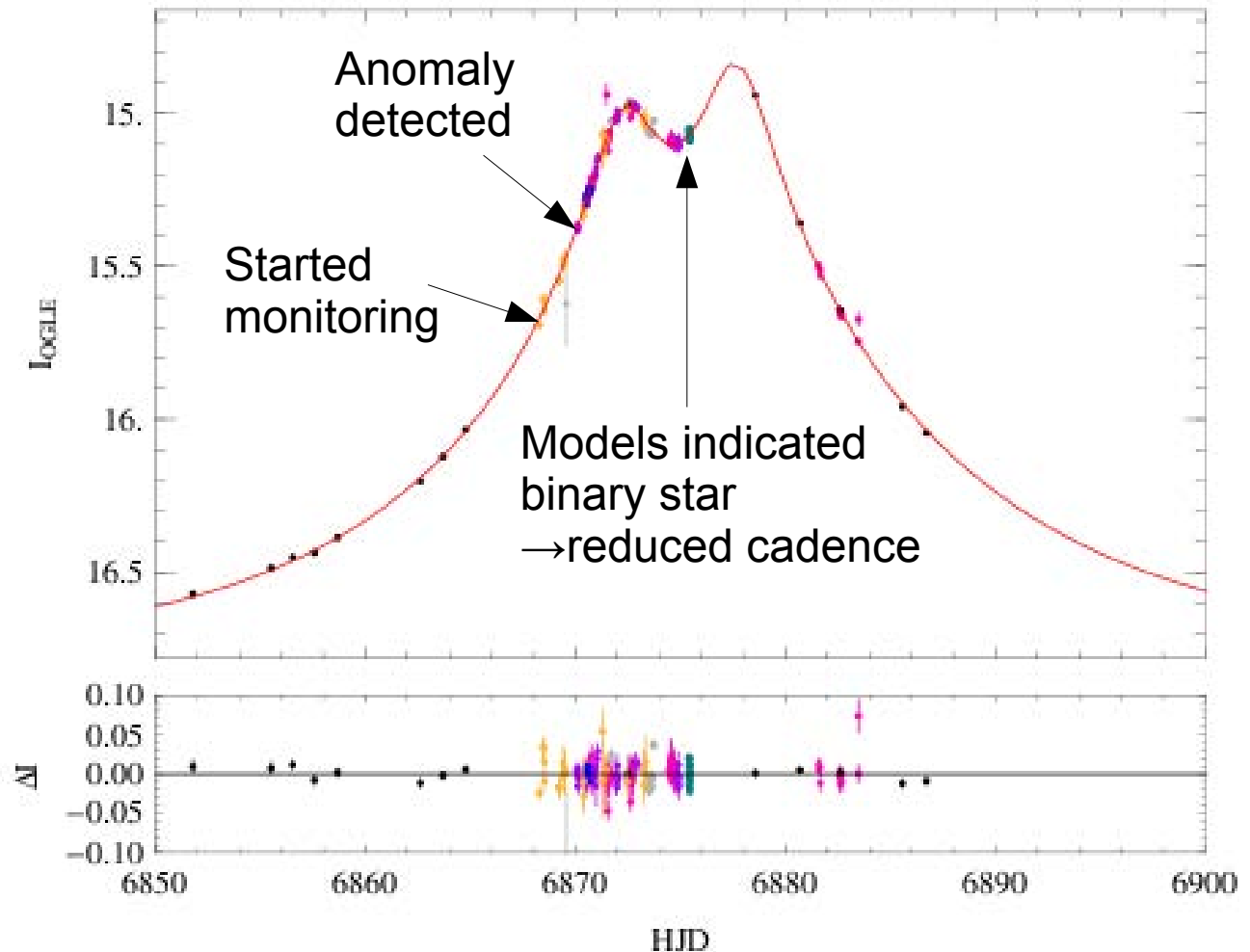
- Complementing survey coverage to expand sample of anomalies detected



Anomaly detection and modeling

- Automatic monitoring of events during rise complementing survey coverage
- Cadence increases around peak/anomalies
- Anomalies alerted via ARTEMiS/human report
- Triggers modeling by RTModel
→ feeds back to cadence

OGLE-2014-BLG-1329



Models by RTModel, [Bozza et al. 2010]

Season 2014 Planets

- Combining real-time modeling from Han and Bozza:
- At least 9 planets
- Additional 7 more possible planets

