

MICROLENSING BINARIES DISCOVERED THROUGH HIGH-MAGNIFICATION CHANNEL

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Importance of binary study

- **To understand theories**
 - **Stellar Formation**
 - **Stellar Evolution**
 - **Star Formation**

Limitation to detect binaries

- **Difficulties of binary detection by using conventional methods**
 - **Faint (low-mass) companions**
 - **Intermediate separation binaries**
- **Microlensing method**
 - **Not depends on lens brightness**
 - **Sensitive to binaries with intermediate separation**
- **Microlensing**
 - **Complete distributions down to low-mass**
 - **A useful tool to detect and study binaries**

High-magnification channel

- **High-magnification events**
 - **The most important targets to find planets**
- **Intensive observed by follow-up**
 - **Predictable** perturbations
 - **Well resolved** light curves
- **Using the high-magnification channel**
 - **Get unbiased** sample

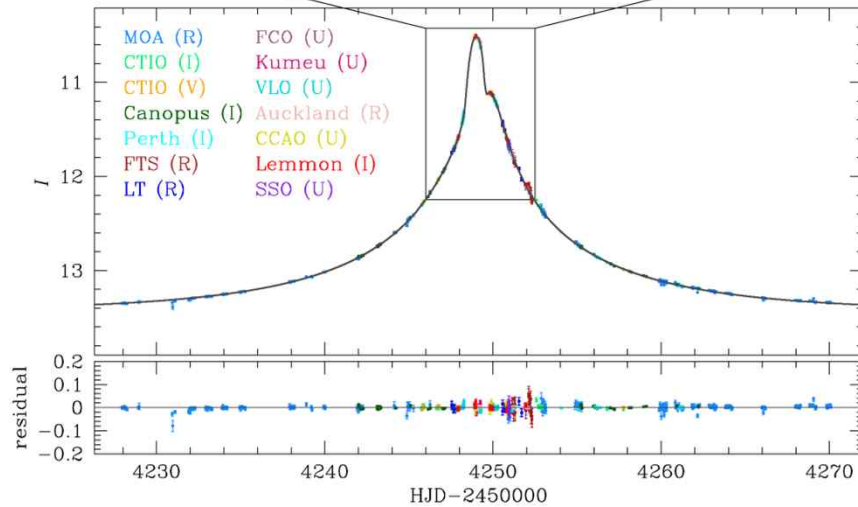
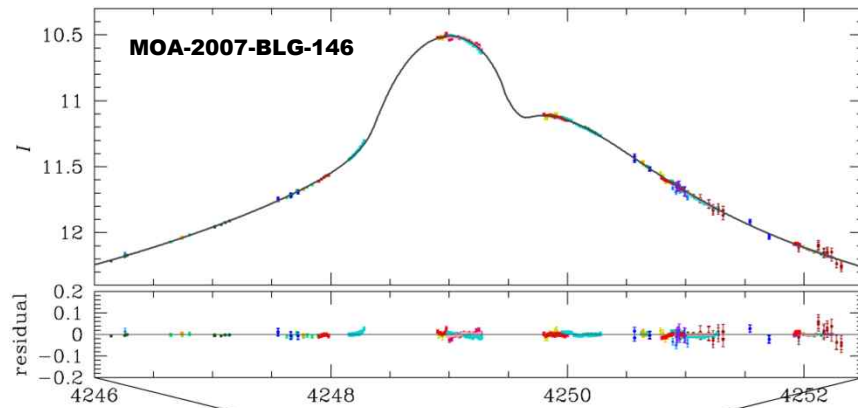
Modeling

- **Searching high-magnification binary events from 2007 to 2010**
- **Analyzing 8 events**
- **Considering higher-order effects**
- **Testing close and wide models**

