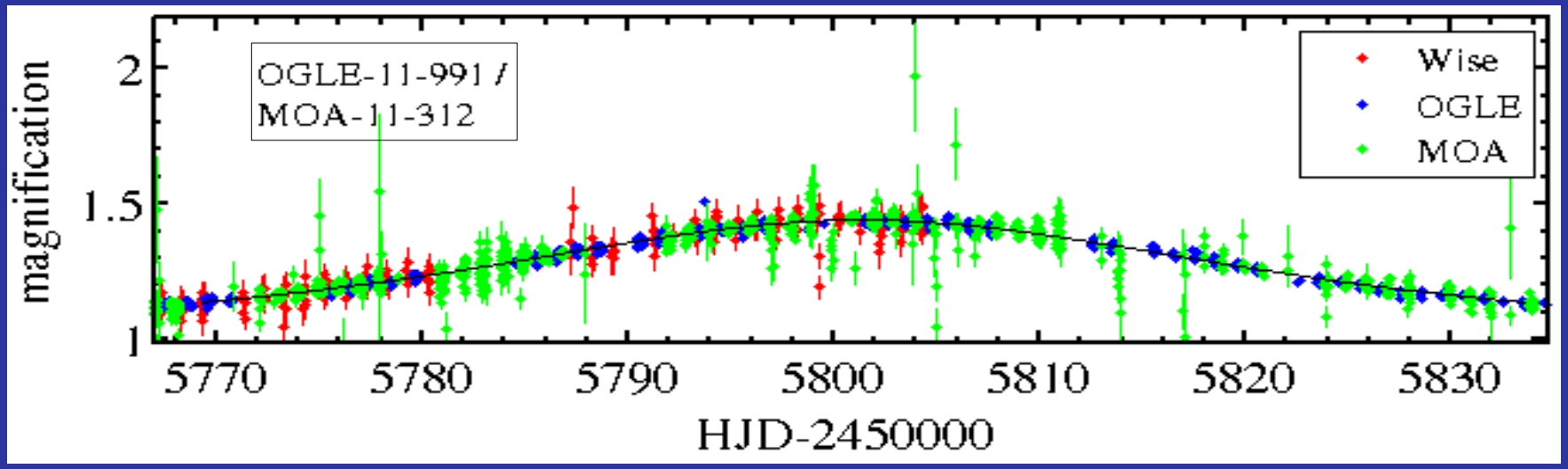
First Results from the Generation-II OGLE-MOA-Wise survey 2011 season

Yossi Shvartzvald Tel-Aviv University
with Dan Maoz, in collaboration with OGLE, MOA, μFUN



Shvartzvald & Maoz, 2012, MNRAS.419.3631S

Introduction

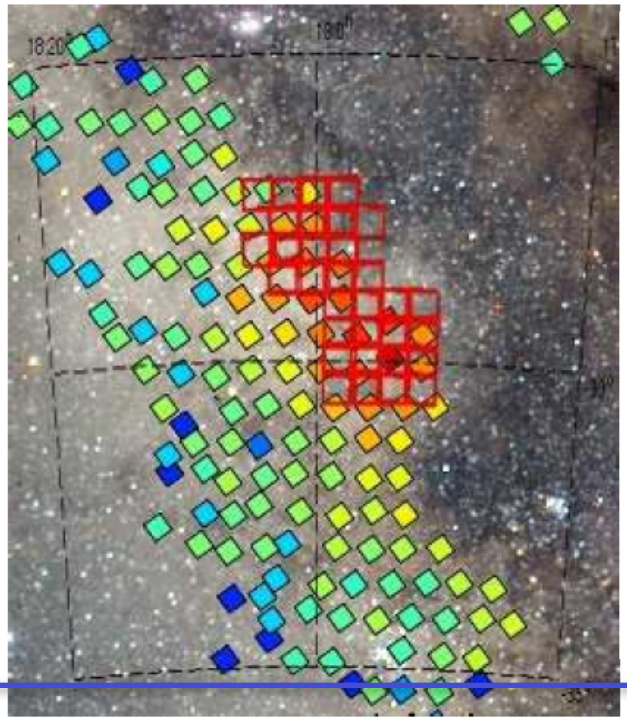
Second generation

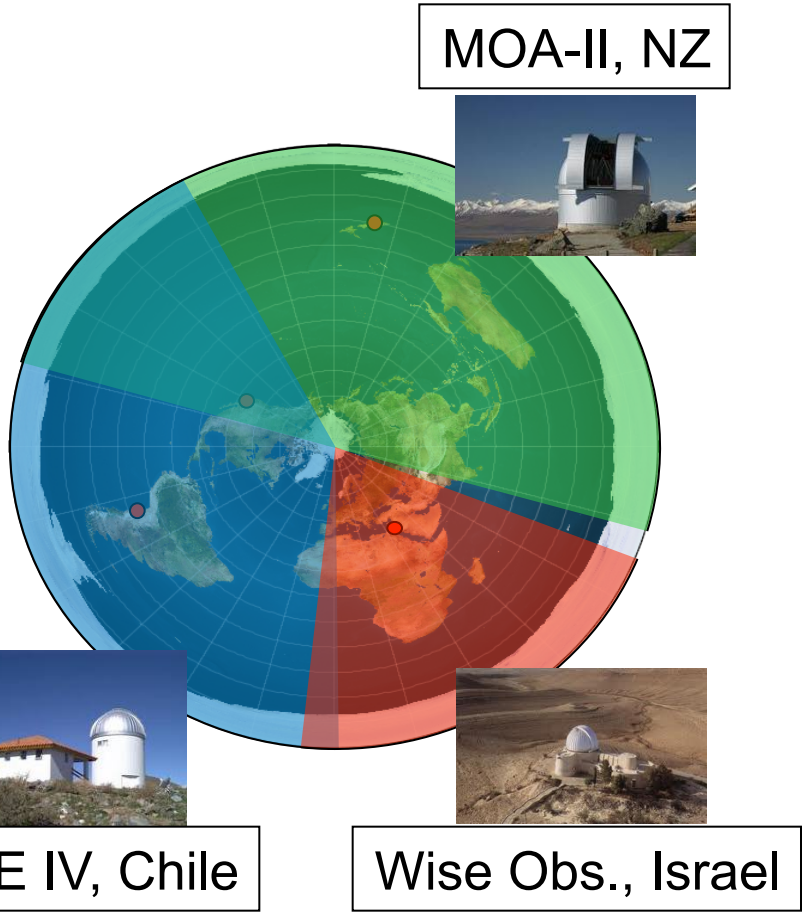
Controlled experiment: frequency of planetary systems

- Global network, 1-2m class telescopes, degree scale imagers
- Continuous, high-cadence, monitoring of significant fraction of **ALL** events (not only high-mag)

The generation-II network

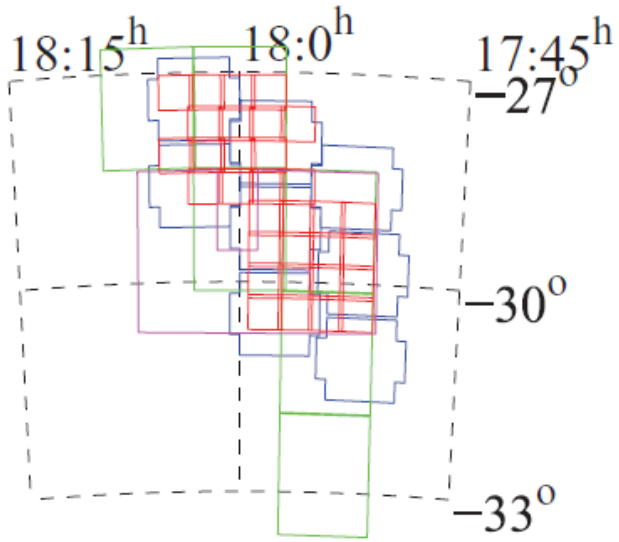
Group	Cadence [min]	Area [deg^2]
OGLE	15-45	11.2
MOA	15	13.2
Wise	30	8.0