Planets

Event	MOA-0069/ OGLE-0221	MOA-0472	OGLE-0124/ MOA-0307	OGLE0319 / MOA-171	OGLE0676/ MOA-175	OGLE-1186	OGLE-1413	OGLE-1722/ MOA-0490	OGLE-1760/ MOA-0547
Data?	✗	✗	✓	✓	✓	✓	✓	✗	✓

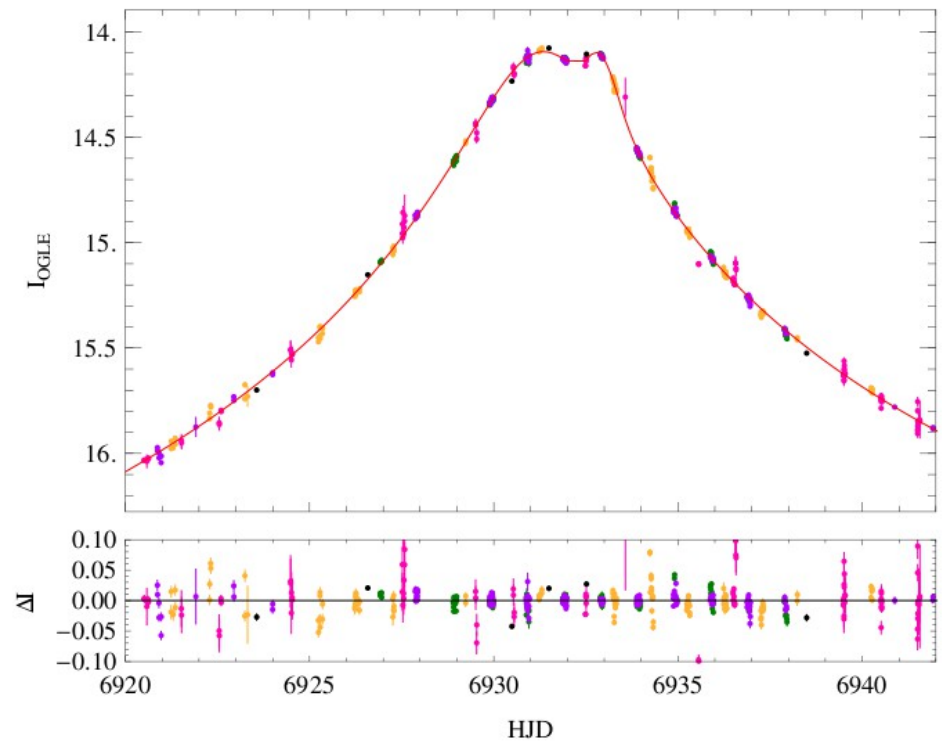
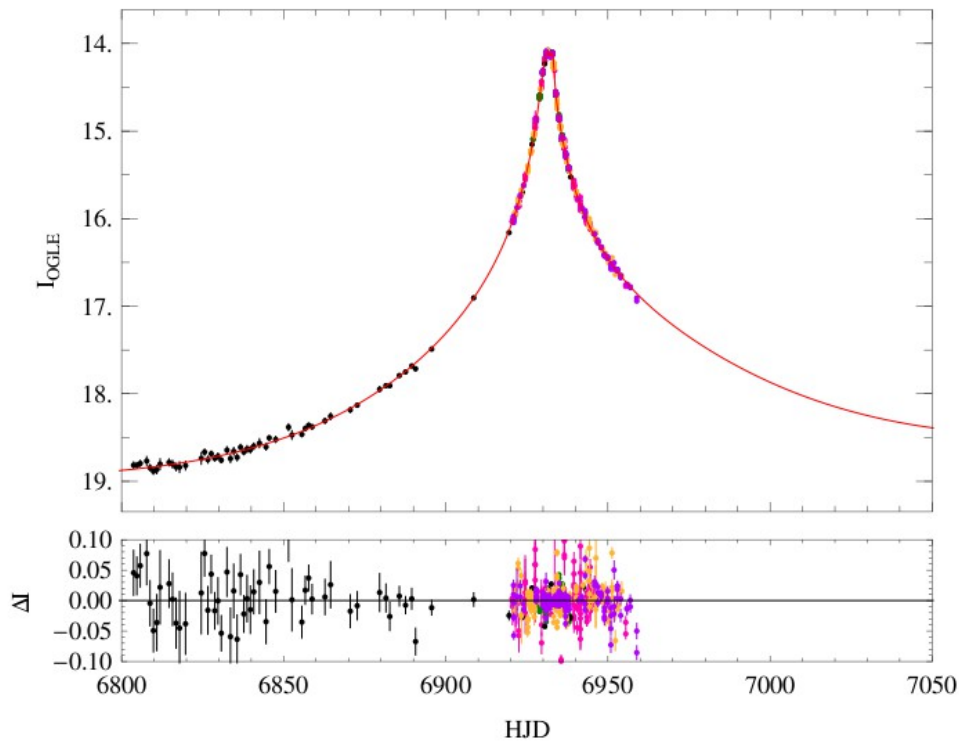
Event	OGLE-1122/ MOA-0336	MOA-0051/ OGLE-0251	MOA-0198/ OGLE-0764	MOA-0472/ OGLE-1783
Data?	✓	✗	✓	✓

