

HARVARD-SMITHSONIAN
CENTER FOR ASTROPHYSICS

Microlens Parallax with *Spitzer*: 2 Case Studies

Jennifer C. Yee

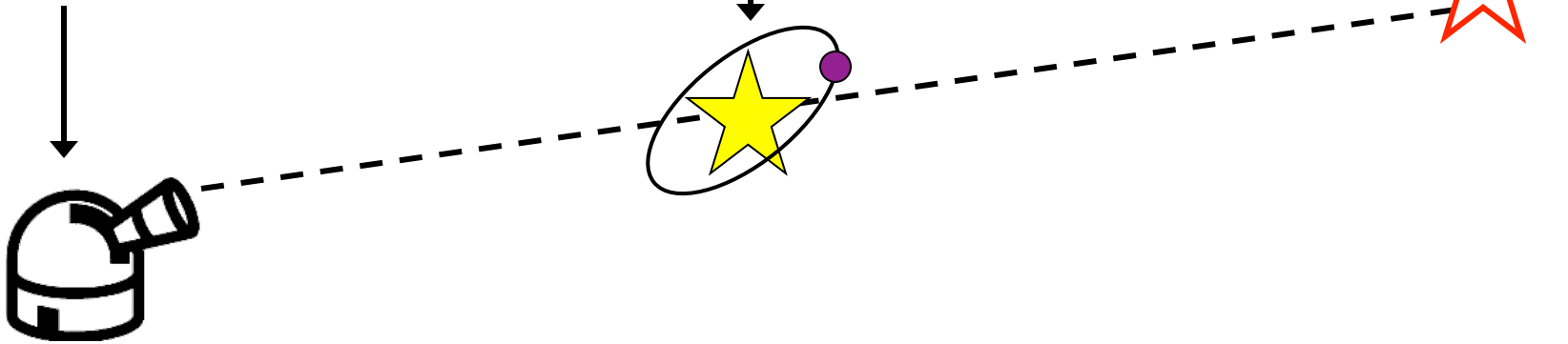
Sagan Fellow

Lensing

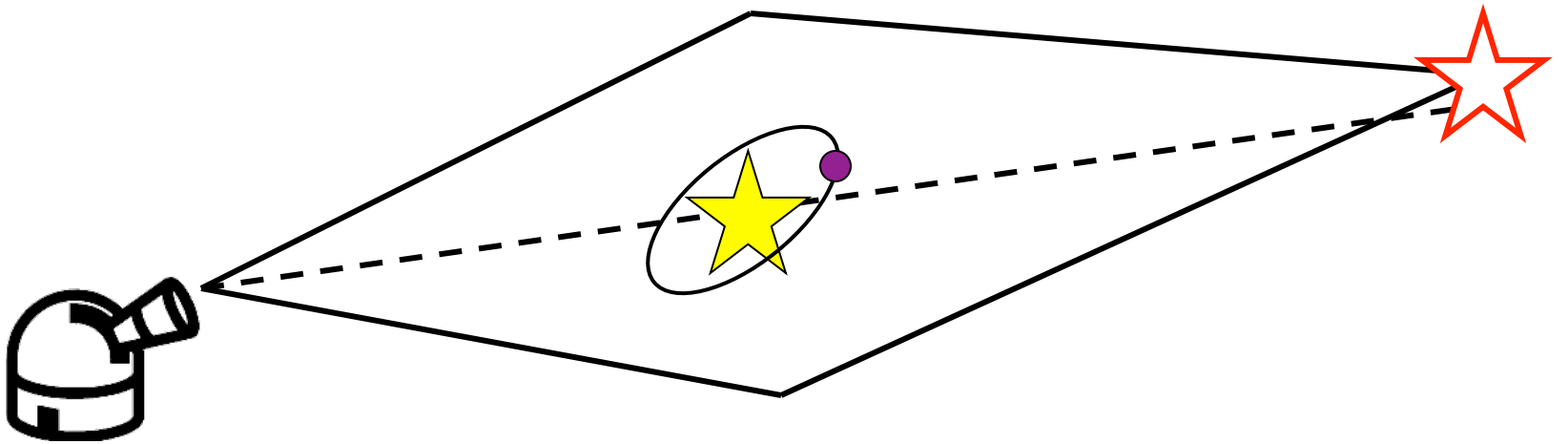
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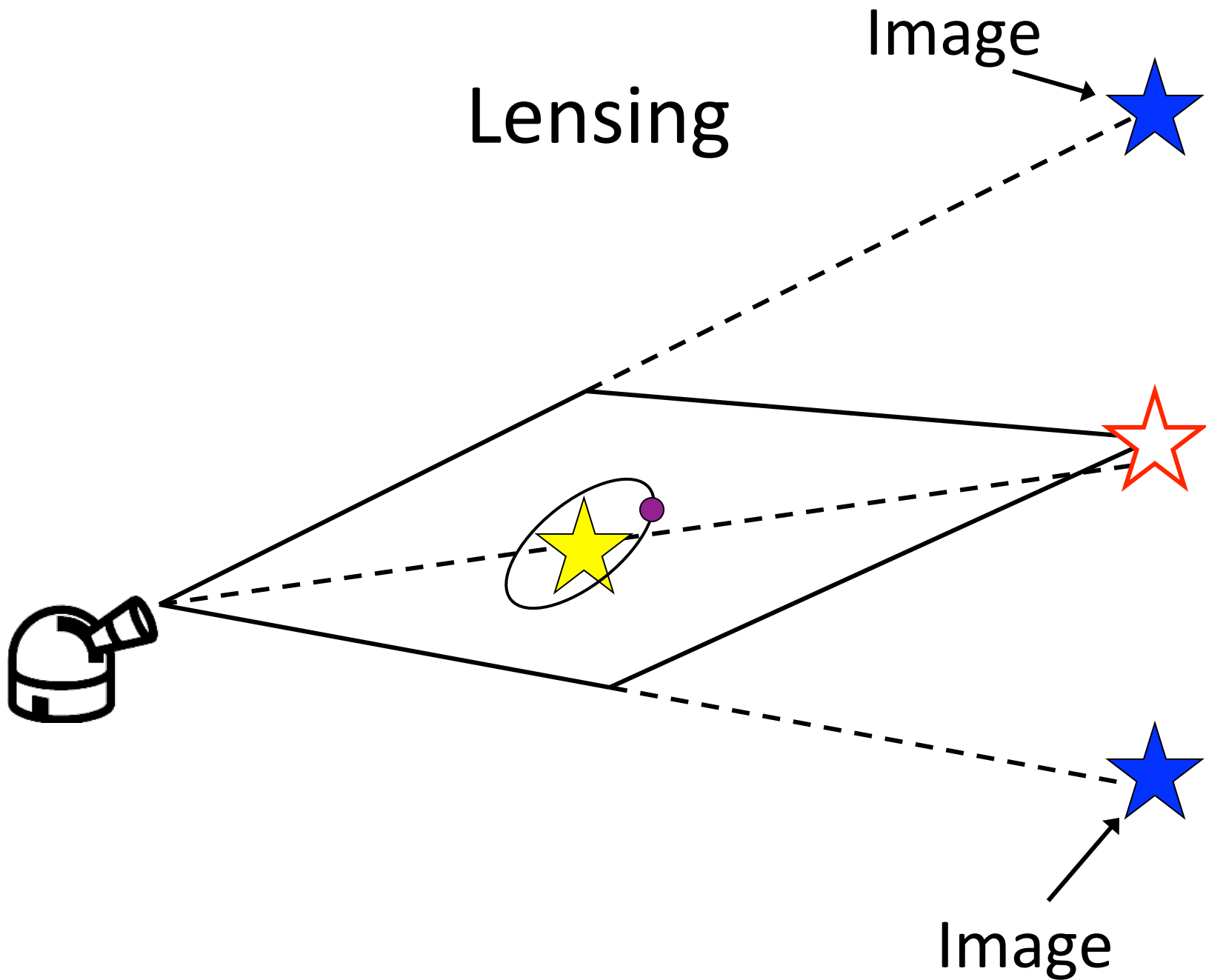
Lens