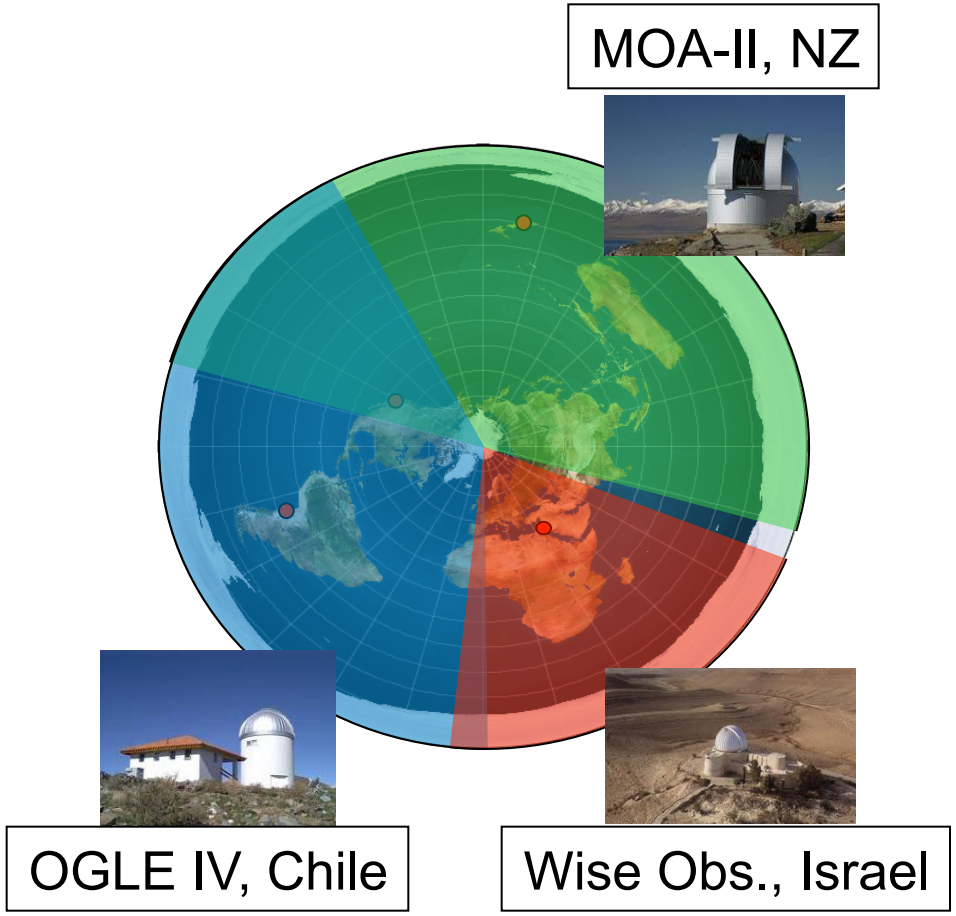




The generation-II network

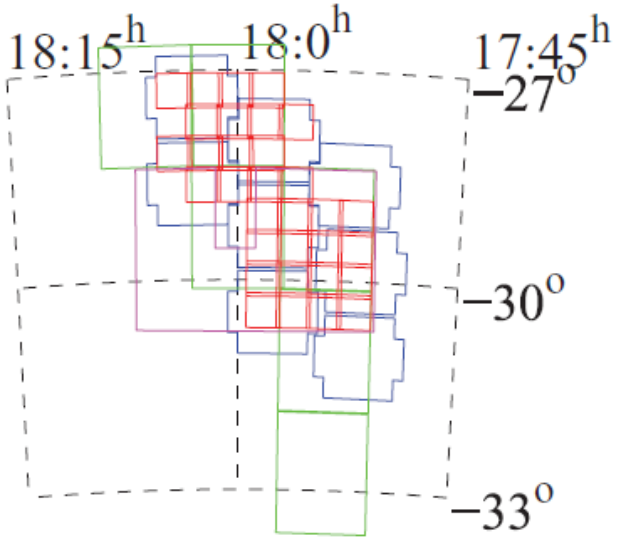
Group	Cadence [min]	Area [deg^2]
OGLE	15-45	11.2
MOA	15	13.2
Wise	30	8.0

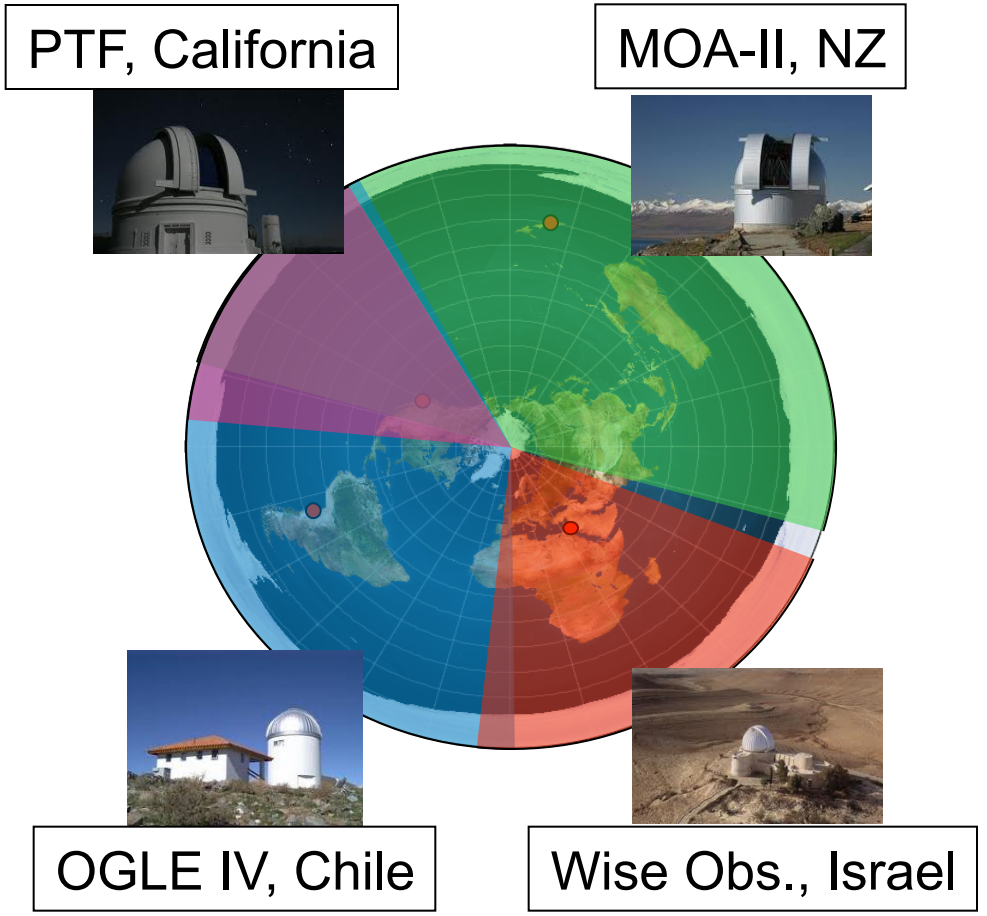




The generation-II network

Group	Cadence [min]	Area [deg^2]
OGLE	15-45	11.2
MOA	15	13.2
Wise	30	8.0
PTF	40	7.8



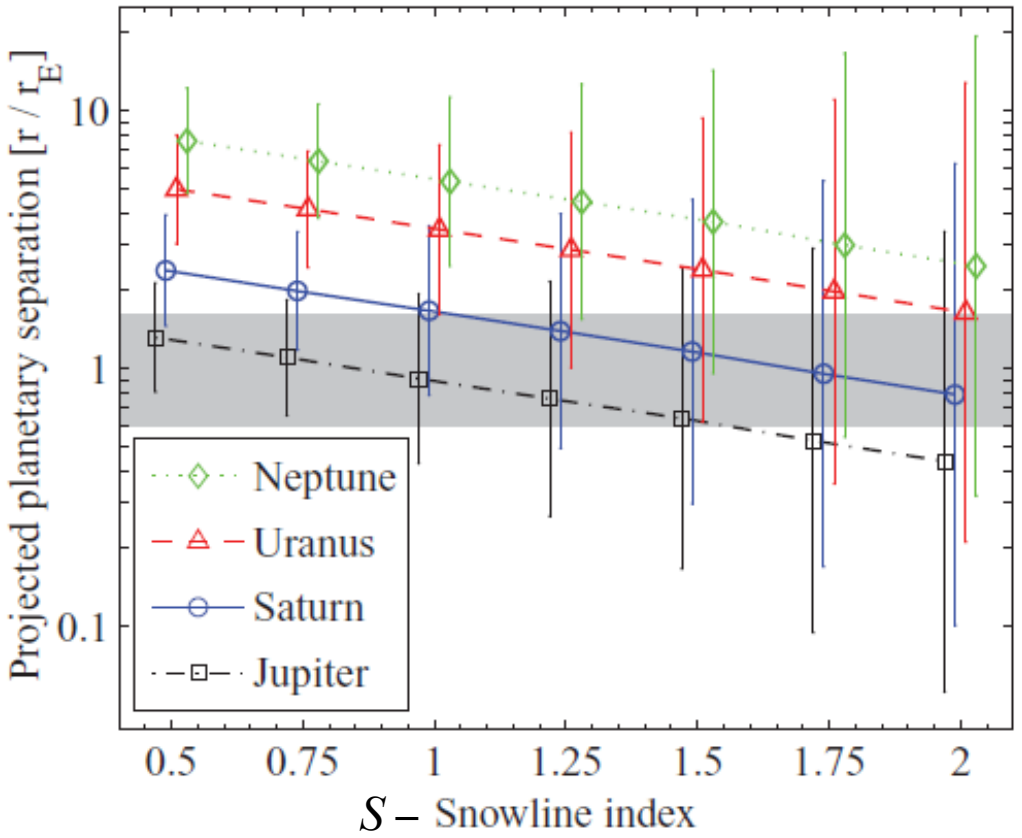


Simulations

- Monte-Carlo simulations of scaled Solar-like systems:

$$R \propto \left(M_{Lens} \right)^{S}$$

- Real sampling sequences and photometric errors



Shvartzvald & Maoz 2012

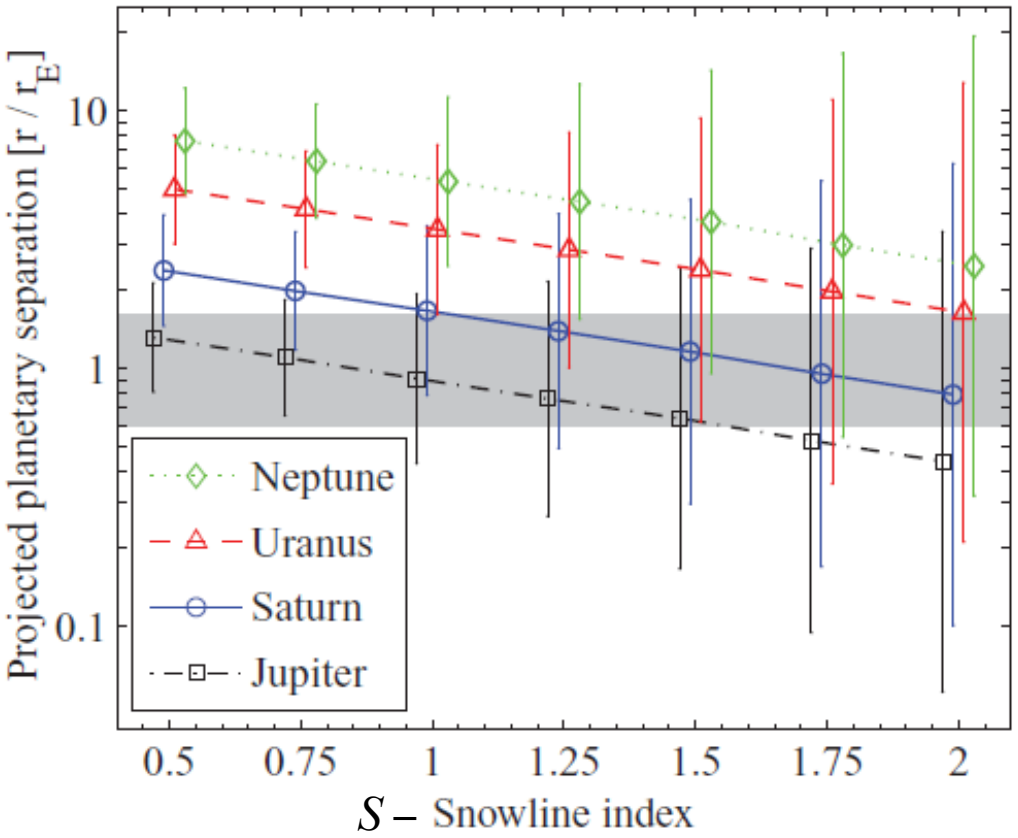
Simulations

- Monte-Carlo simulations of scaled Solar-like systems:

$$R \propto \left(M_{Lens} \right)^{S}$$

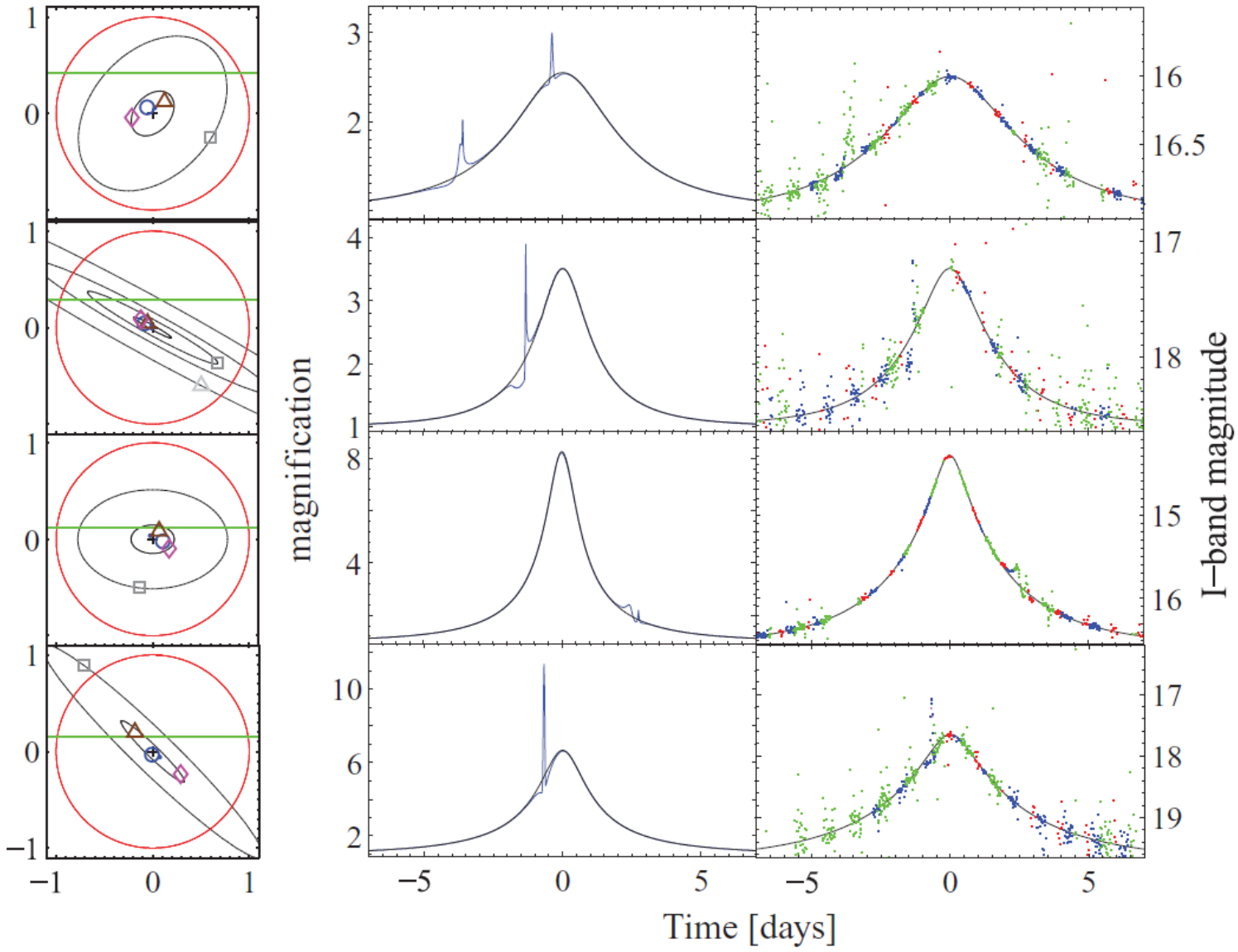
- Real sampling sequences and photometric errors

- Assumptions:
  - Planetary system frequency: $f = 1$
  - 340 events/season (observable by all sites)