Results

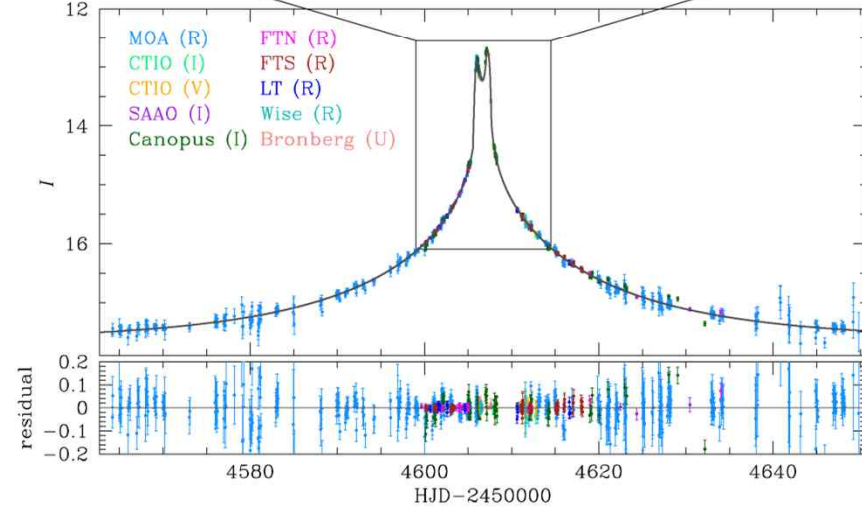
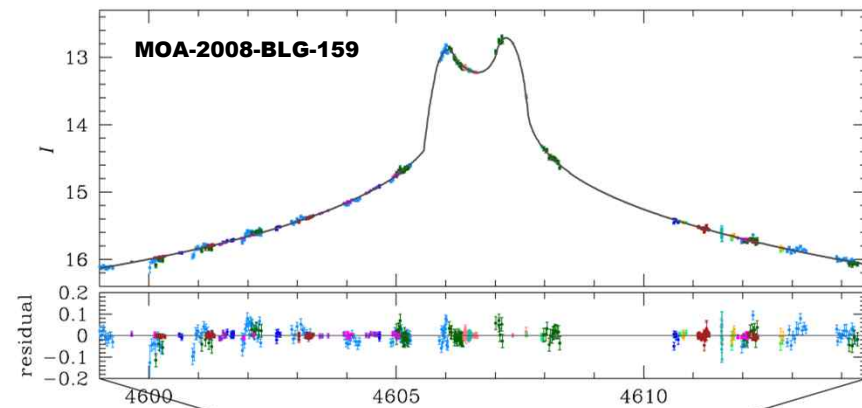
Events	Model	χ^2	$5 \leq t_E \leq 29$	$0.2 \leq s \leq 7.5$	$0.1 \leq q \leq 0.7$
			t_E (days)	s	q
MB07146	Close	1550.7	15.506	0.308	0.729
	Wide	1855.6	14.081	5.785	3.279
MB08159	Close	2407.3	29.180	0.368	0.292
	Wide	2472.1	32.221	4.486	0.747
OB08510 /MB08369	Close	1879.2	21.531	0.315	0.099
	Wide	1878.1	21.972	4.100	0.156
MB09408	Close	1740.8	13.769	0.228	0.493
	Wide	1740.0	13.886	7.472	1.720
MB10266	Close	4817.0	14.632	0.583	0.234
	Wide	4837.4	15.702	2.768	0.514
MB10349	Close	7883.4	24.695	0.299	1.562
	Wide	7909.6	24.530	6.351	4.391
MB10406	Close	2108.9	5.359	0.570	0.515
	Wide	2020.4	5.362	2.787	1.252
MB10546	Close	462.1	8.814	0.269	0.546
	Wide	458.4	9.305	6.102	1.618