Us



Lensing



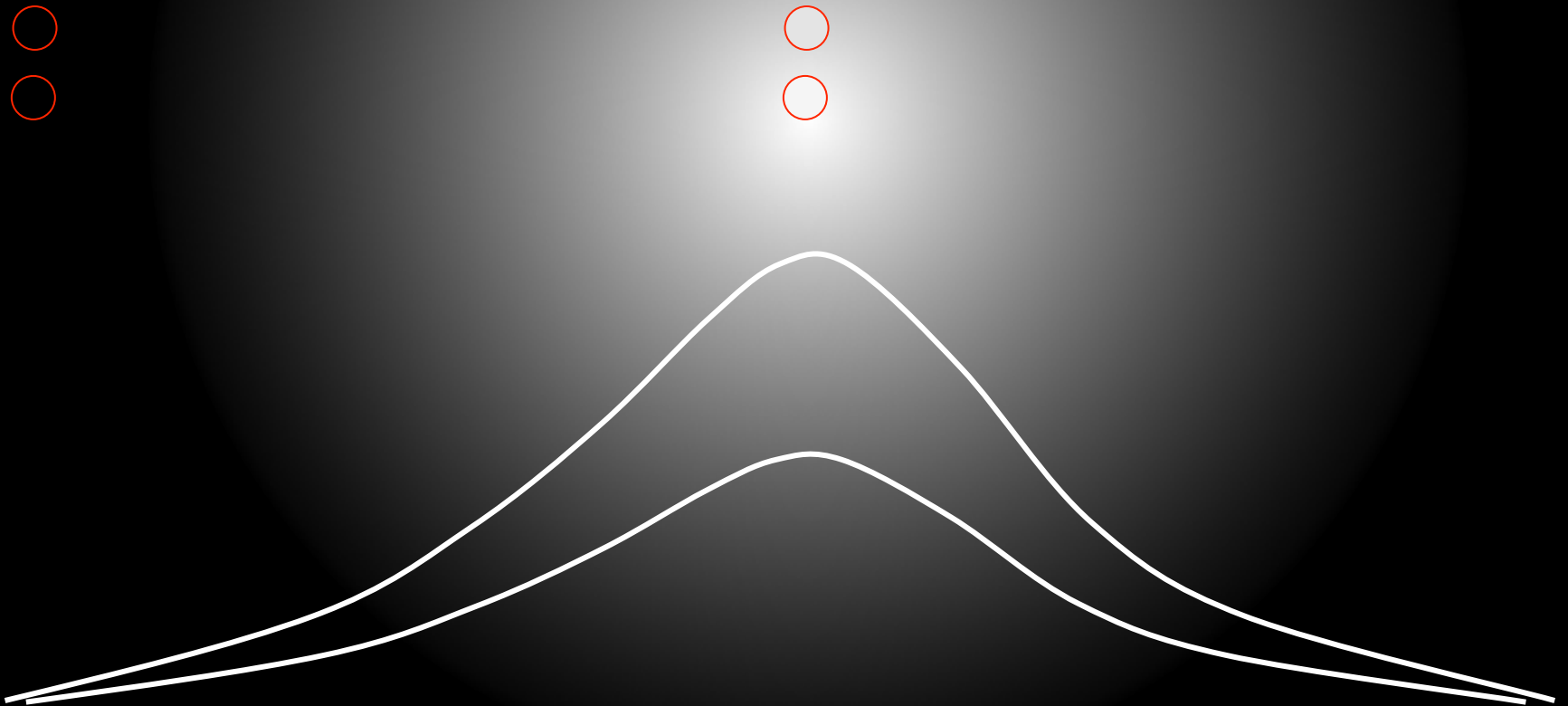


Magnification Map

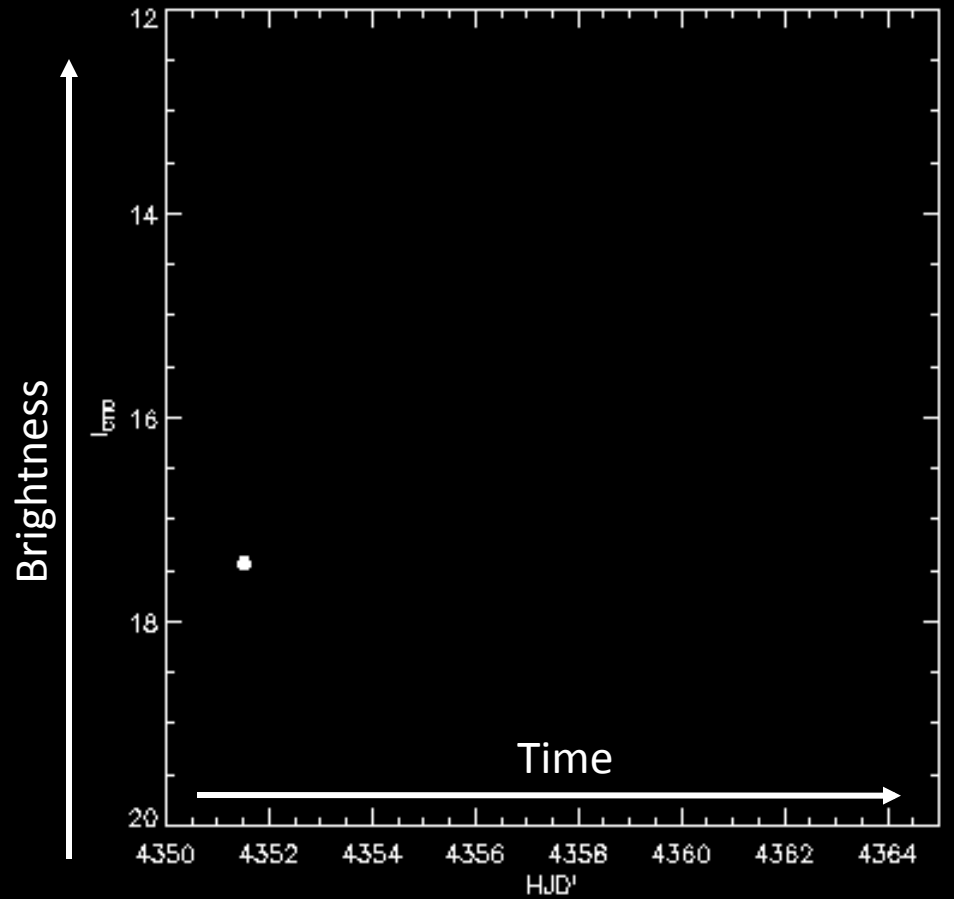
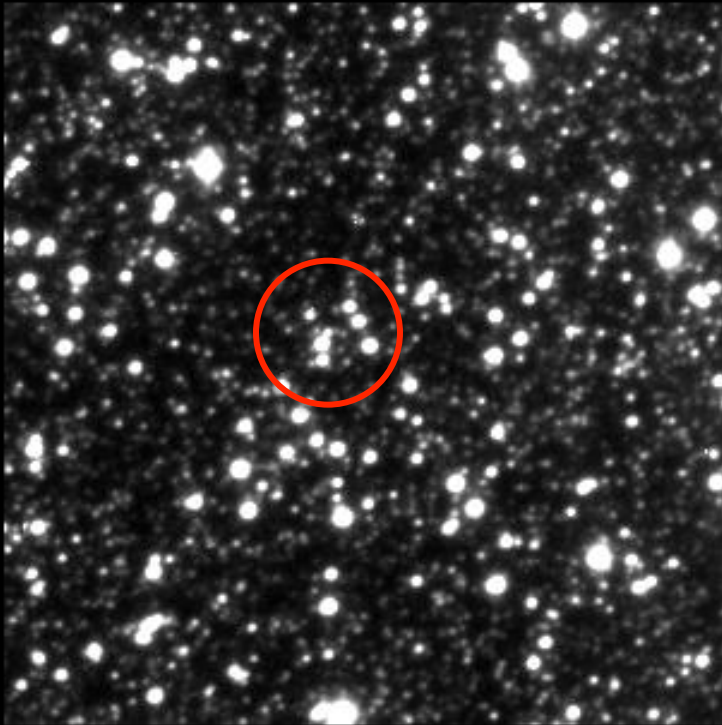
Lens Star



Magnification Map



MOA-2007-BLG-400



Angular Size
of Einstein
Ring

Microlens
Parallax

$$M_{\text{star}} = \theta_E / (\kappa \pi_E)$$

$$D_L = (\theta_E \pi_E + \pi_S)^{-1}$$

$\kappa = \text{constant}$

Source
Parallax

$$\theta_E = \mu t_E$$

Microlens
Parallax

$$M_{\text{star}} = \theta_E / (\kappa \pi_E)$$

$$D_L = (\theta_E \pi_E + \pi_s)^{-1}$$

$\kappa = \text{constant}$

Source
Parallax

ON THE POSSIBILITY OF DETERMINING THE DISTANCES AND MASSES OF STARS FROM THE GRAVITATIONAL LENS EFFECT

S. Refsdal

(Communicated by Professor S. Rosseland)

(Received 1966 June 6)


Summary

It is shown that the distance and the mass of a star which acts as a gravitational lens can be determined if the lens effect can be observed from the Earth and from at least one distant space observatory. The distance from the Earth to the space observatory will usually have to be of the order of 5% of one astronomical unit or more.



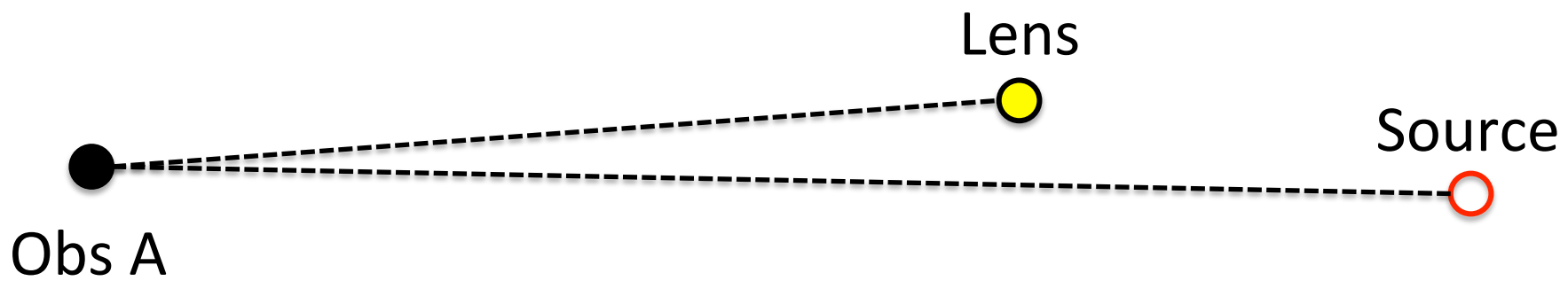
Obs A

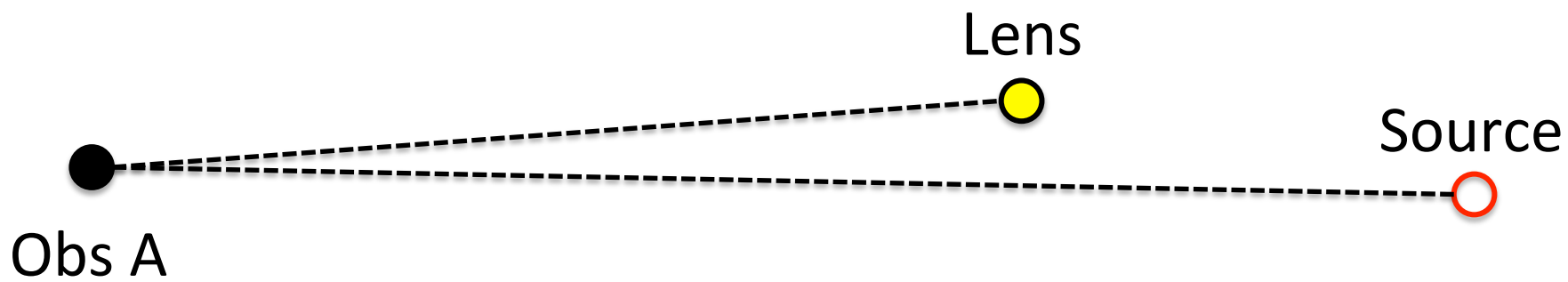
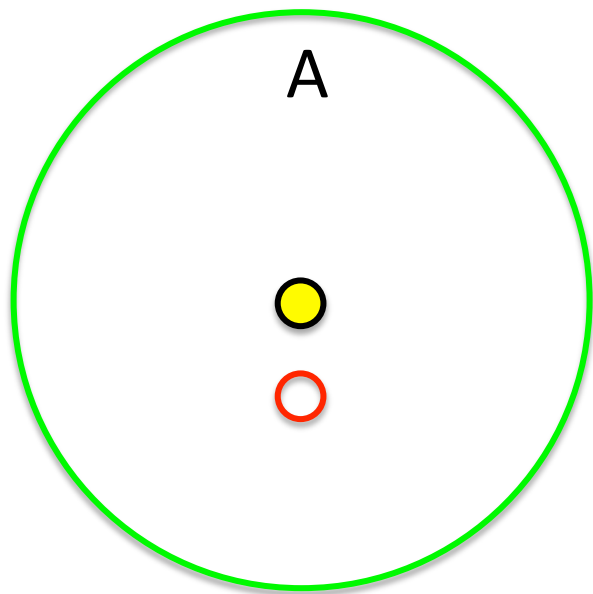
Lens

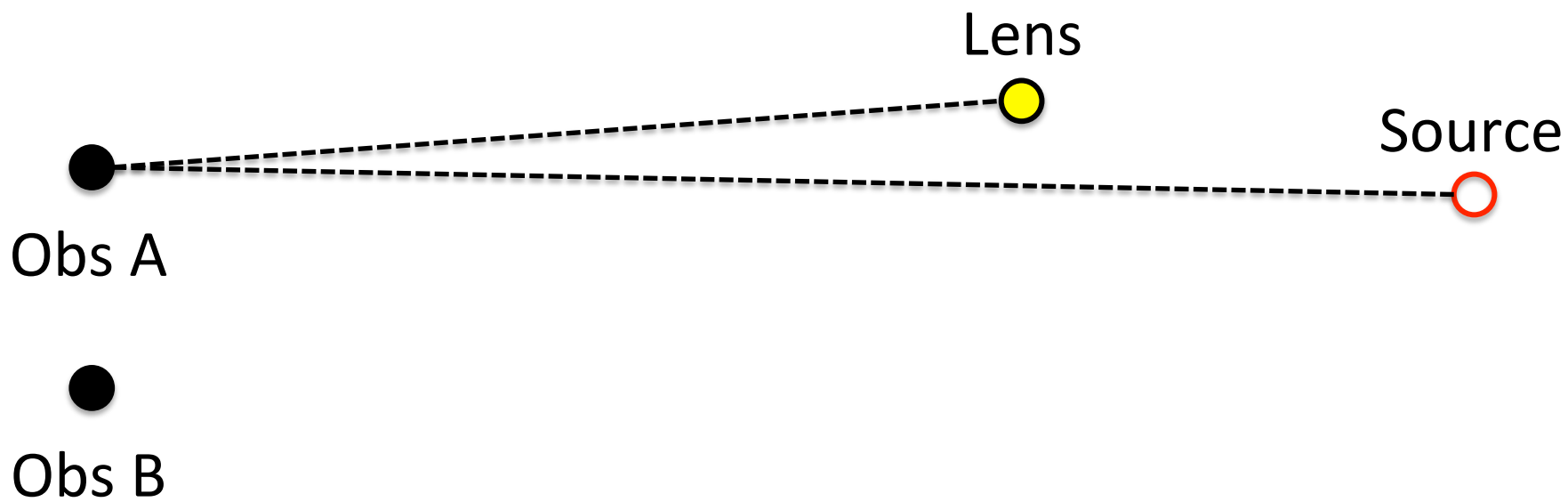
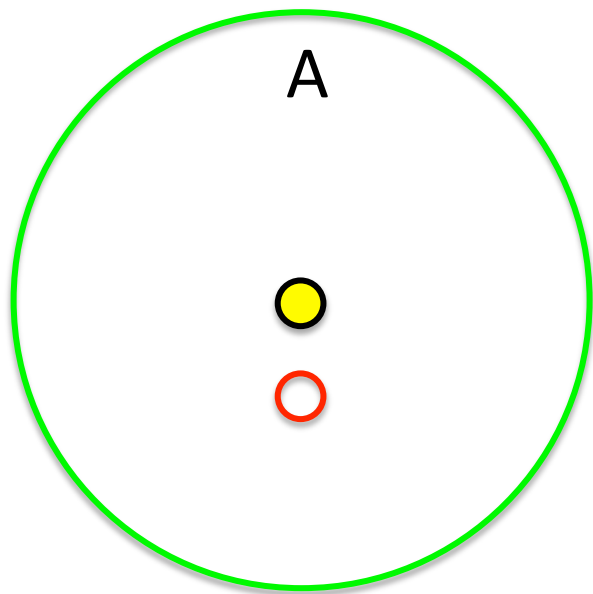