Planets/binary lens

Event	MOA-0051/ OGLE-0251	MOA-0270	OGLE-0706/ MOA-0222	OGLE-1102	OGLE-1112/ MOA-0368	OGLE-1275	OGLE-1419
Data?	✗	✓	✓	✓	✓	✓	✗

Season 2014 Highlights

- OGLE-2014-BLG-1186
- Data on other targets being re-processed now



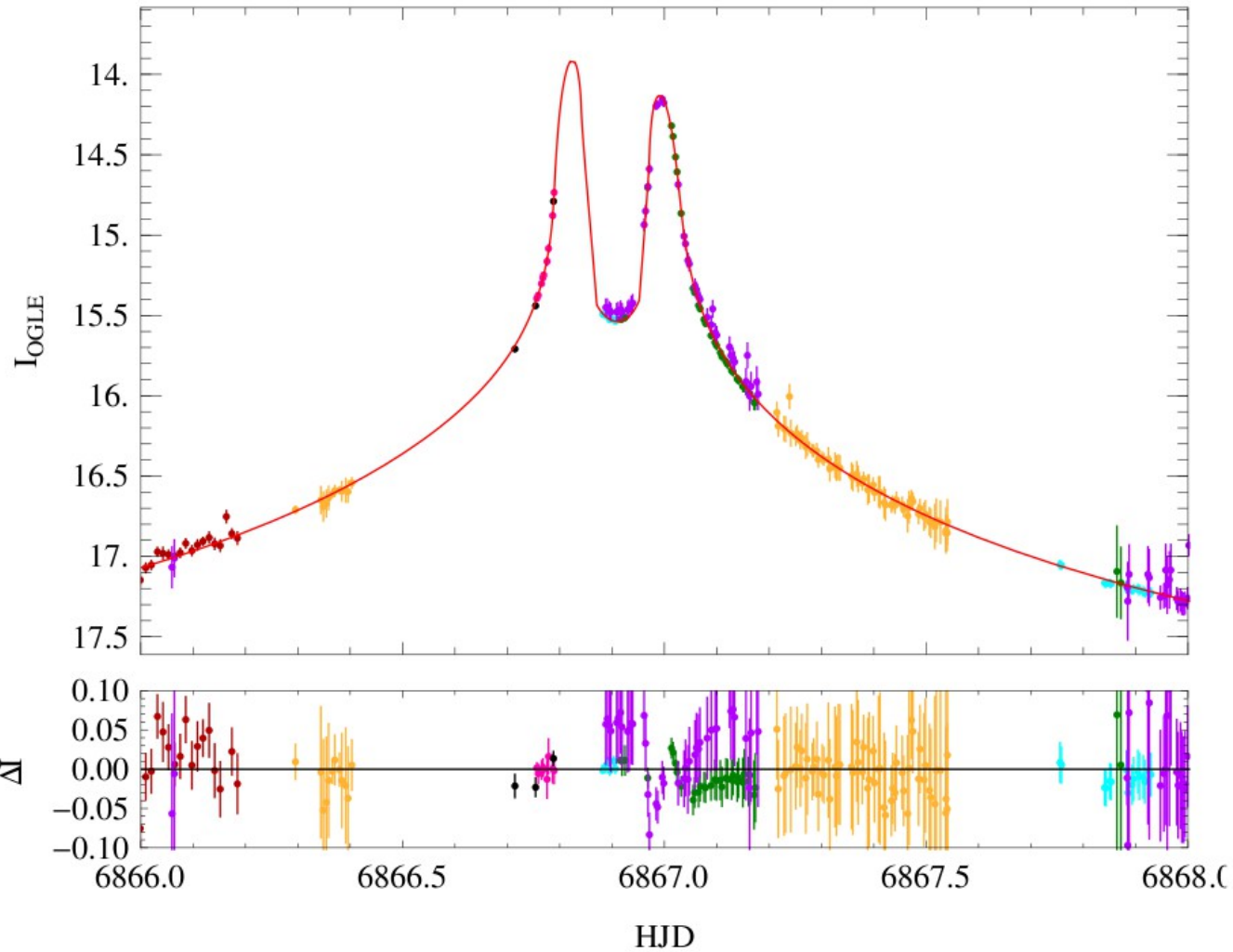