Shvartzvald & Maoz 2012

Simulations



Predictions

Anomaly detection criteria

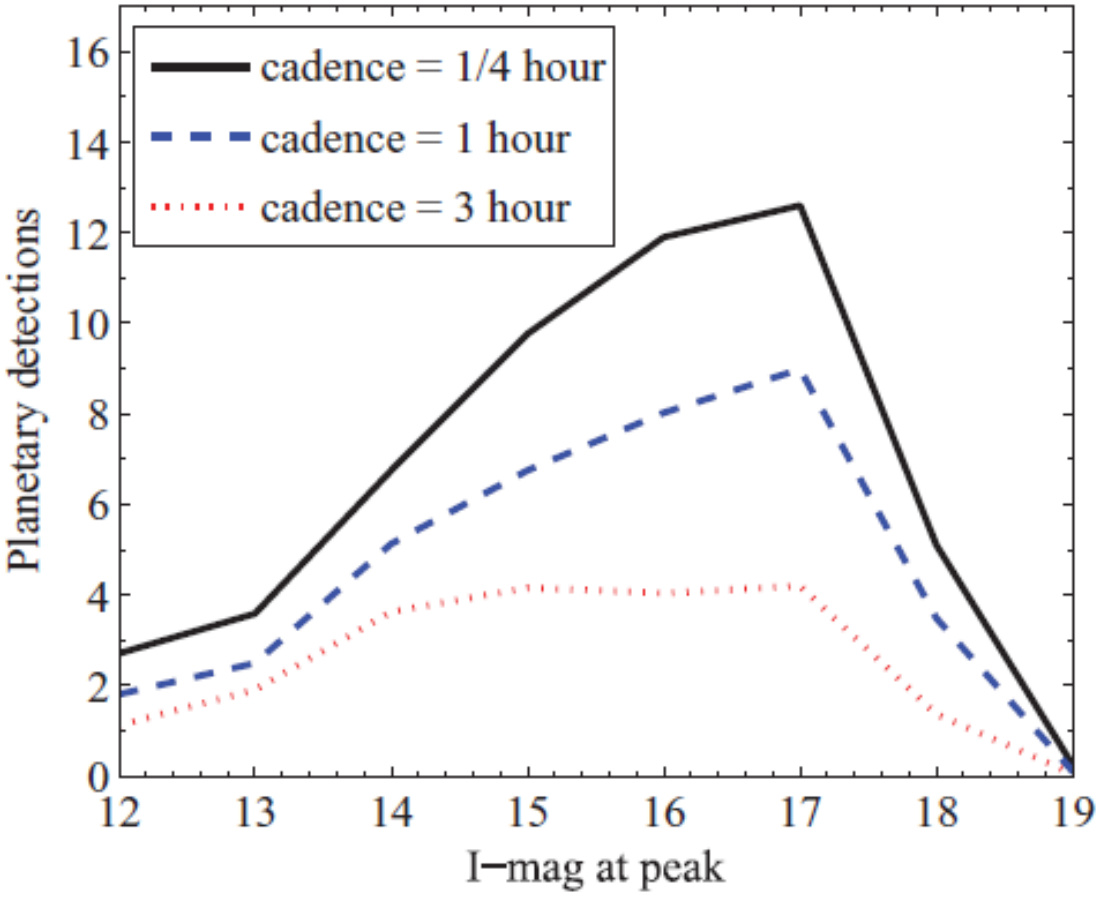
- Same for simulations and real observations
- Detection and not complete characterization

- 1st step: Point-lens model to inter-calibrate 3 datasets
- 2nd step: Running χ^2-test:

$$P\left(\chi^2_{local}\right) > 3\sigma$$

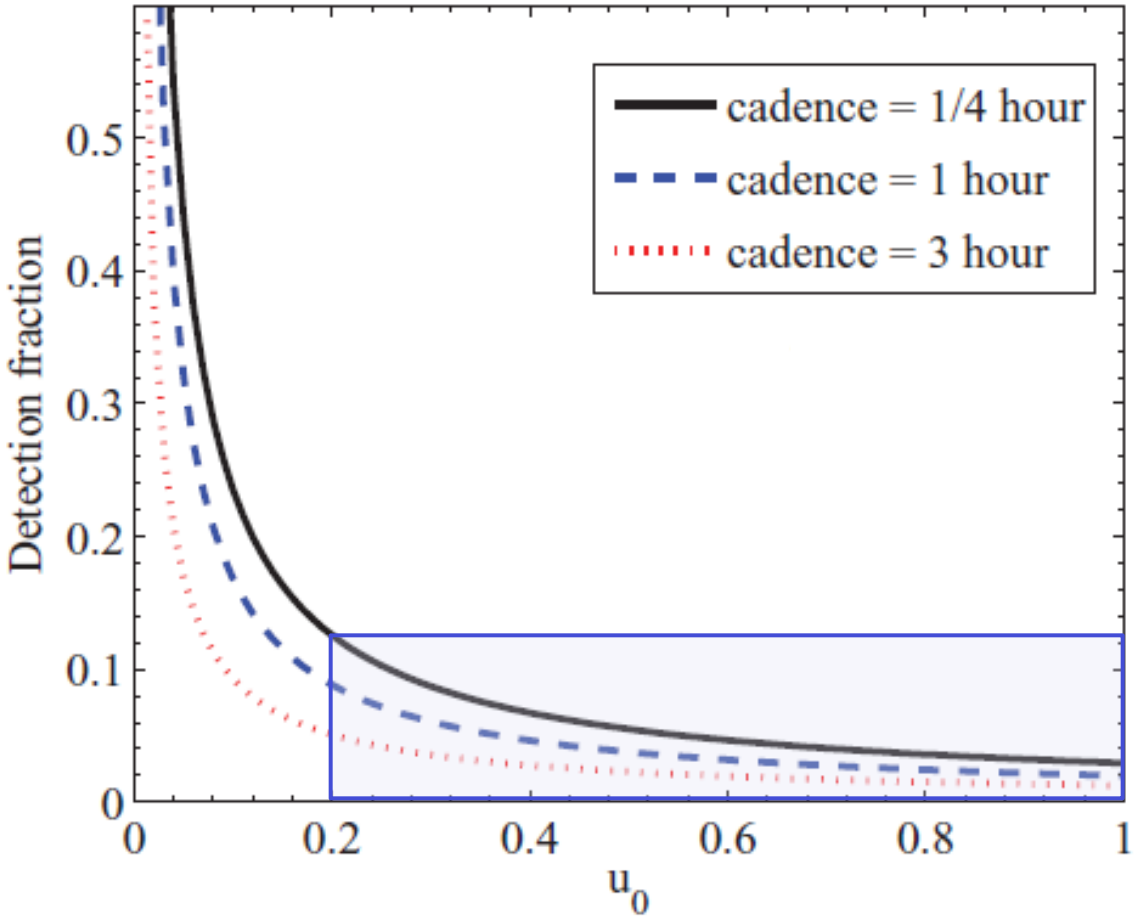
Predictions

Limiting event peak magnitude: I~17

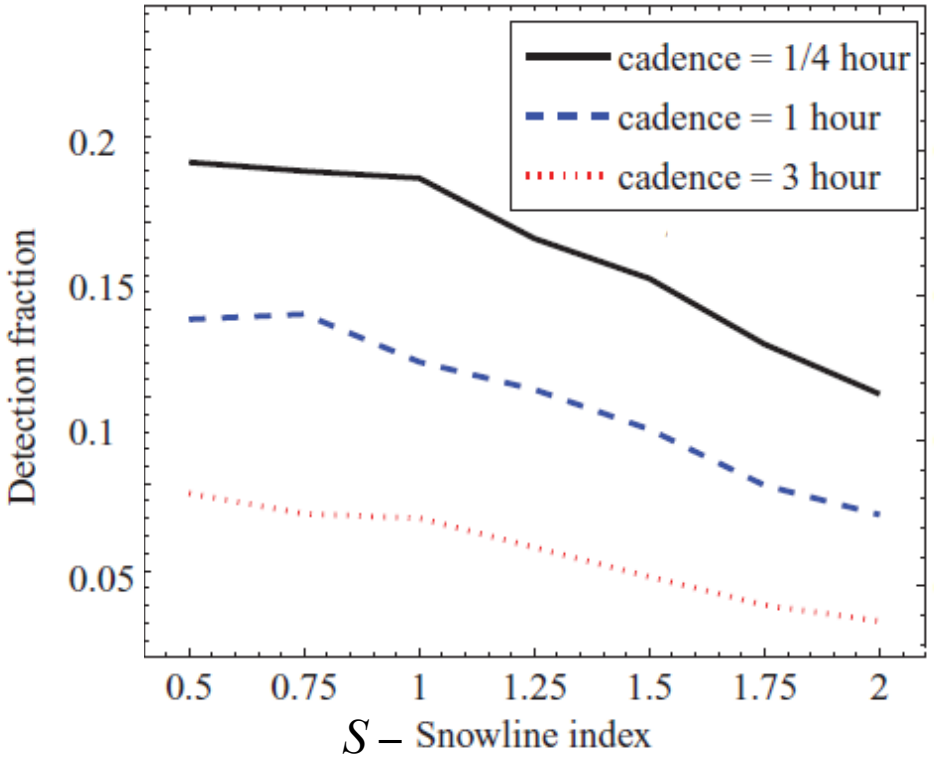


Predictions

Low magnification sensitivity



Predictions

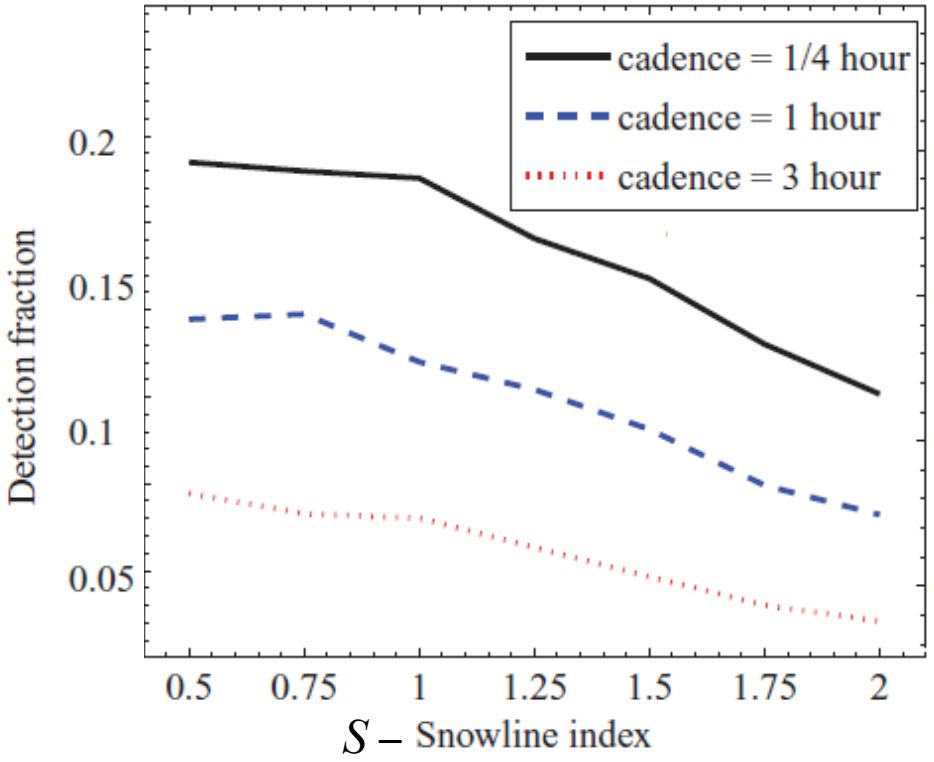


Shvartzvald & Maoz 2012

Predictions

Example:

- 100 events (all 3 sites)
- $f = 1/6$ (Gould et al. 2010)
- Snowline index, s=1



Seasonal predictions:

- 3.3 ± 1.4 planetary detections
- +30% contamination by binaries

Shvartzvald & Maoz 2012

2011 season statistics

	OGLE & MOA	OGLE only	MOA only	Total
Events	219	1084	191	1494
Wise footprint	97	360	41	498

2011 season statistics

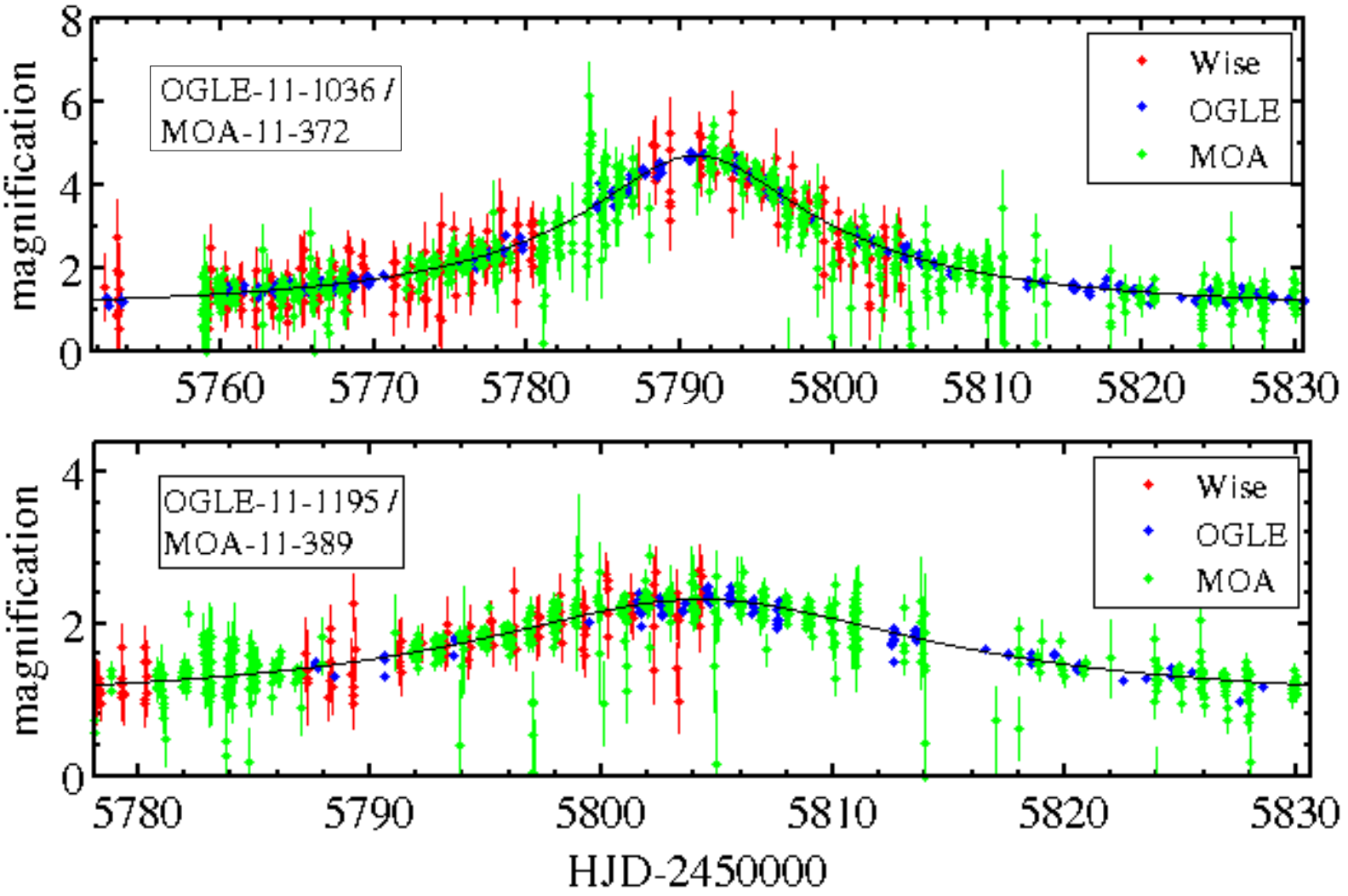
	OGLE & MOA	OGLE only	MOA only	Total
Events	219	1084	191	1494
Wise footprint	97	360	41	498