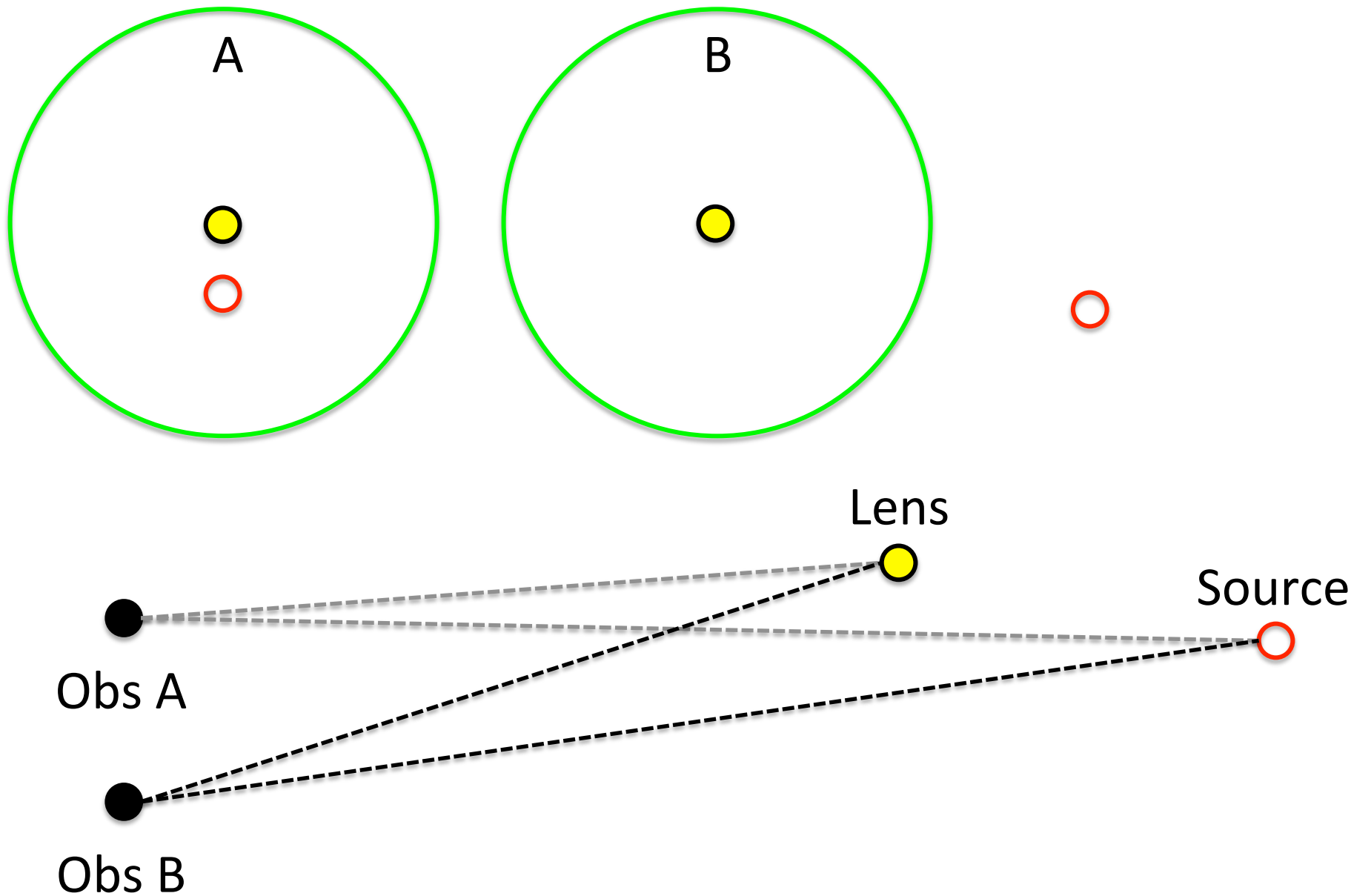
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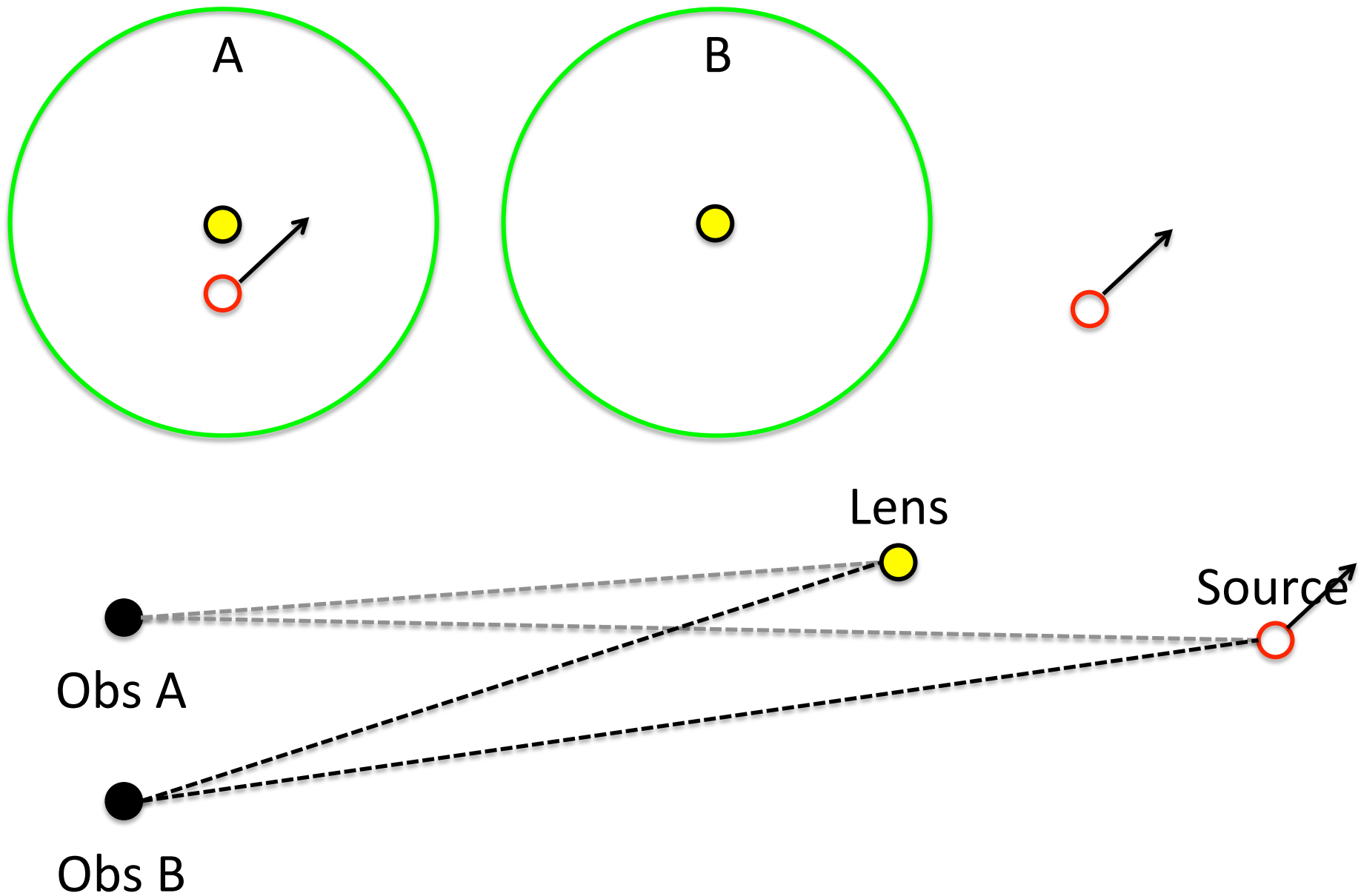