Results : Light curves



Close : $\chi^2 = 1550.7$, $s = 0.308$, $q = 0.708$

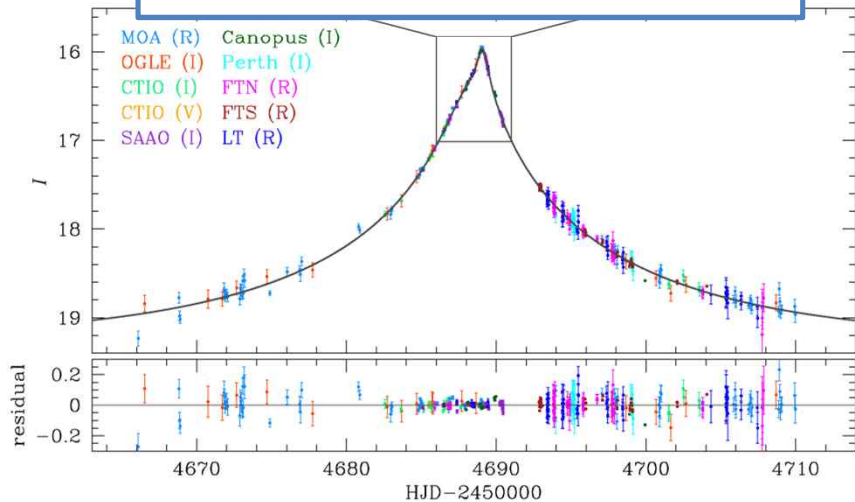
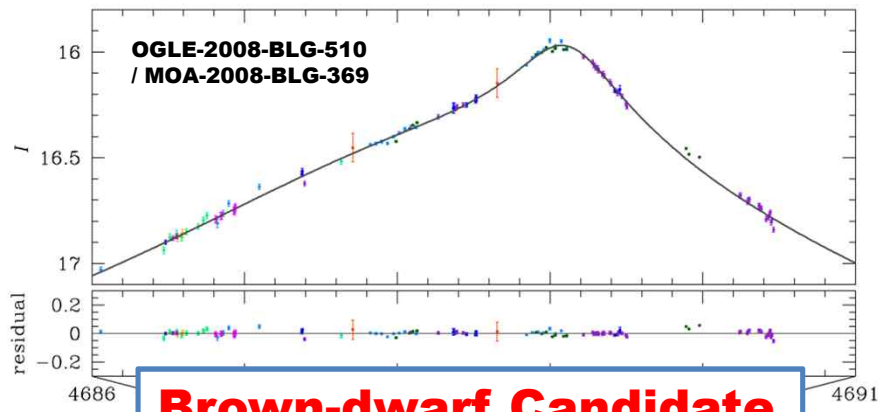
Wide : $\chi^2 = 1855.6$, $s = 5.785$, $q = 3.279$



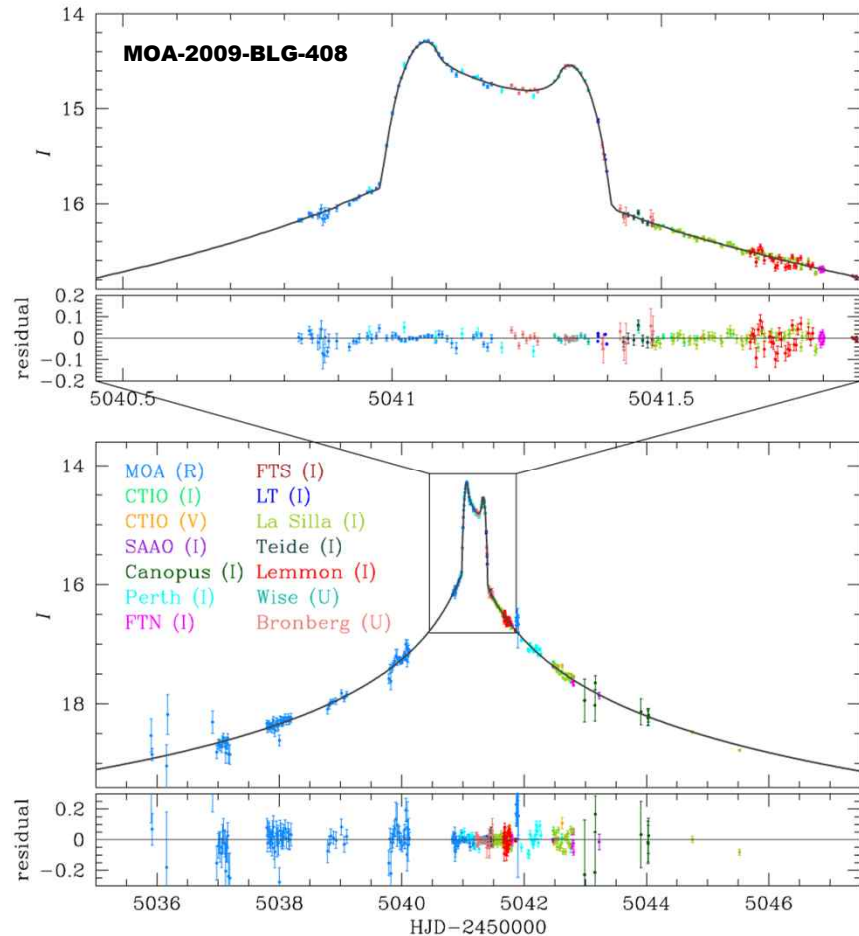
Close : $\chi^2 = 2407.3$, $s = 0.368$, $q = 0.292$