See talk by Martin Dominik

Other Events of Interest

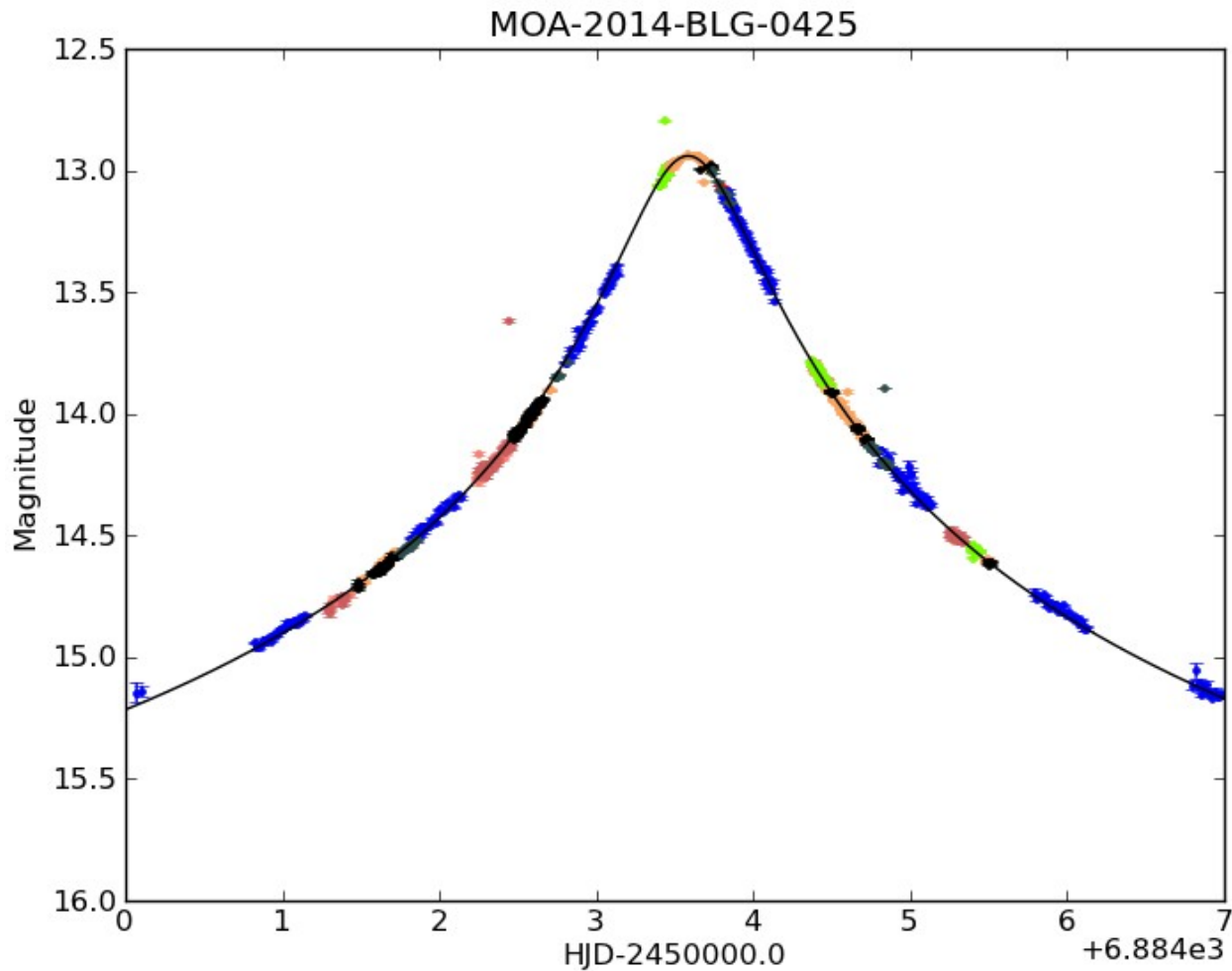
OGLE-2014-BLG-1507 /
MOA-2014-BLG-0438

Binary lens

OGLE
MOA
All other colors from LCOGT



Other Events of Interest



MOA-2014-BLG-0425

Low amplitude anomaly alert(?)