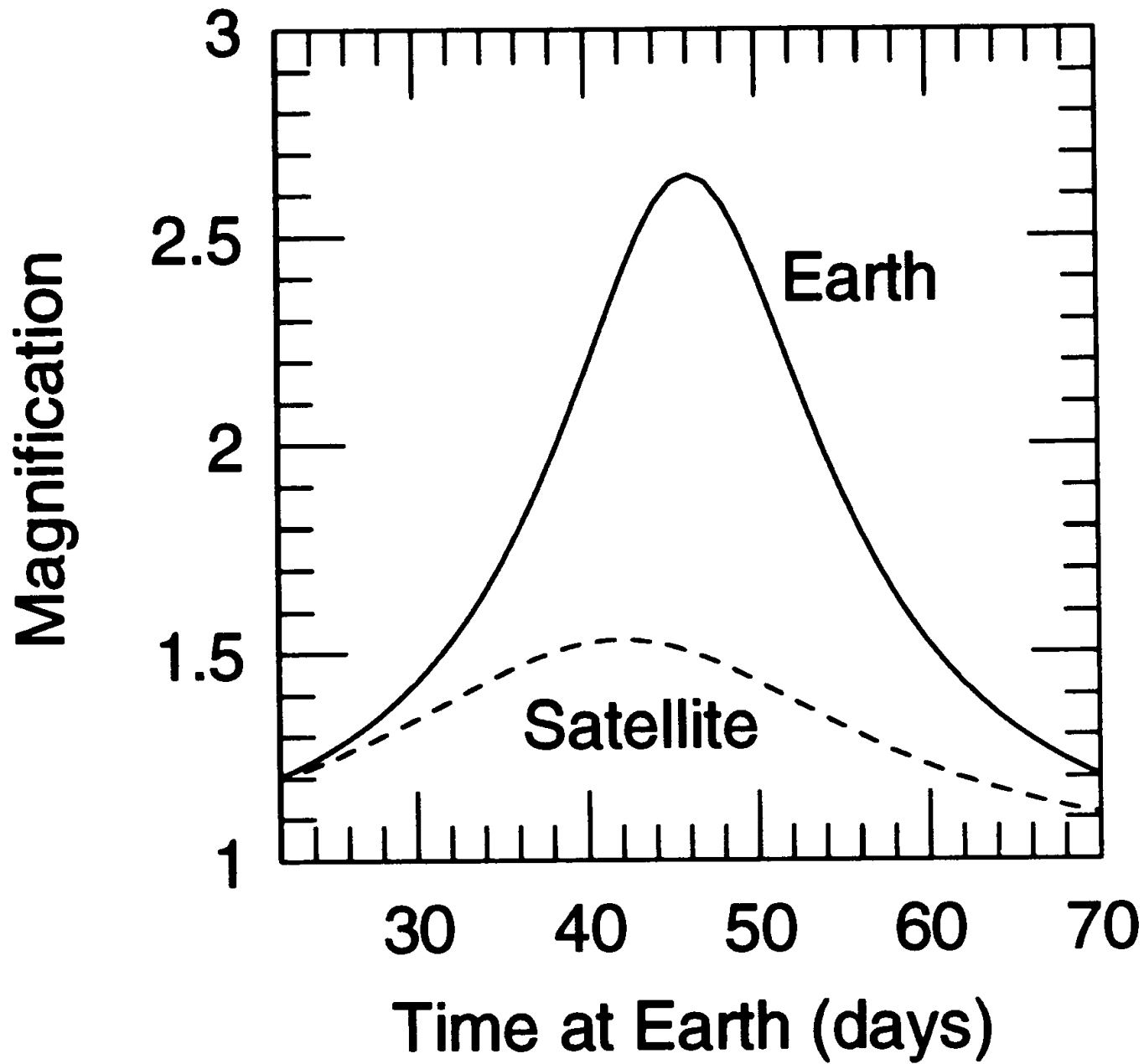


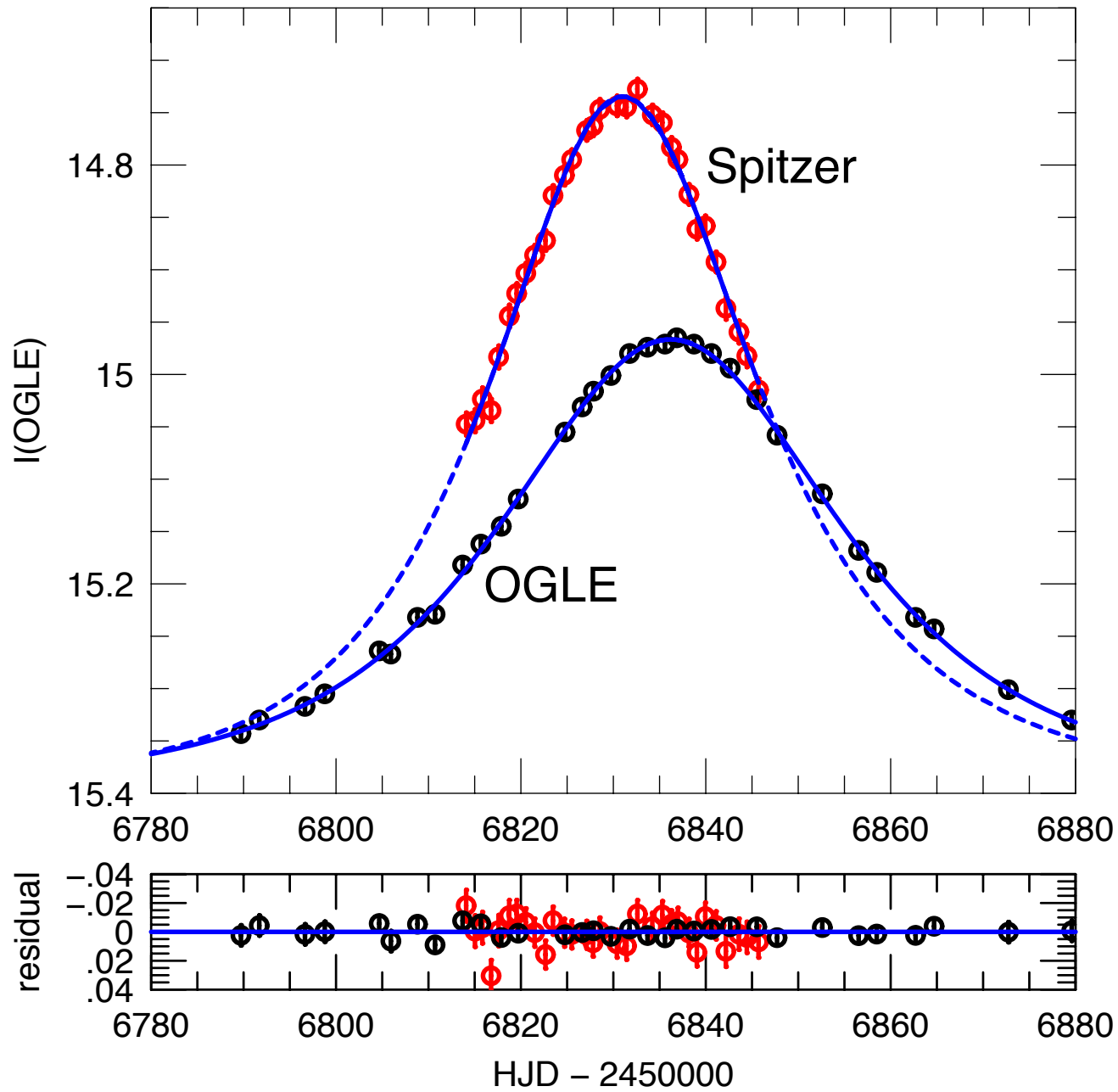


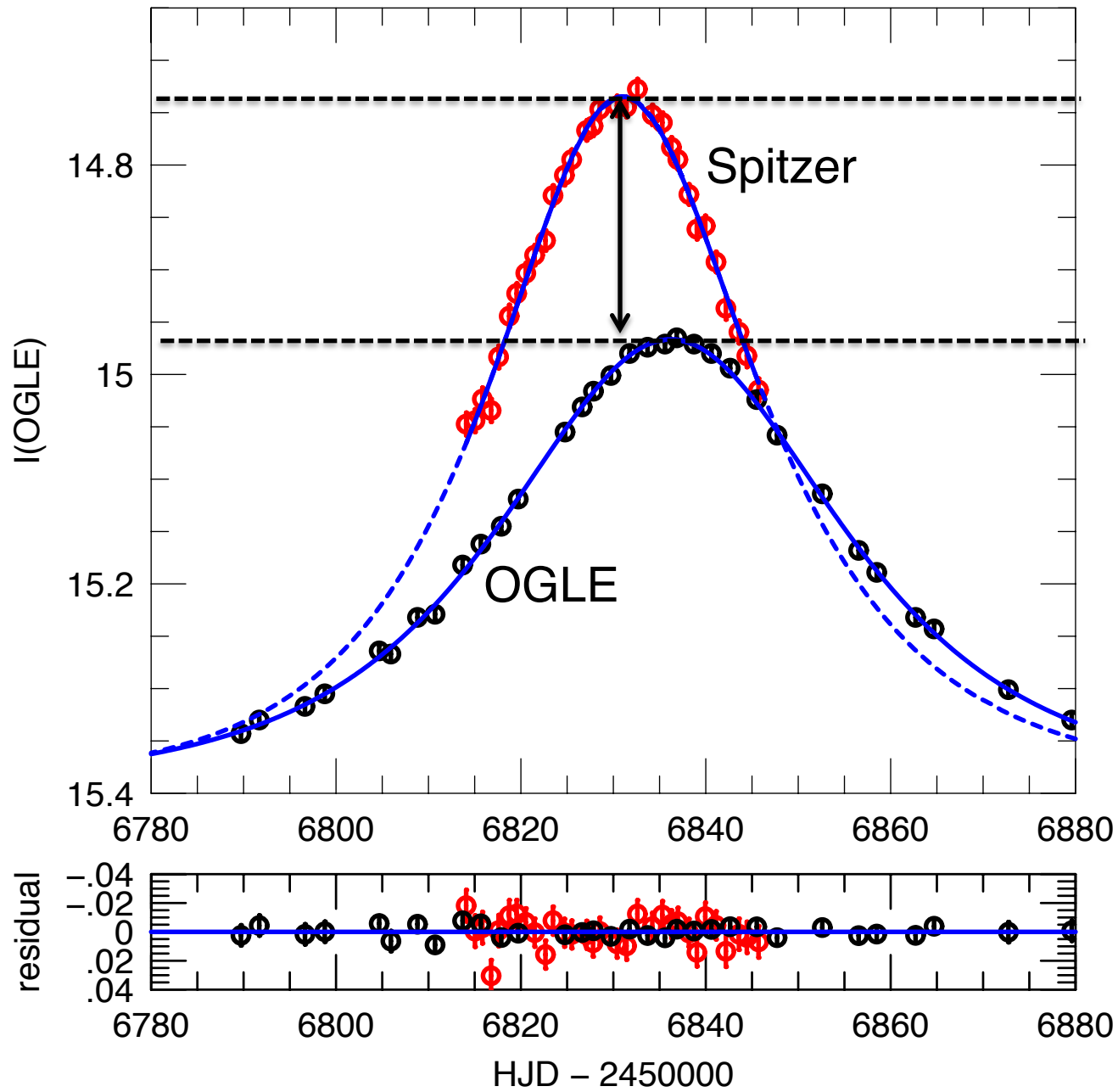


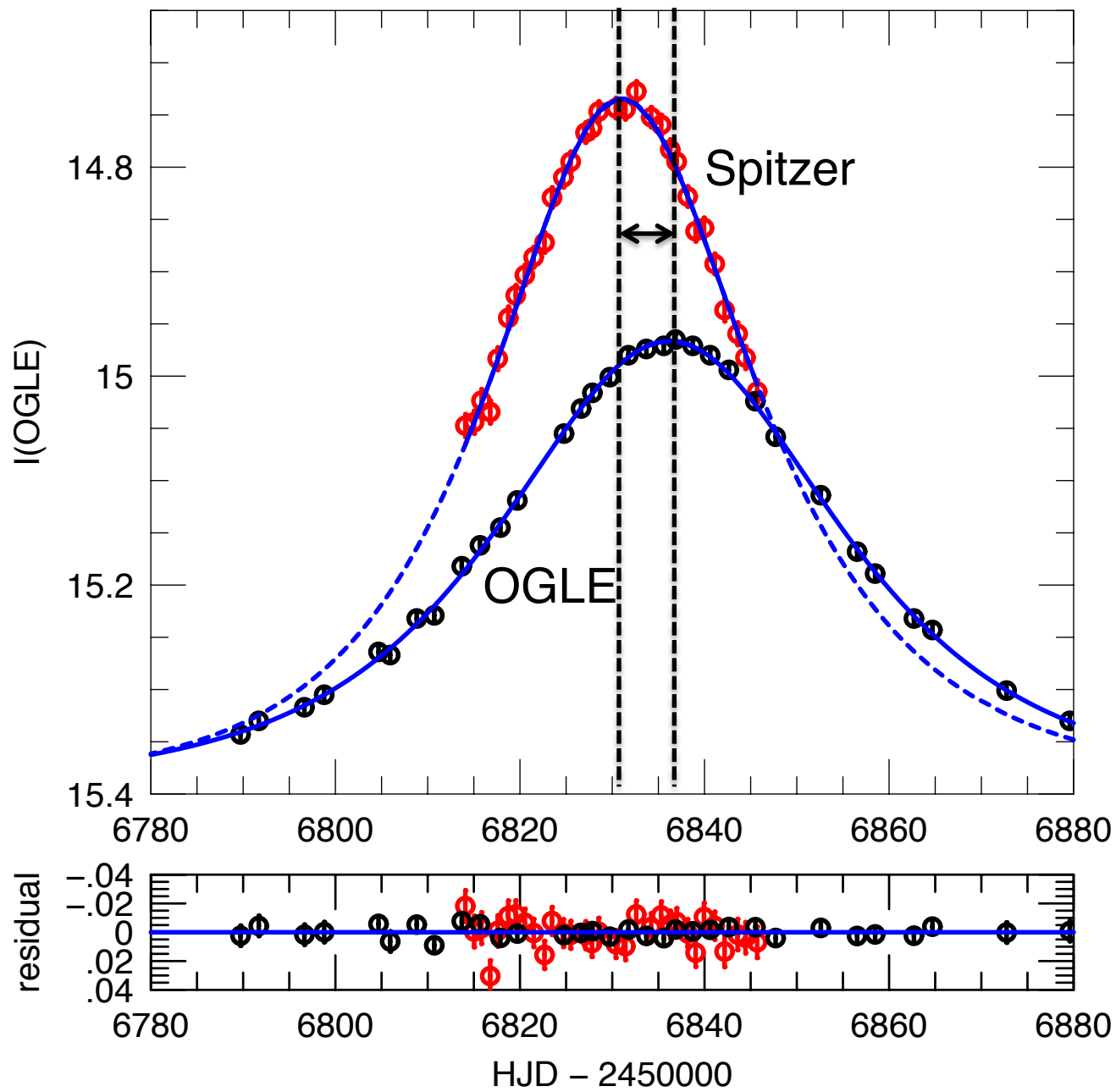