Wide : $\chi^2 = 2482.1$, $s = 4.486$, $q = 0.747$

Results : Light curves

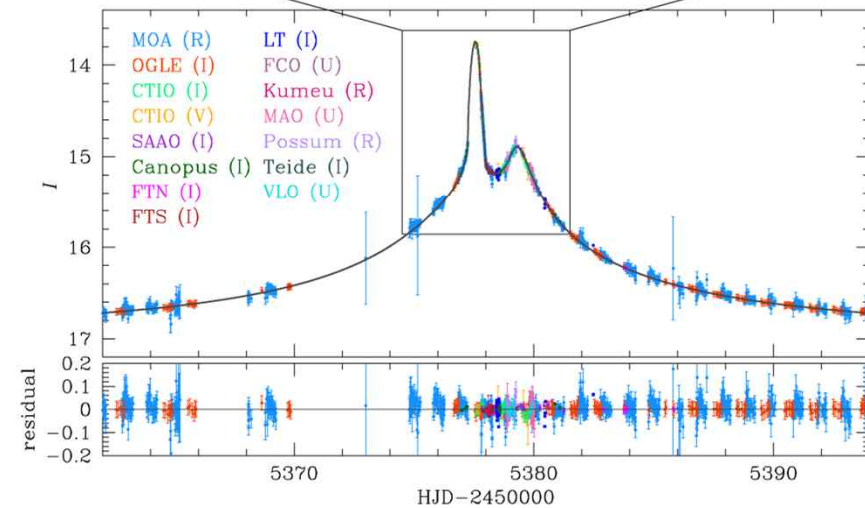
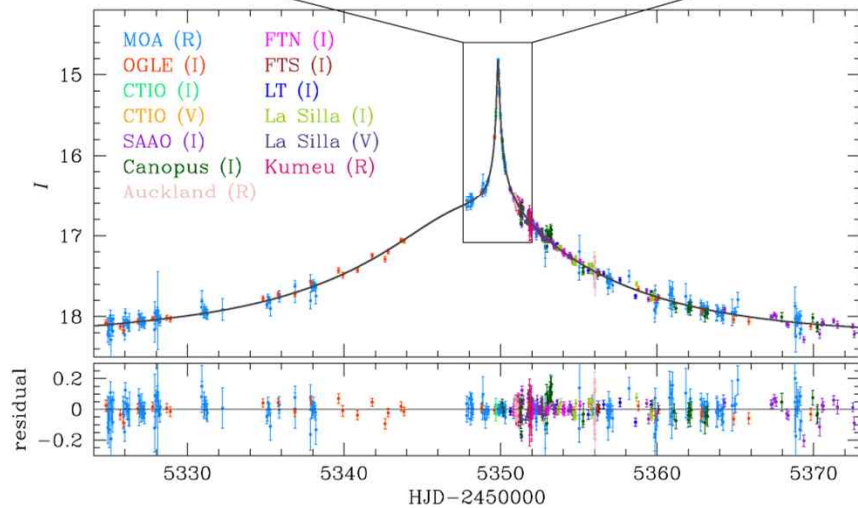
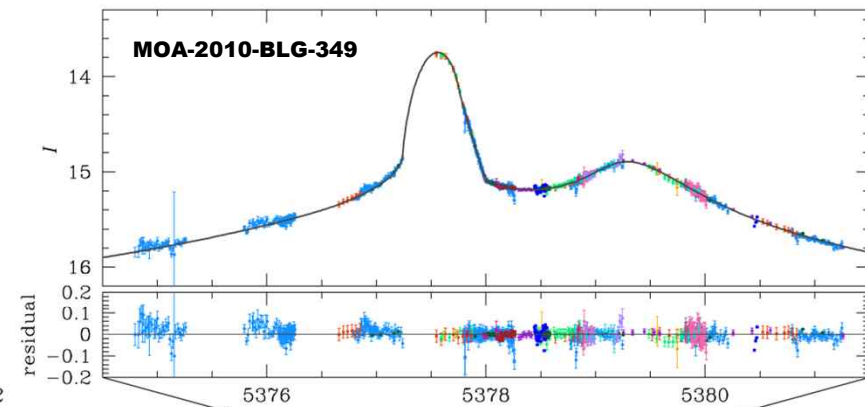
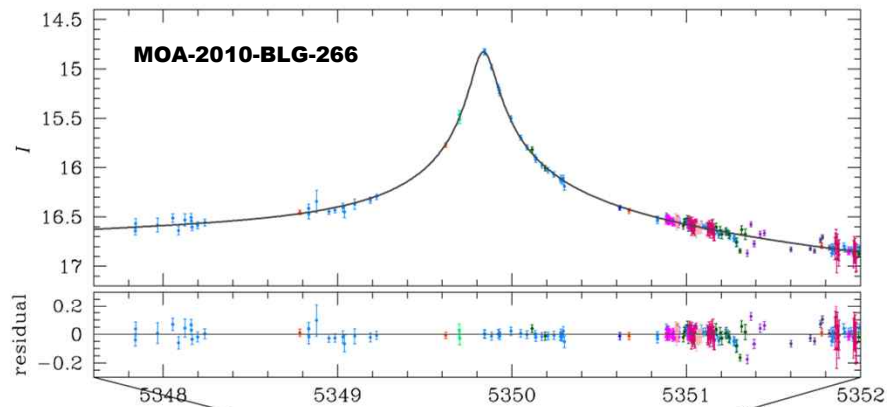