MOA

All other colors from LCOGT

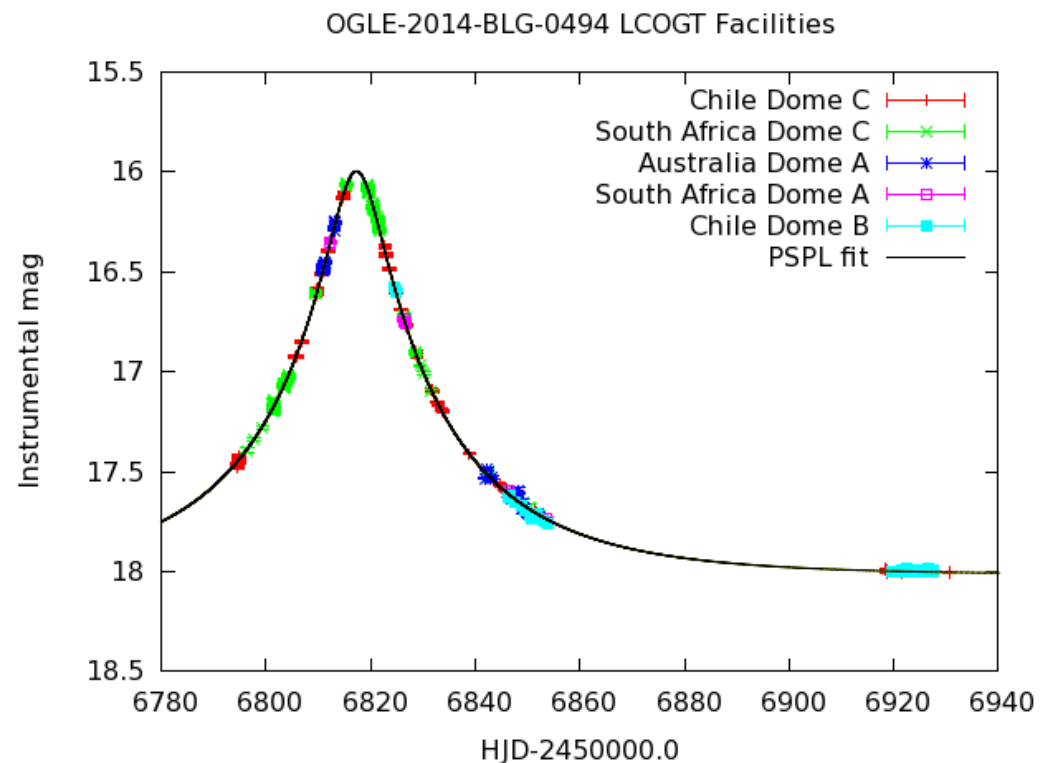
Spitzer Program

- Conducted supporting observations June 2-26
- 24 targets monitored upon request
- Early phase of v1.0 launch → manual interaction/reduction
- Exceeded time available per site (regular program hiatus)

Useful coverage of:

OGLE-2014-BLG-0124/MOA-2014-BLG-0307
OGLE-2014-BLG-0099/MOA-2014-BLG-0109
OGLE-2014-BLG-0494/MOA-2014-BLG-0156
OGLE-2014-BLG-0589
OGLE-2014-BLG-0874/MOA-2014-BLG-0302

OGLE-2014-BLG-1050 (under reduction)
OGLE-2014-BLG-0289 (largest dataset, under reduction)



Data Release Plan

- Avoid piecemeal reduction → reduce all data (>32,000 frames)
- More consistent, careful reduction
- Order of priority:
 - Events where our dataset substantially characterize event
 - Other events of interest
 - Rest of data
- Data releases rather than individual events

- Lightcurve data for all stars to eventually go public via IPAC archive

Looking Forward: 2015 onwards

Tile Field Program

Etienne Bachelet

- New wider-field Sinistro cameras
- Preparing deep reference frames for common fields
 - Faster data reduction
 - Better quality lightcurves, sooner
- Pipeline integration



Looking Forward: 2015 onwards

- Preparing 2014 data for publications
- First season Key Project status report due
- Observations will start shortly!
- Spitzer?



K2? Need efficient use of resources