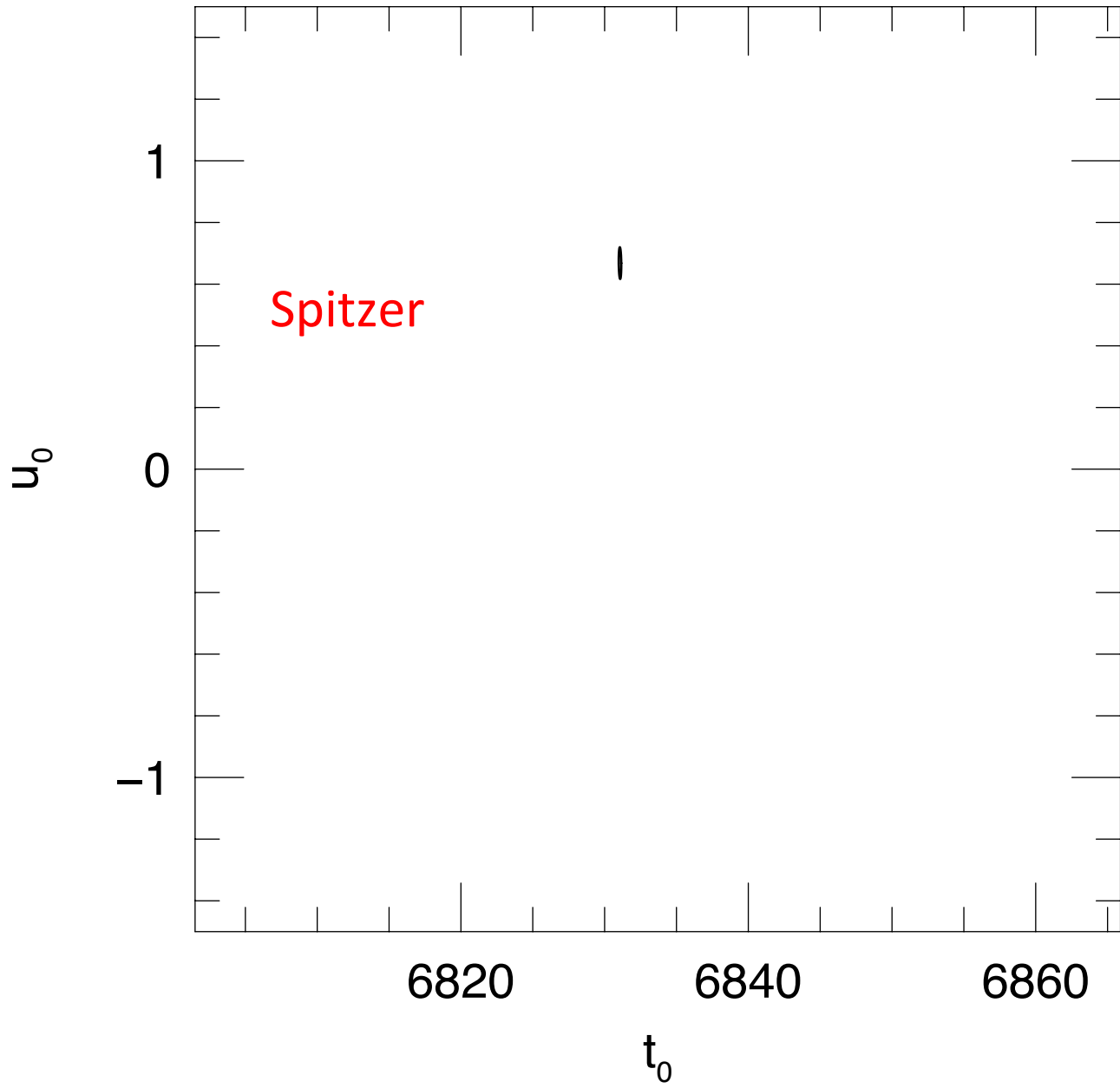


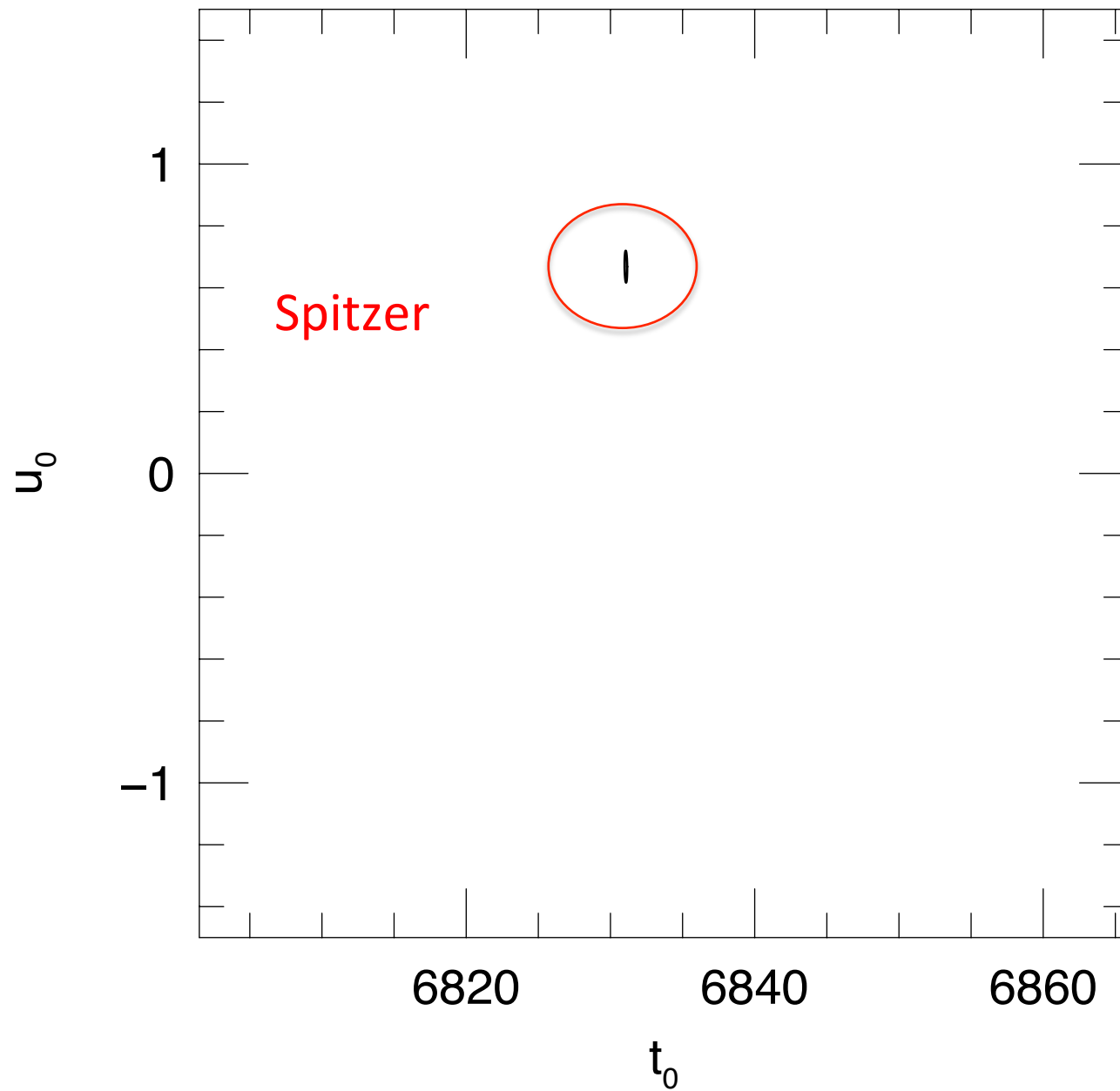


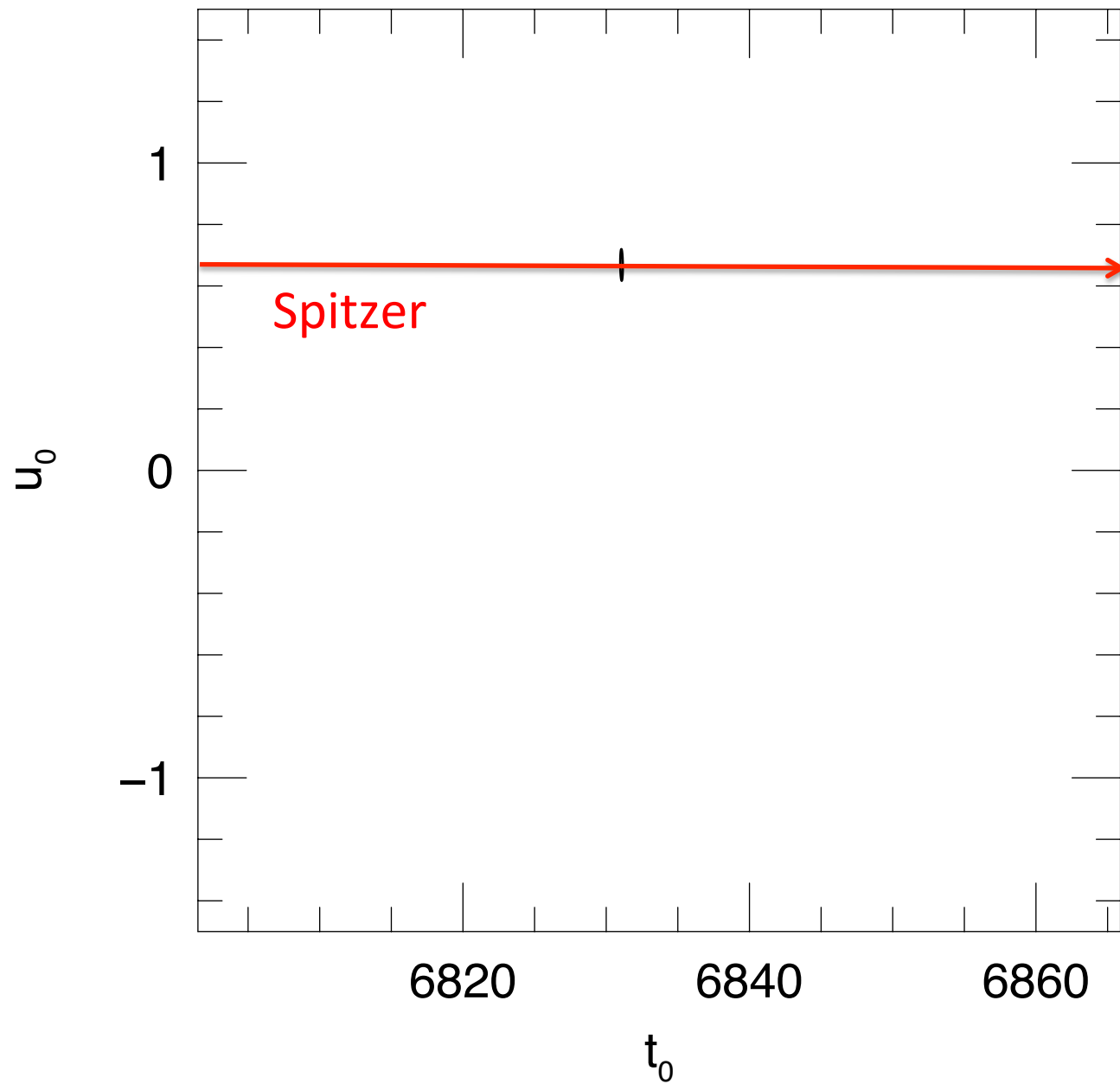


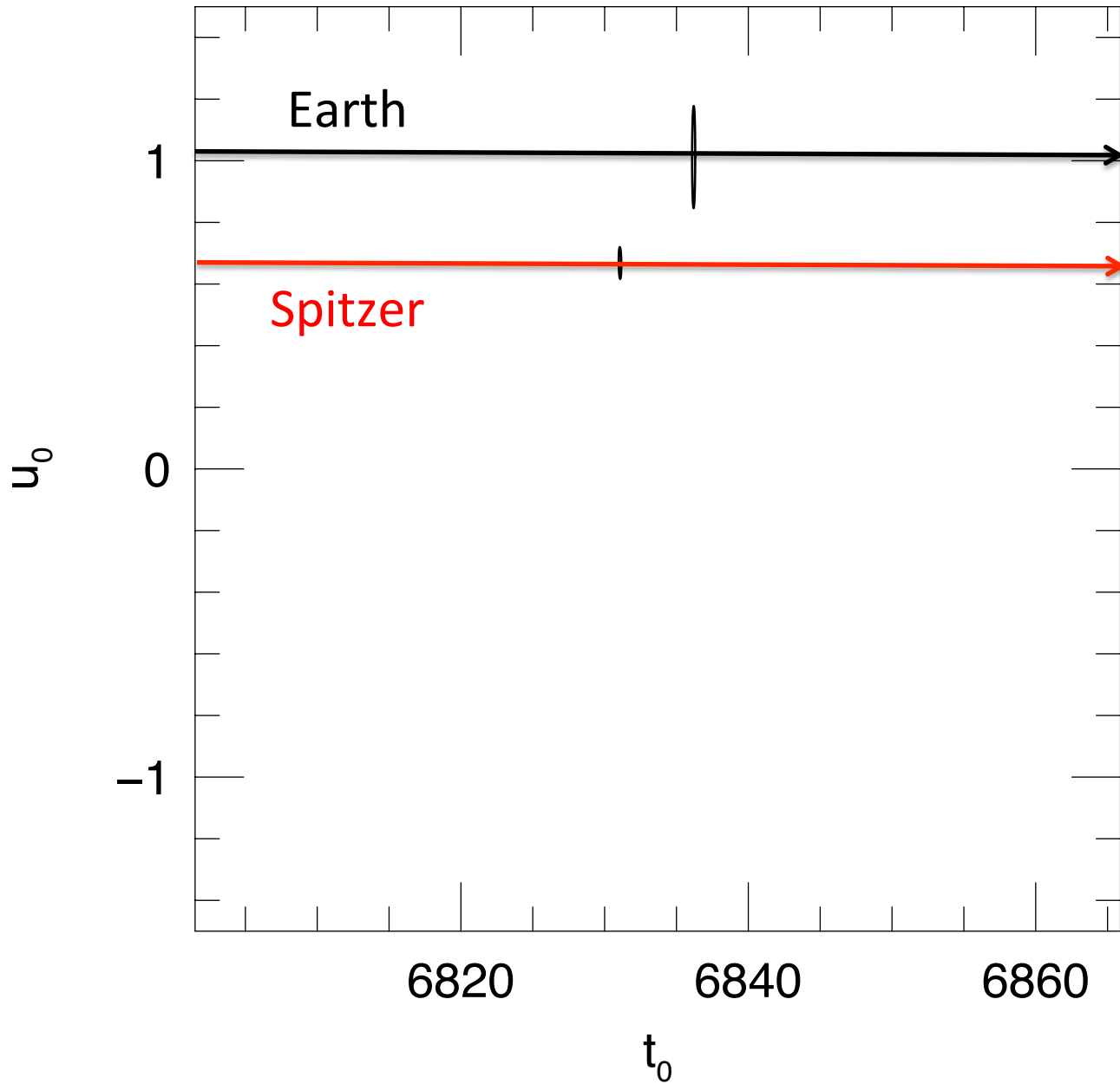