Close : $\chi^2 = 1879.2$, $s = 0.315$ $q = 0.099$
Wide : $\chi^2 = 1878.1$, $s = 4.100$ $q = 0.156$



Close : $\chi^2 = 1740.8$, $s = 0.228$, $q = 0.493$
Wide : $\chi^2 = 1740.0$, $s = 7.472$, $q = 1.720$

Results : Light curves



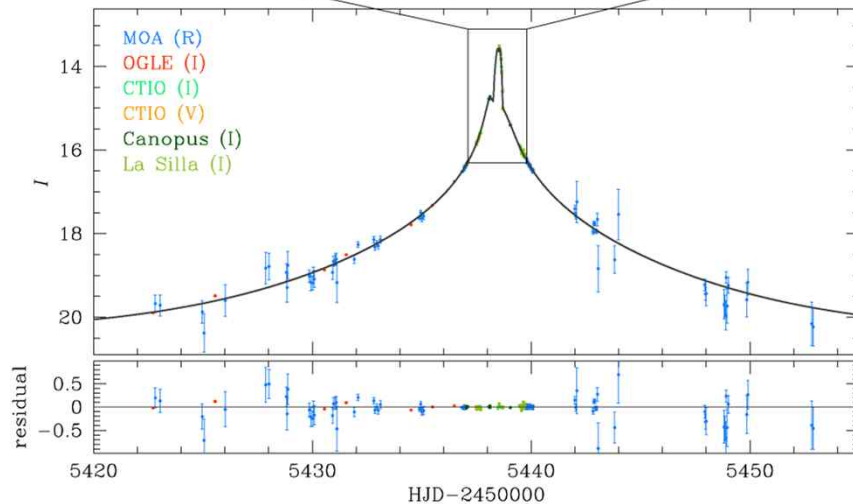
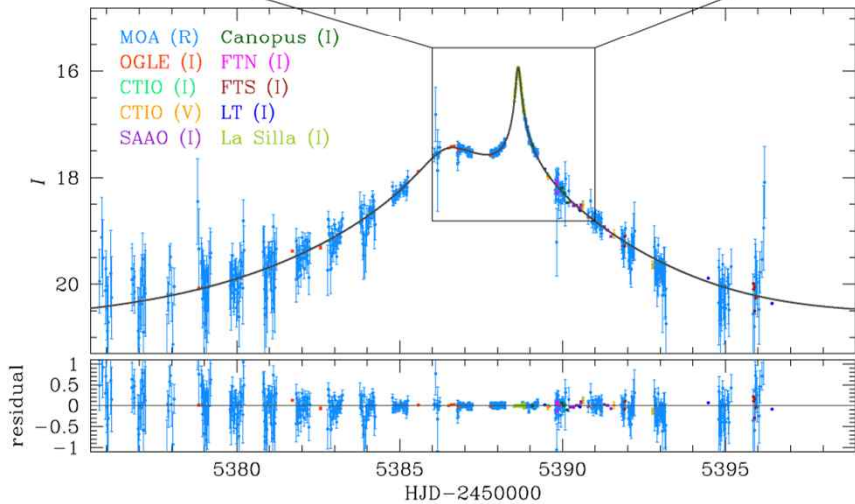
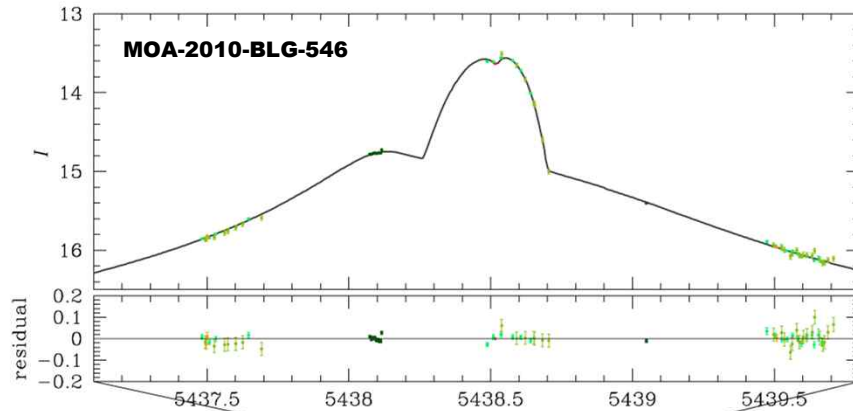
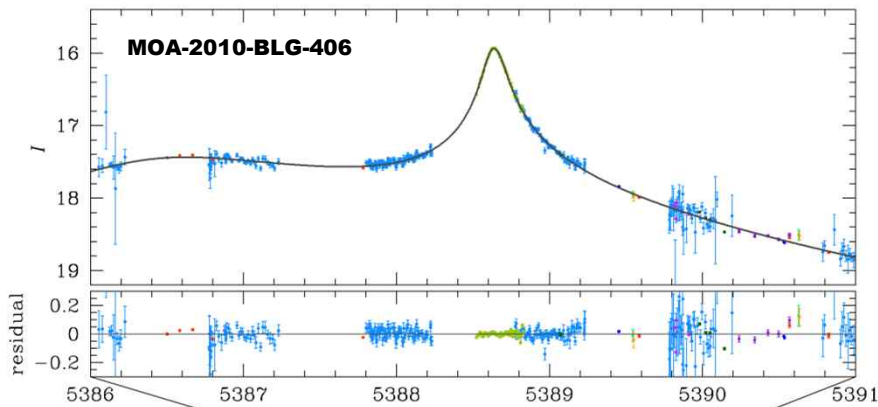
Close : $\chi^2 = 4817.0$, $s = 0.583$, $q = 0.234$