2011 season statistics

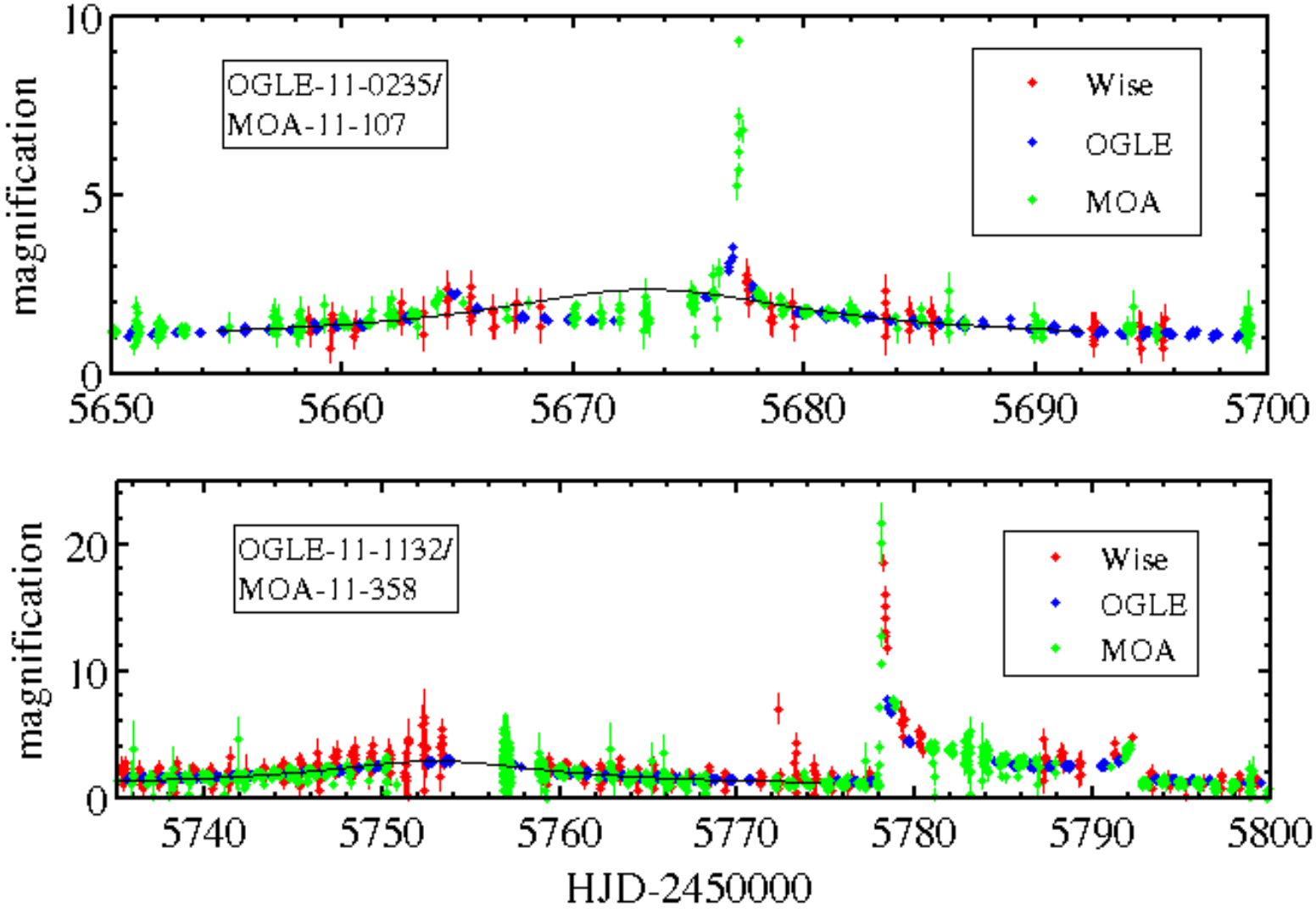
	OGLE & MOA	OGLE only	MOA only	Total
Events	219	1084	191	1494
Wise footprint	97	360	41	498

	Anomalies
Planetary	2
Binaries	4
???	8

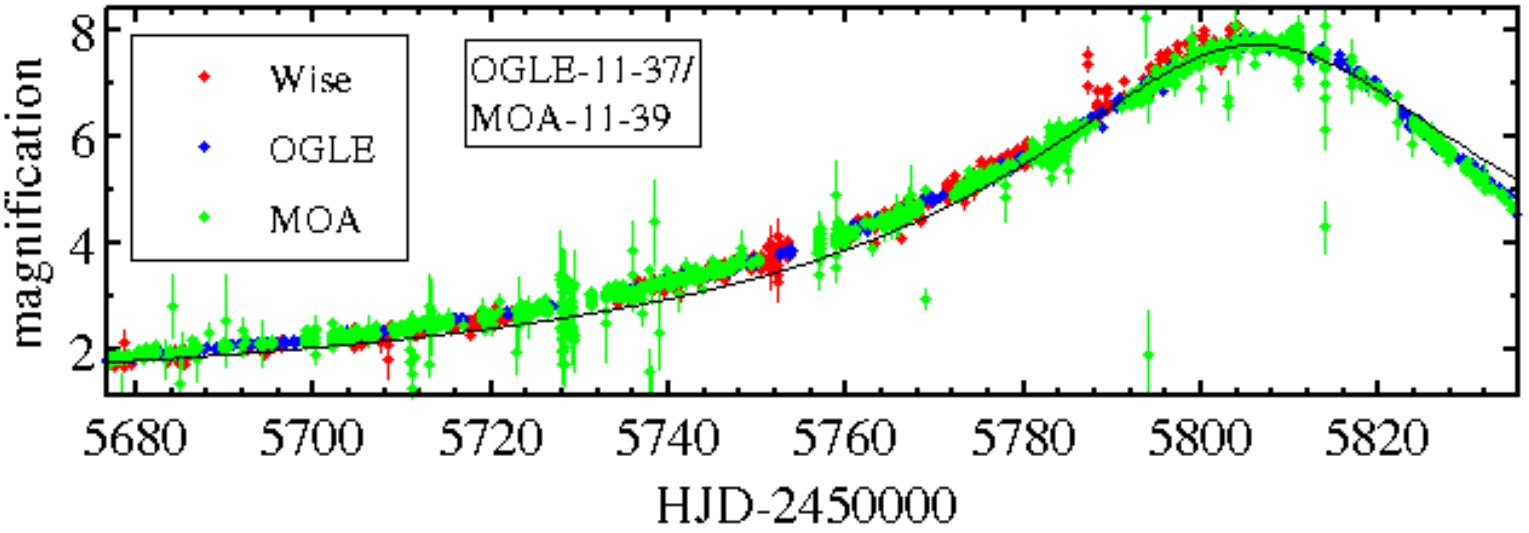
Low magnification w/o anomalies



Binaries

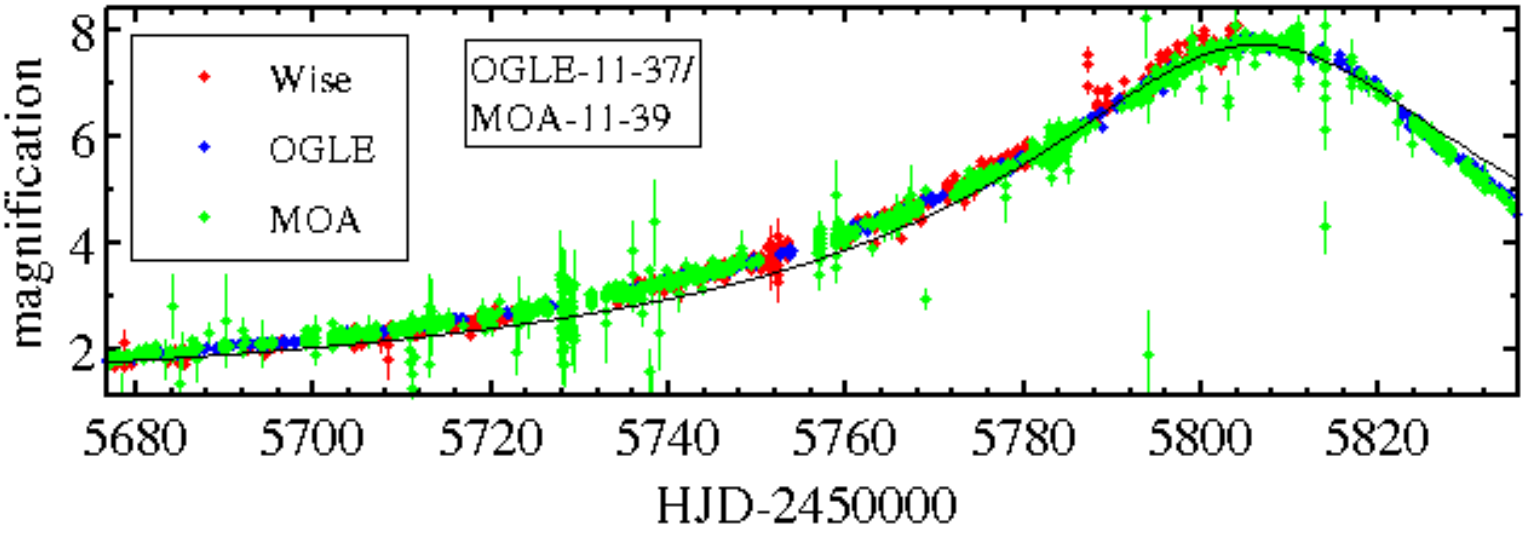

OGLE-11-0235/
MOA-11-107
Wise
OGLE
MOA
magnification
10
5
0
5650
5660
5670
5680
5690
5700
OGLE-11-1132/
MOA-11-358
Wise
OGLE
MOA
magnification
20
10
0
5740
5750
5760
5770
5780
5790
5800
HJD-2450000