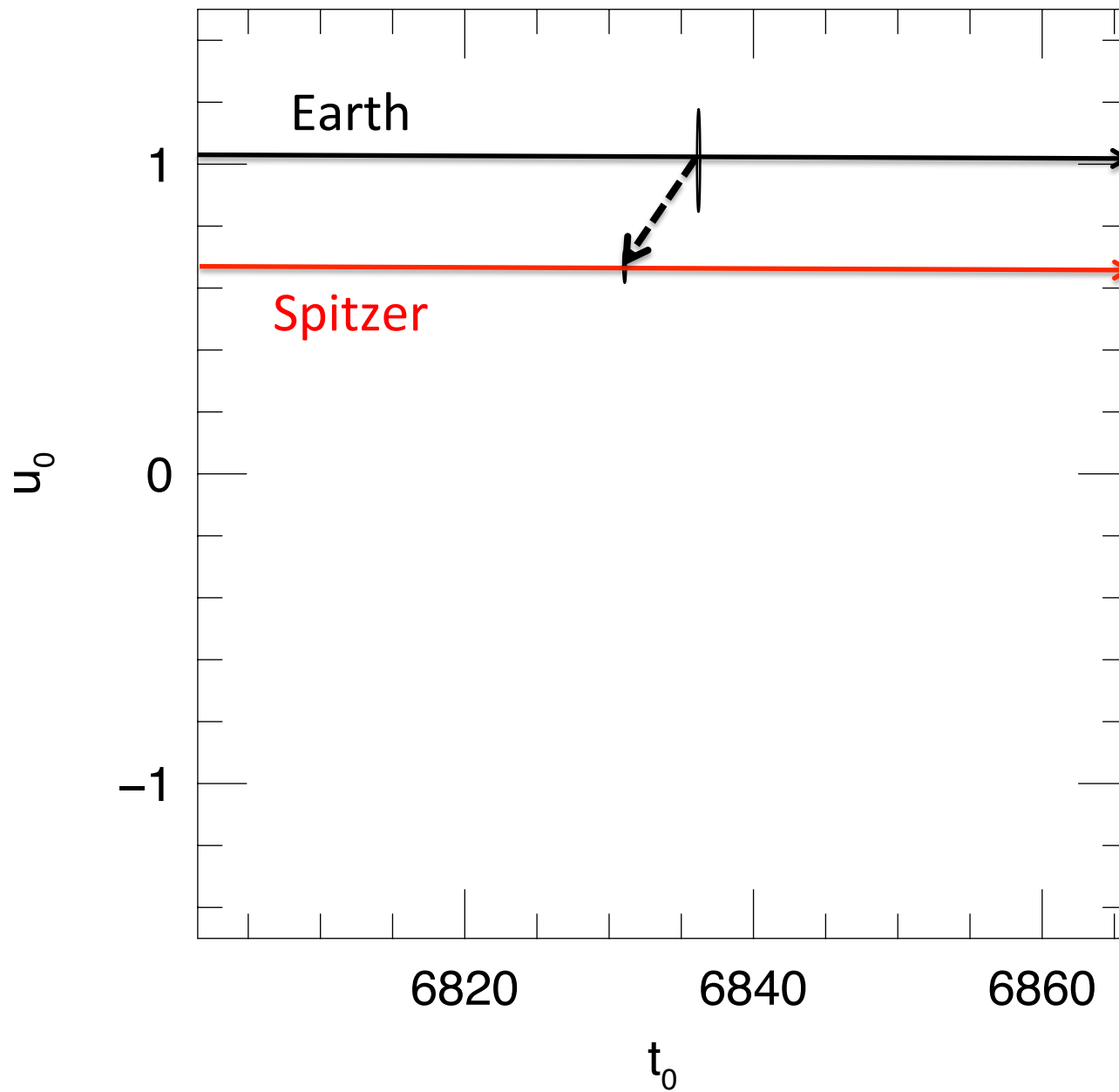


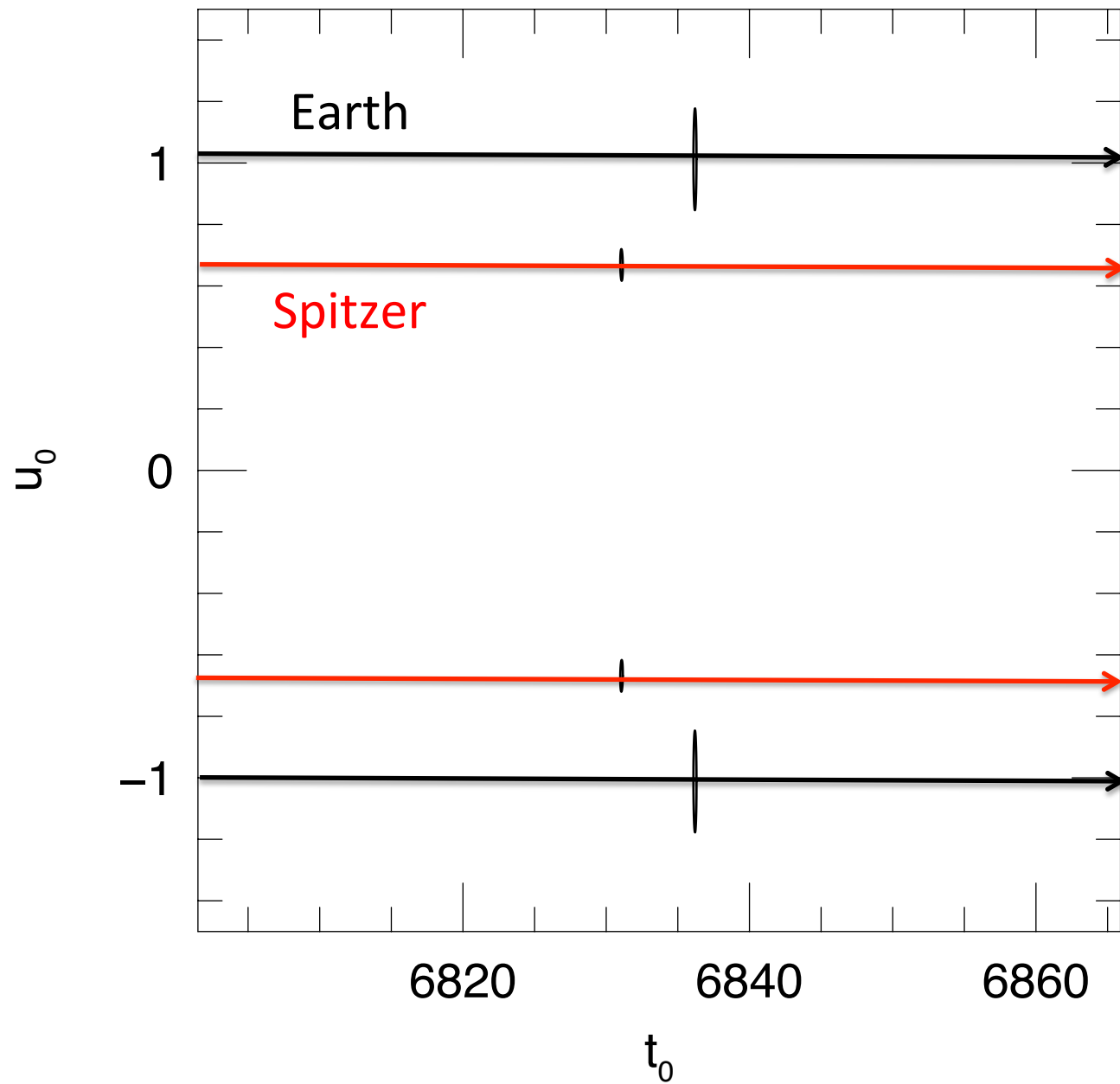


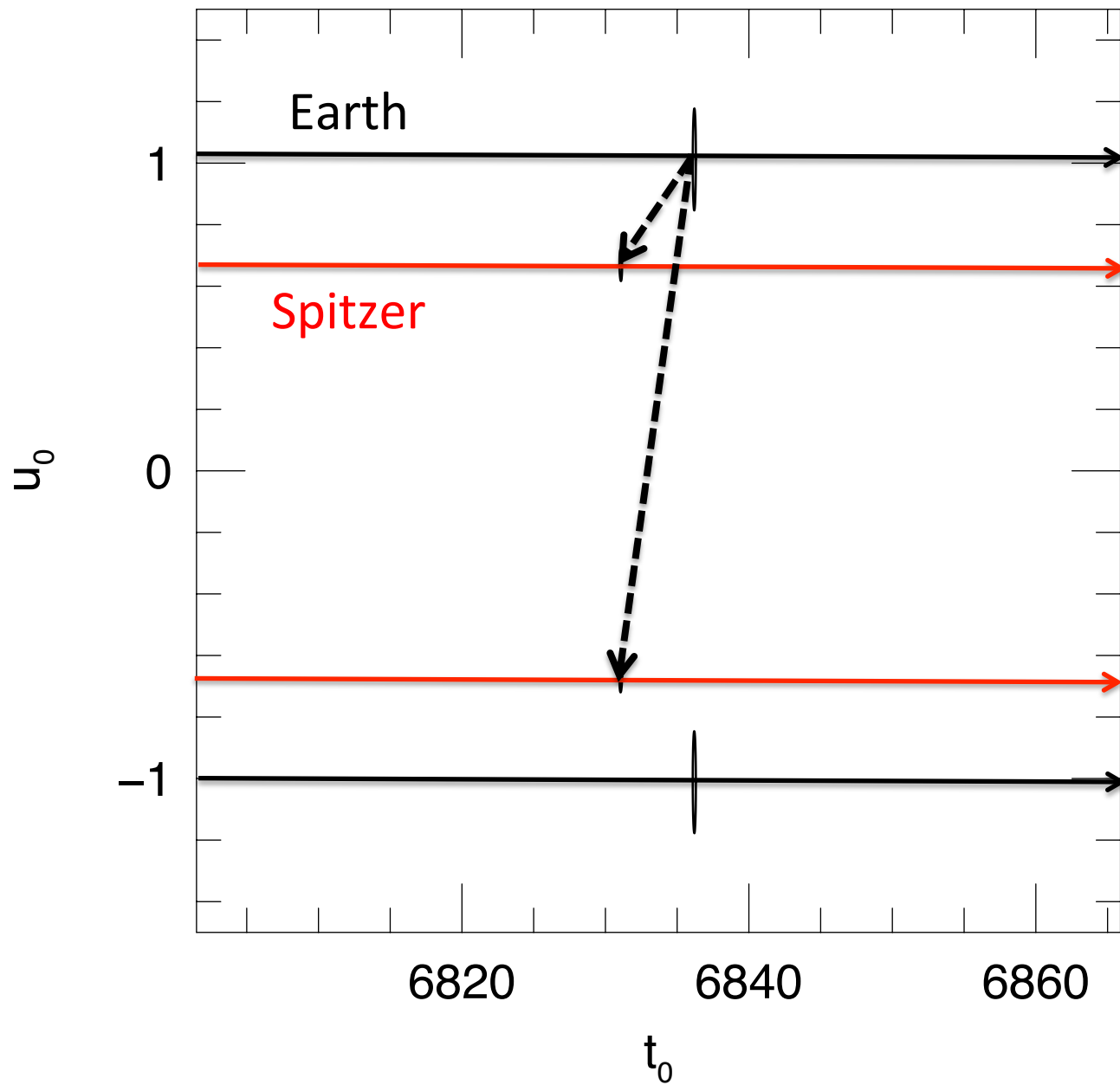


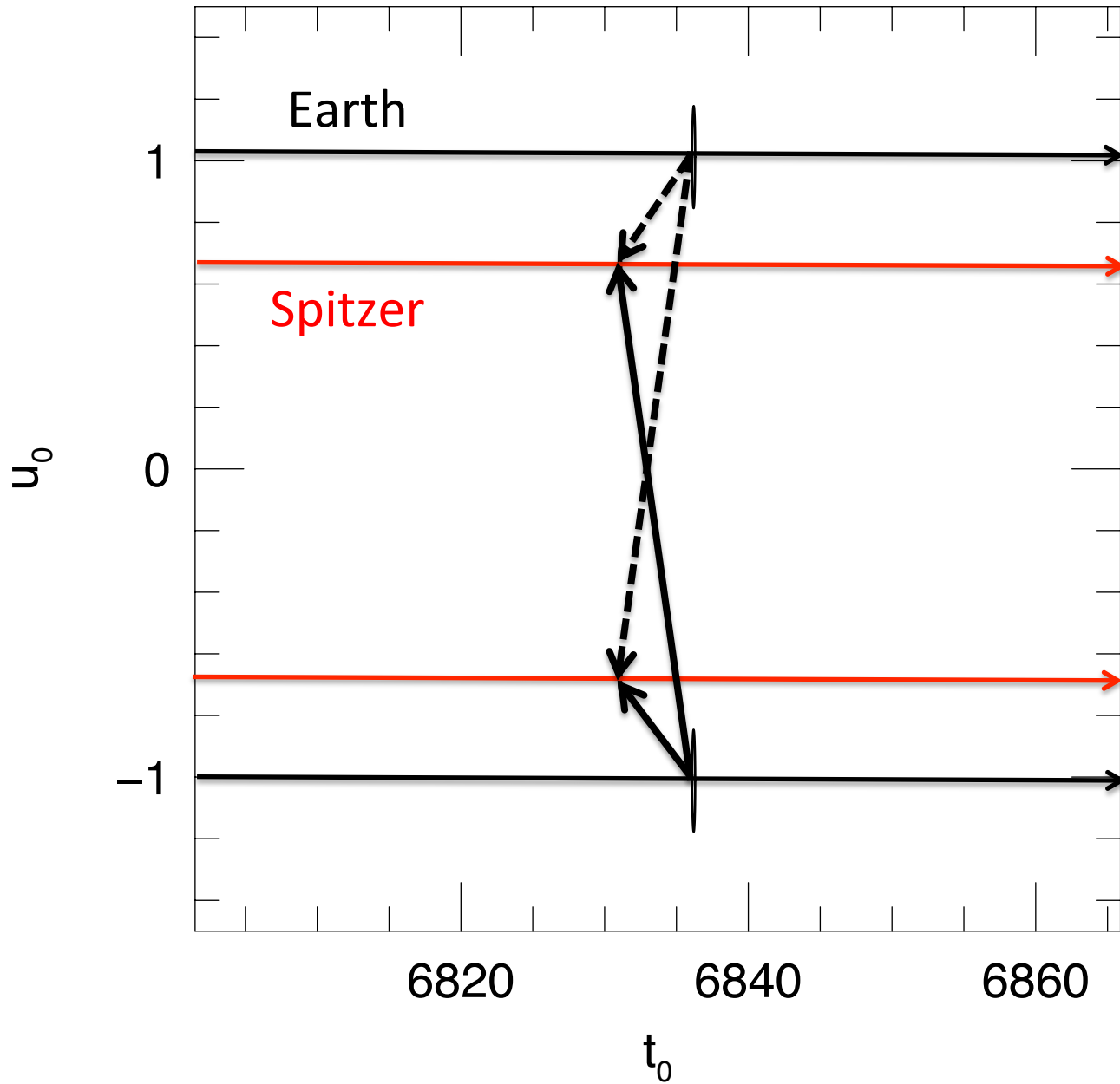