Wide : $\chi^2 = 4837.4$, $s = 2.768$, $q = 0.514$

Close : $\chi^2 = 7883.4$, $s = 0.299$, $q = 1.562$

Wide : $\chi^2 = 7909.6$, $s = 6.351$, $q = 4.391$

Results : Light curves



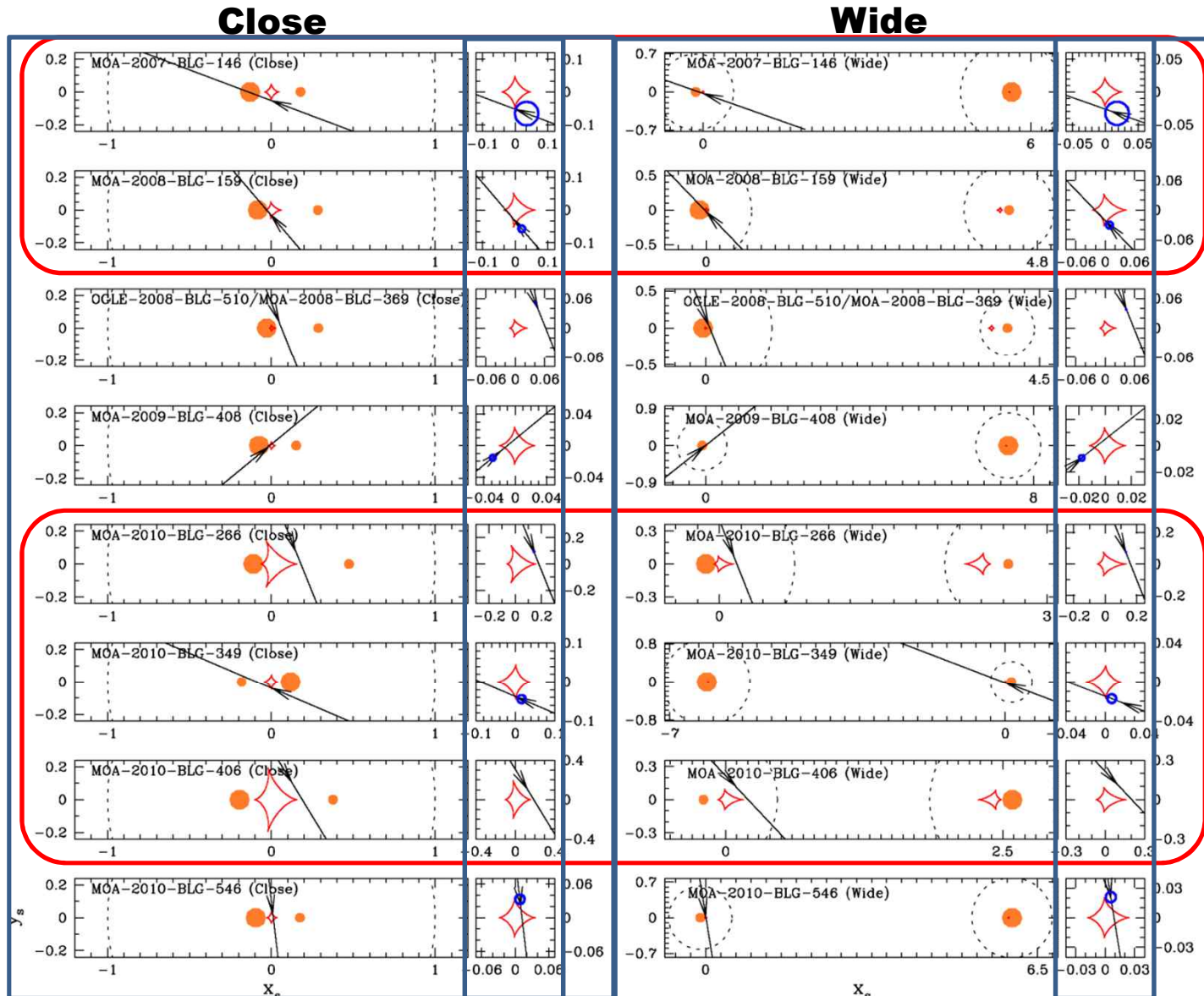
Close : $\chi^2 = 2108.9$, $s = 0.570$, $q = 0.515$