Other anomalies

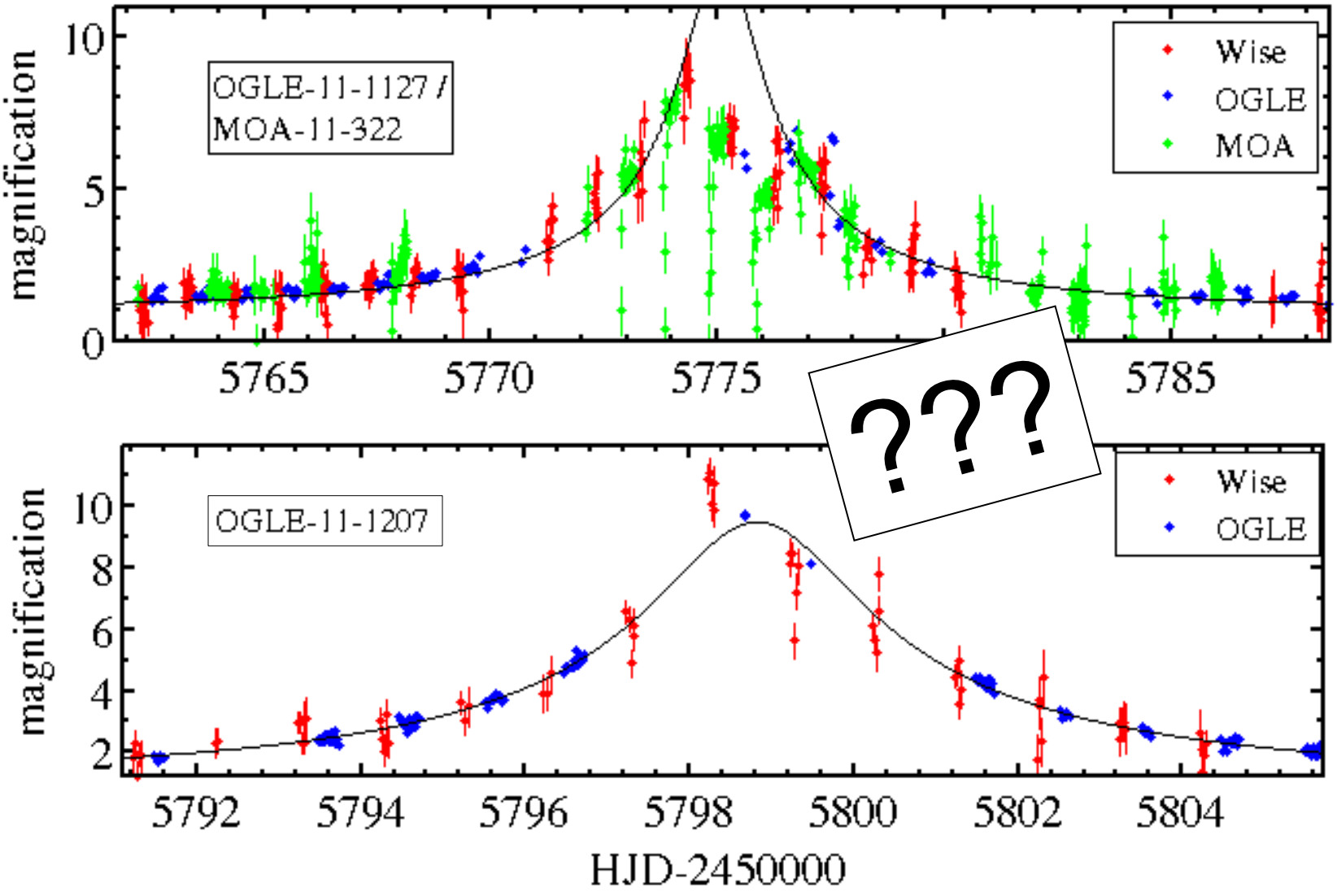


Other anomalies

Parallax



Other anomalies



Planetary events

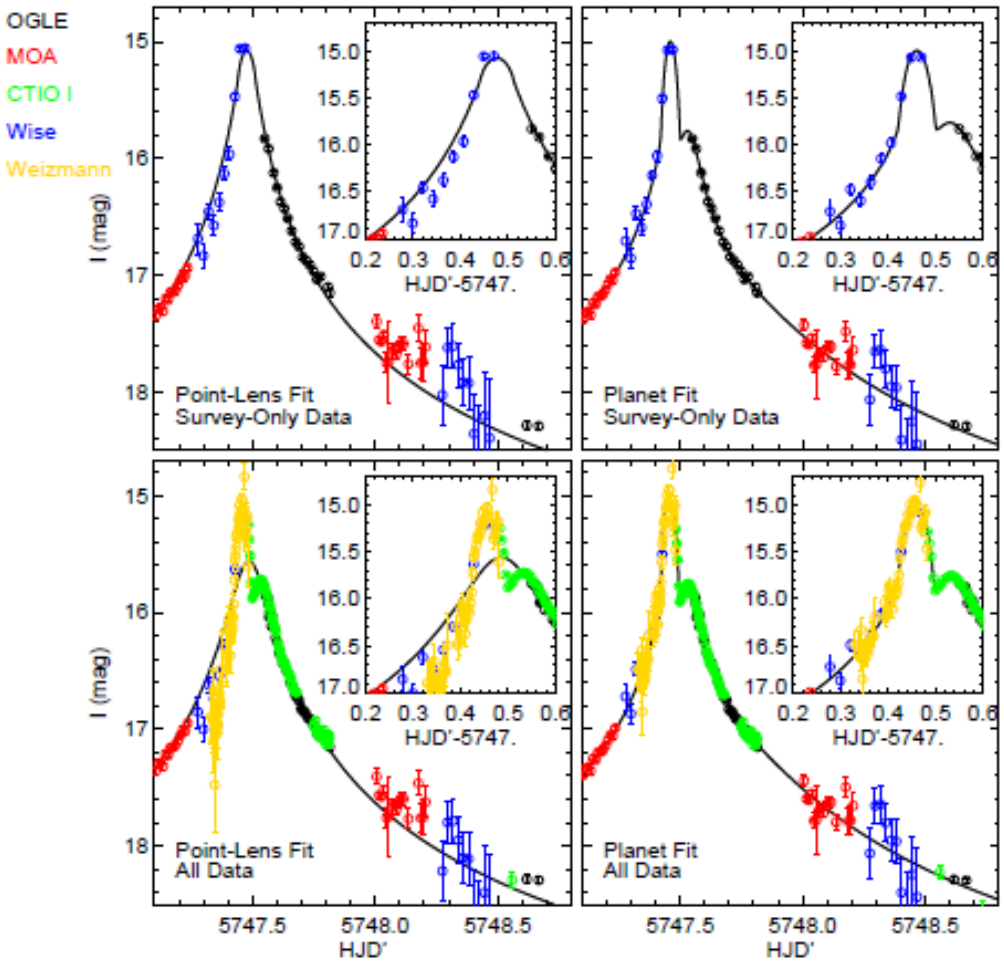
2/6 season planetary events

inside the network footprint:

Planetary events

2/6 season planetary events inside the network footprint:

- MOA-293

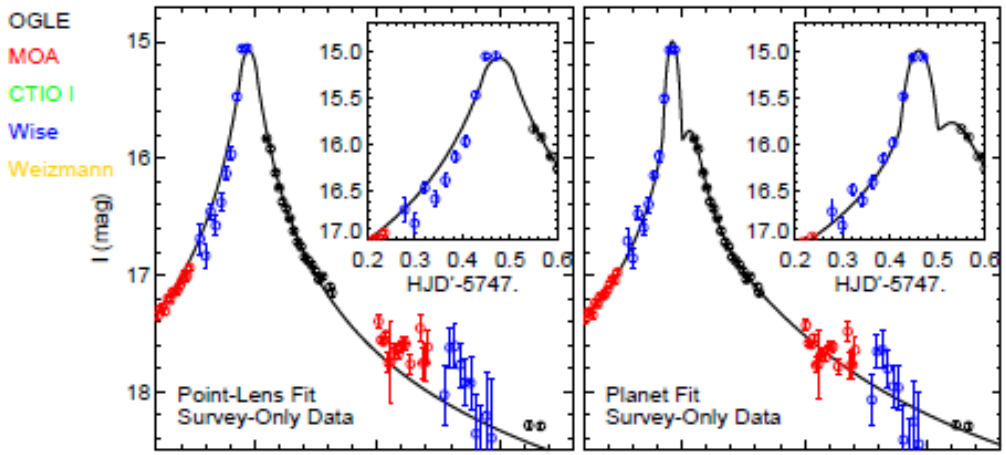


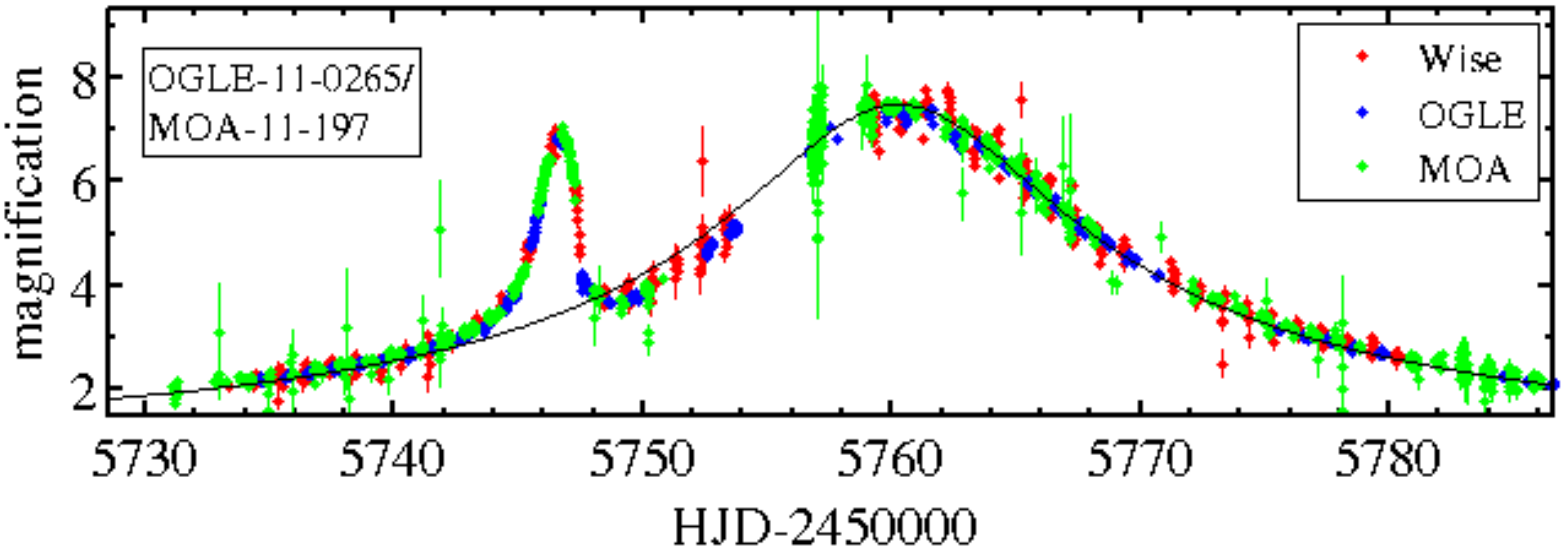
Yee et al. 2012

Planetary events

2/6 season planetary events inside the network footprint:

- MOA-293
- OGLE-0265/MOA-197

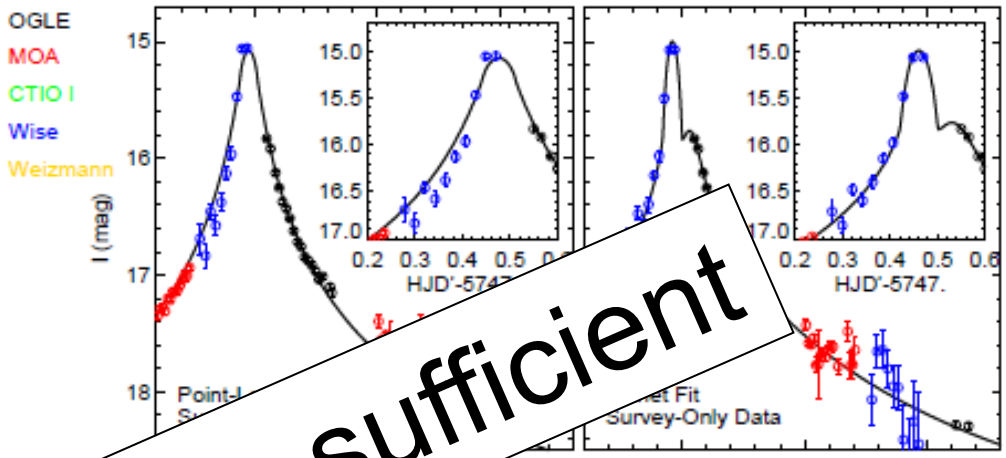


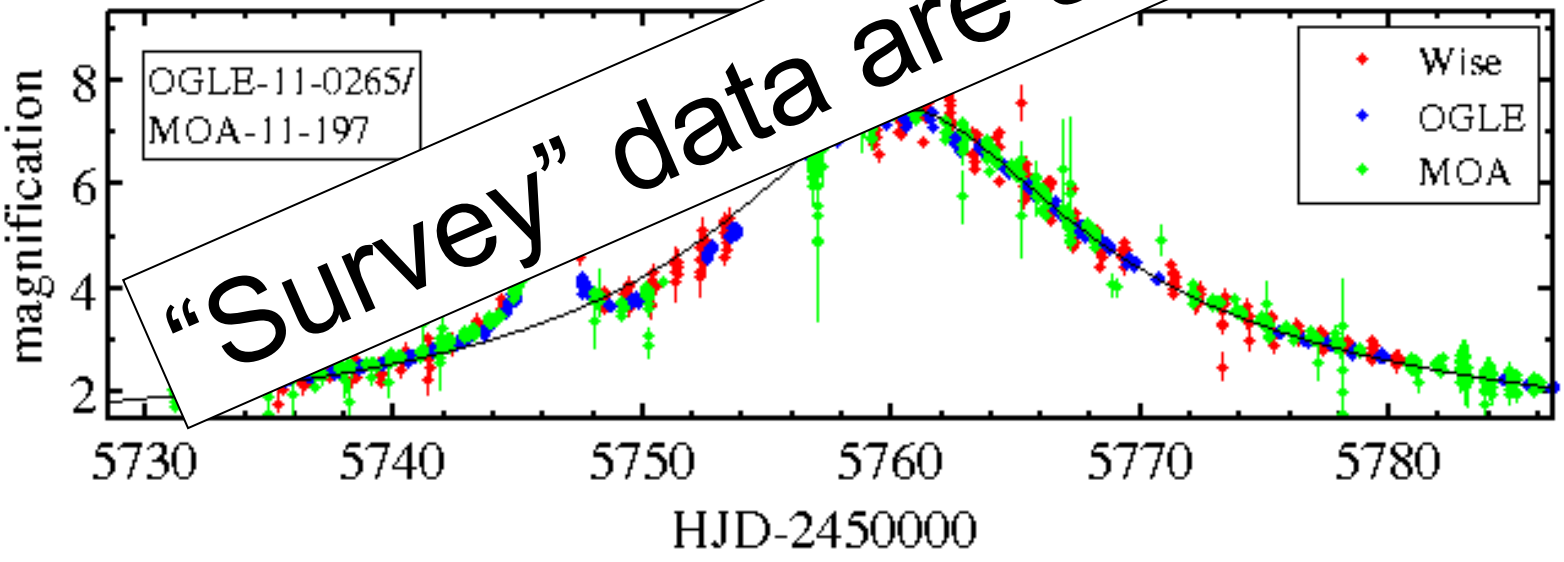


Planetary events

2/6 season planetary events inside the network footprint:

- MOA-293
- OGLE-0265/MOA-197





"Survey" data are sufficient

Summary

- 1/3 events inside network footprint
- Number of detections consistent with predictions for

  $f = 1/6$ for Solar–like systems

  (also consistent with $f = 1/2$ for "snowy" Neptunes, Cassan et al. 2012)
- Survey data sufficient to characterize planets

Summary

- 1/3 events inside network footprint
- Number of detections consistent with predictions for

  $f = 1/6$ for Solar–like systems

  (also consistent with $f = 1/2$ for "snowy" Neptunes, Cassan et al. 2012)
- Survey data sufficient to characterize planets

Next season:

- Real-time analyzed Wise data (DIA)
- Multi-band images – source color near peak for ALL events

Planet identity