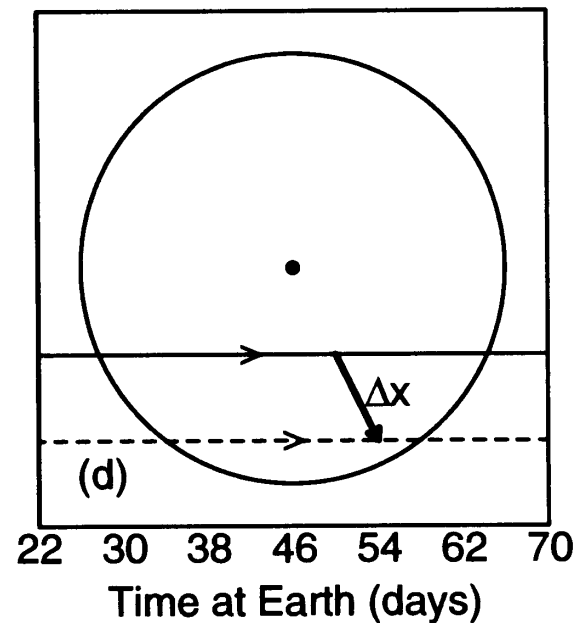
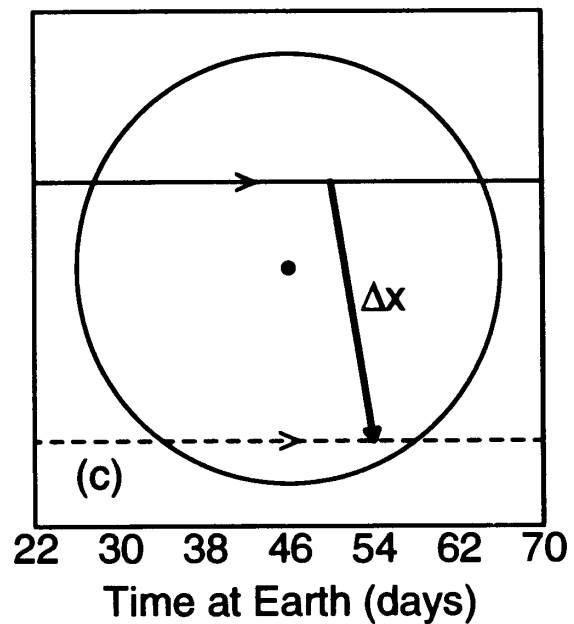
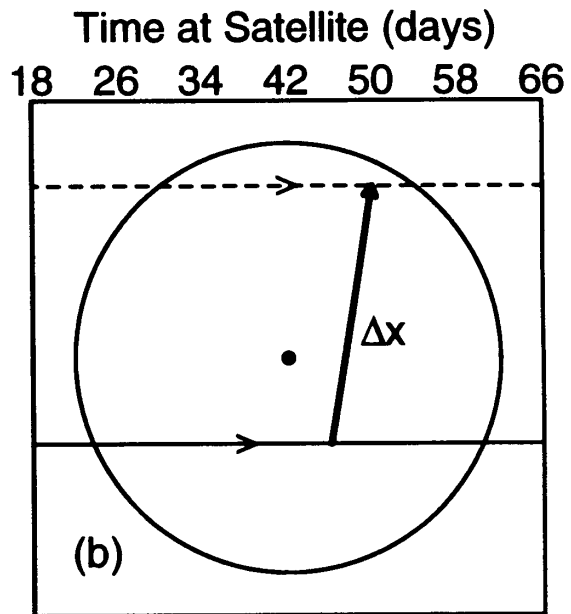
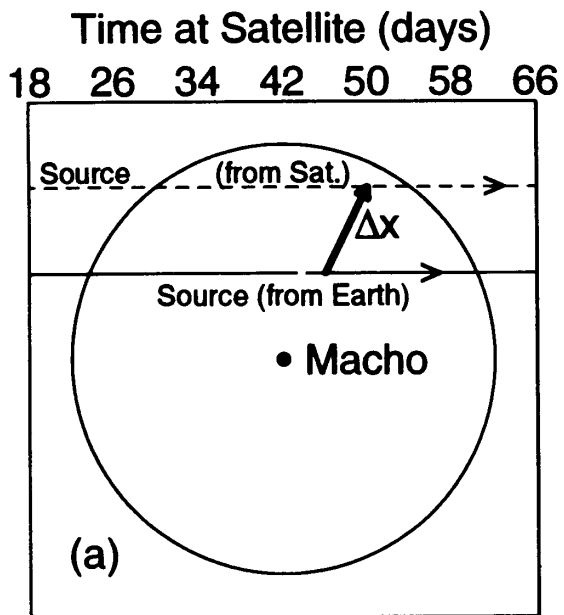