Wide : $\chi^2 = 2020.4$, $s = 2.787$, $q = 1.252$

Close : $\chi^2 = 462.1$, $s = 0.269$, $q = 0.546$

Wide : $\chi^2 = 458.4$, $s = 6.102$, $q = 1.618$

Results : Geometry



$$\Delta\chi^2 = 304.9$$

$$\Delta\chi^2 = 64.8$$

$$\Delta\chi^2 = 1.1$$

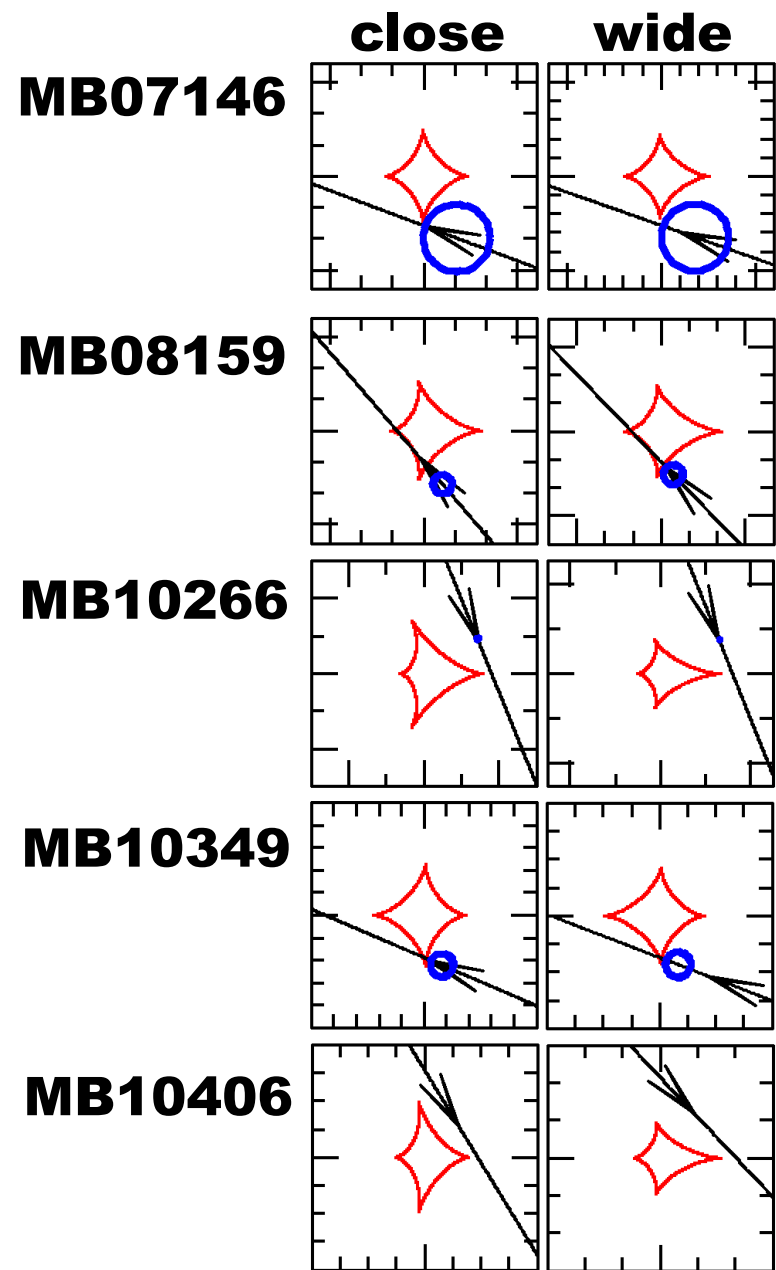
$$\Delta\chi^2 = 0.8$$

$$\Delta\chi^2 = 20.4$$

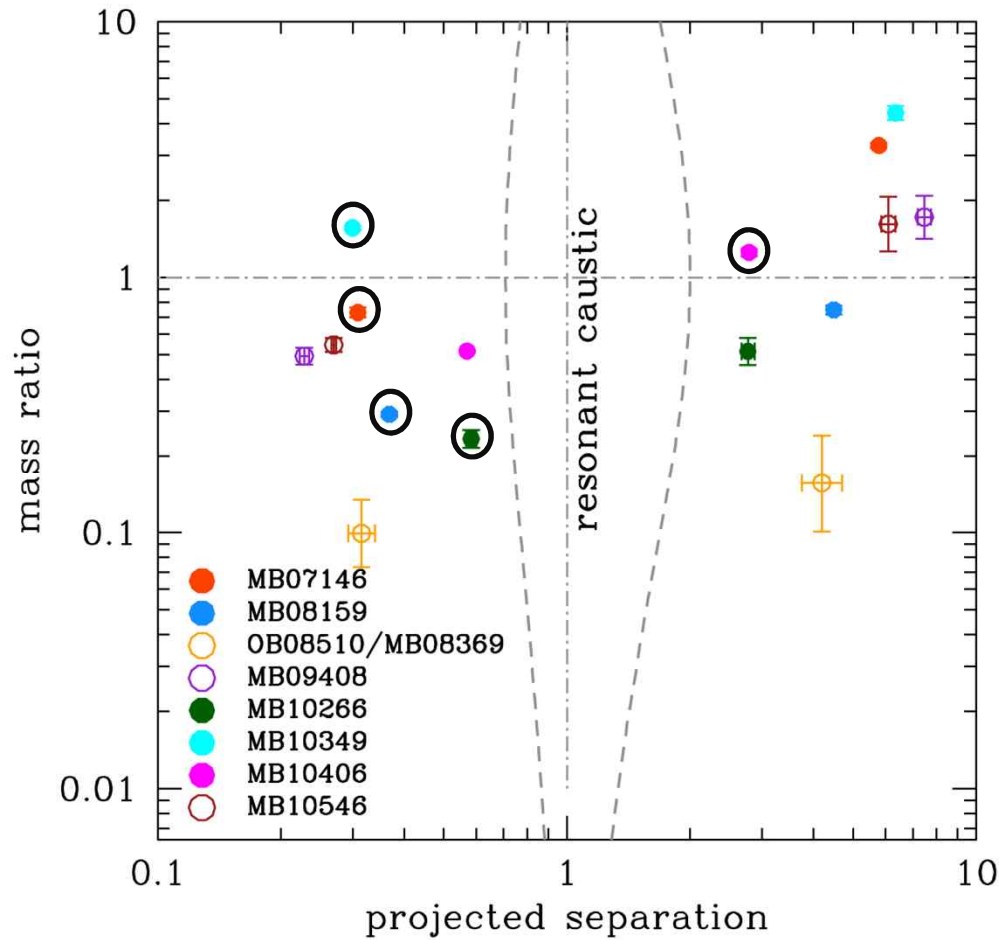
$$\Delta\chi^2 = 26.2$$

$$\Delta\chi^2 = 88.5$$

$$\Delta\chi^2 = 3.7$$



Results : Degeneracy



Filled dots : resolved degeneracy
Empty dots: not resolved degeneracy
Black circles : preferred solution

Very close or wide binaries
- **severe close/wide degeneracy**

Thank you for listening

**If you want to know details of this work,
please read the paper :**

Shin et al. (2012) ApJ, 746, 127