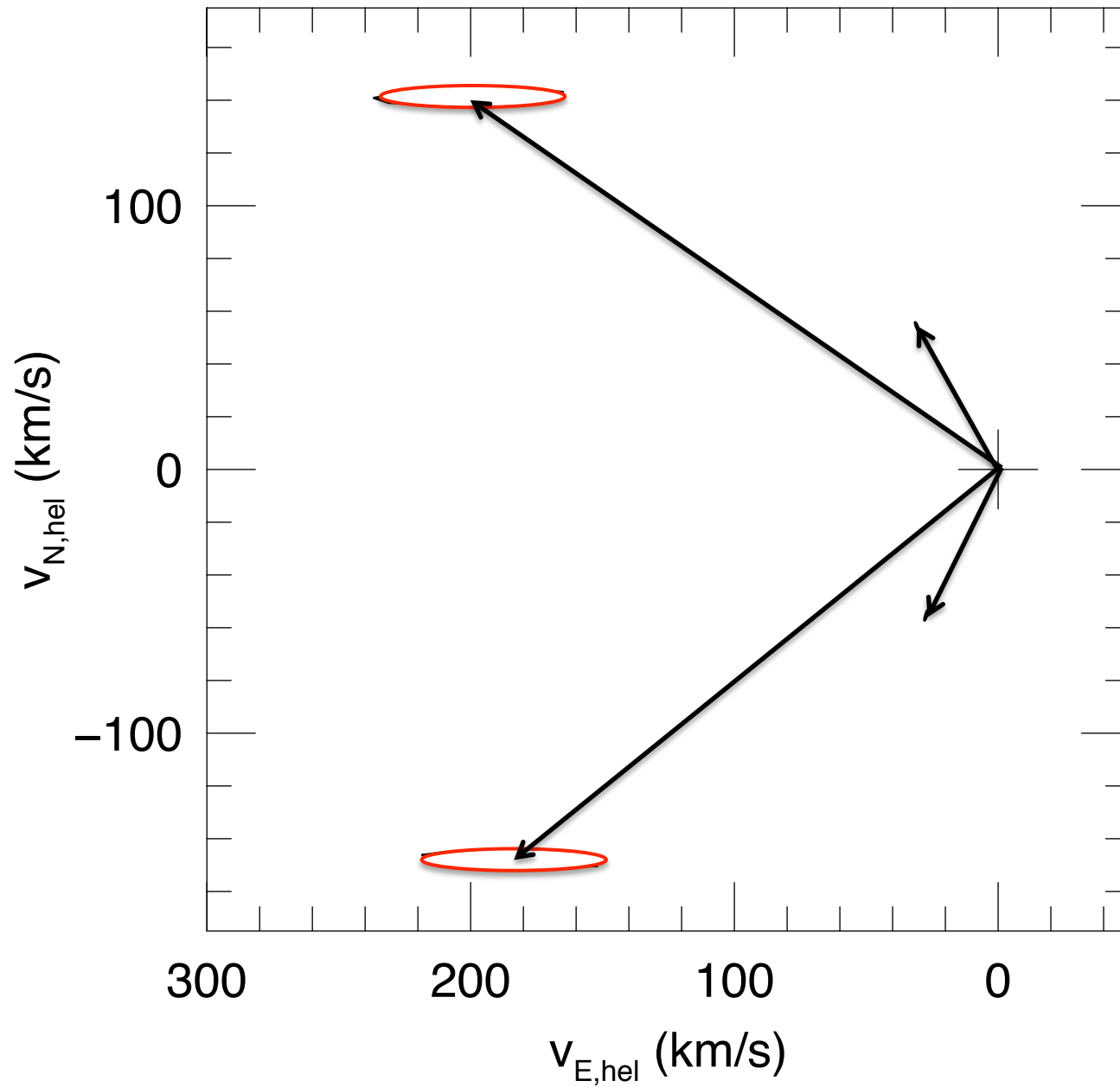


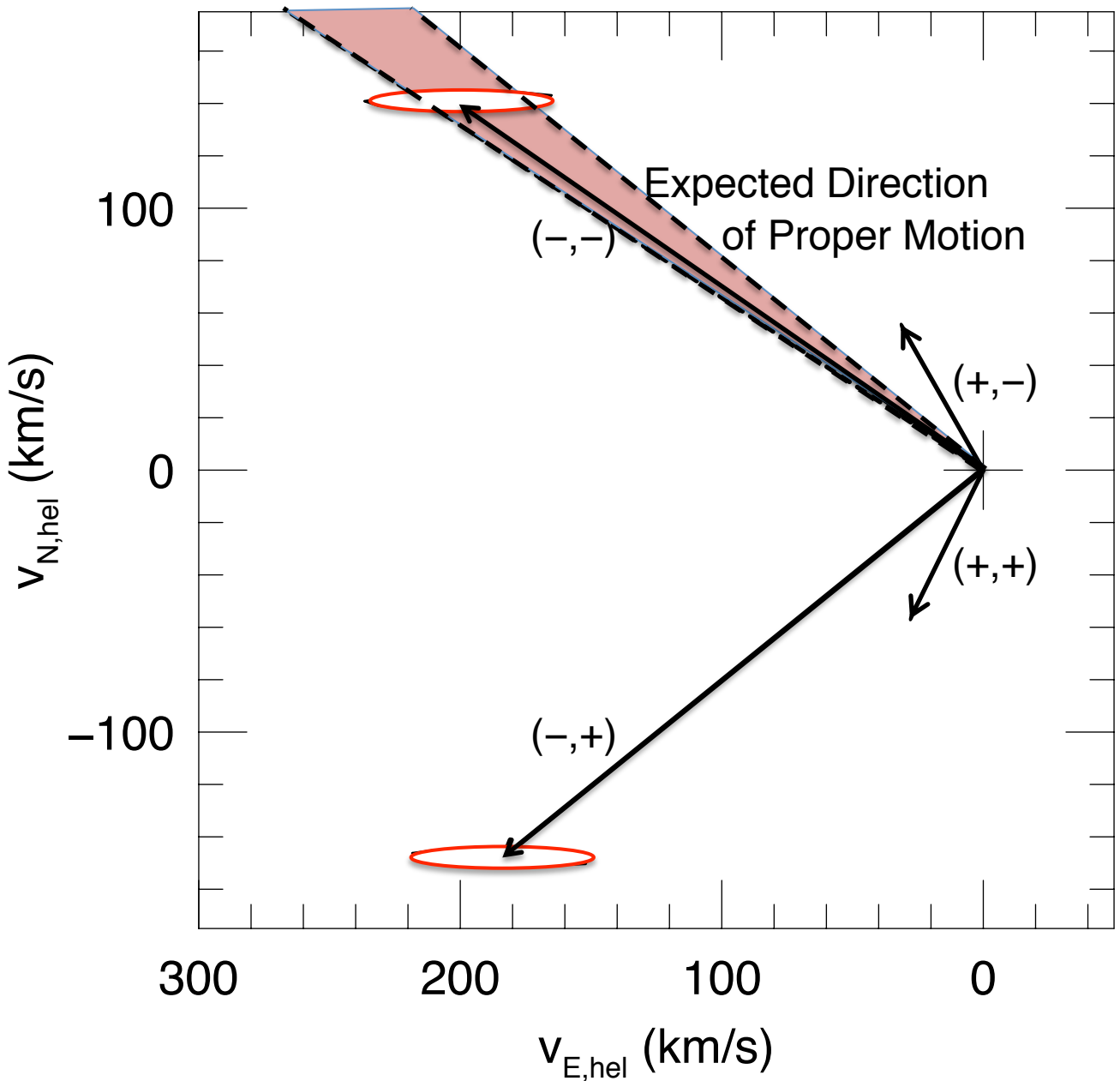




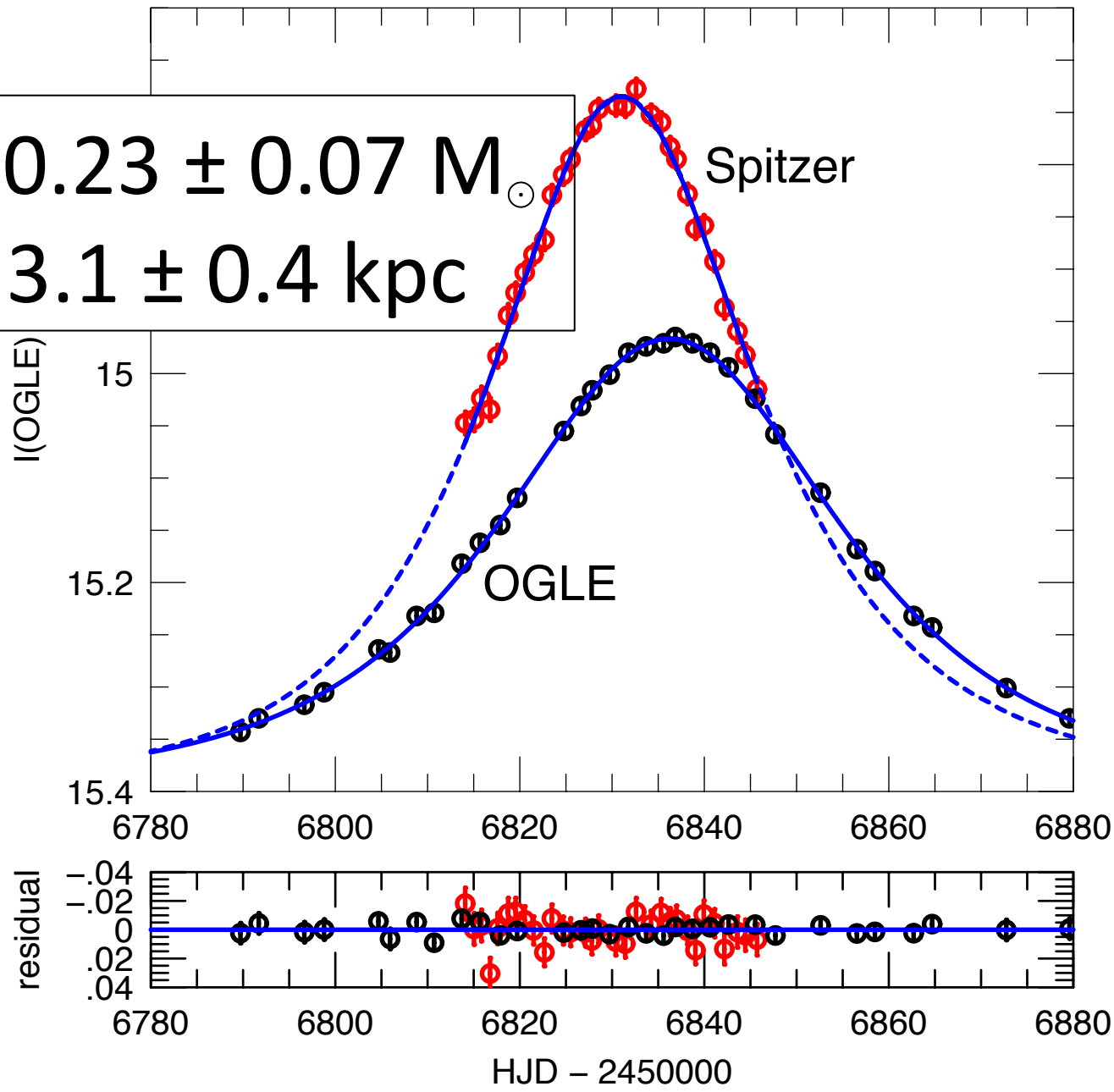


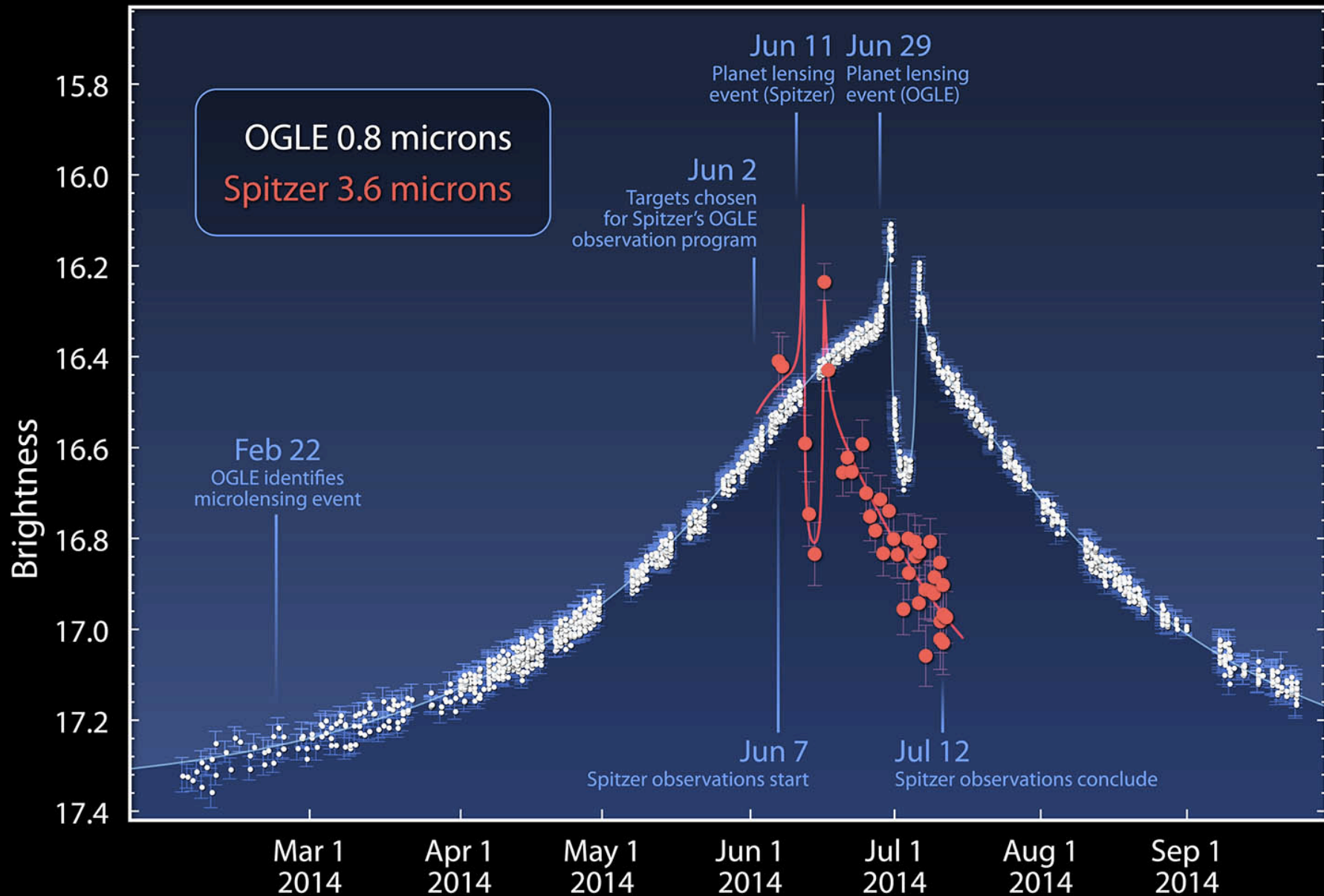






$M = 0.23 \pm 0.07 M_{\odot}$
 $D_L = 3.1 \pm 0.4 \text{ kpc}$



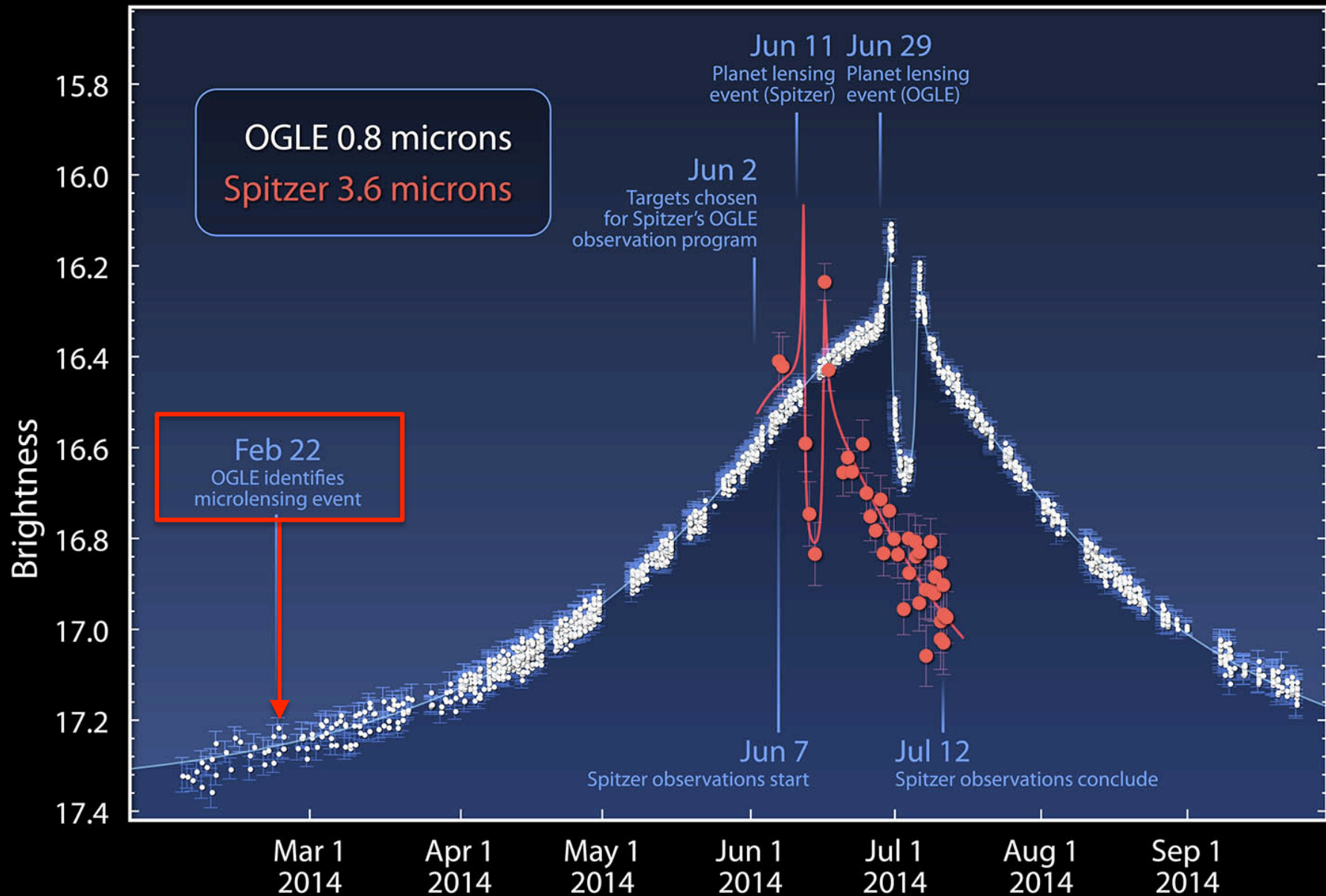


Microlens Parallax Vector of OGLE-2014-BLG-0124L

NASA / JPL-Caltech / A. Udalski (Warsaw University Observatory)

Spitzer Space Telescope • IRAC

sig15-005

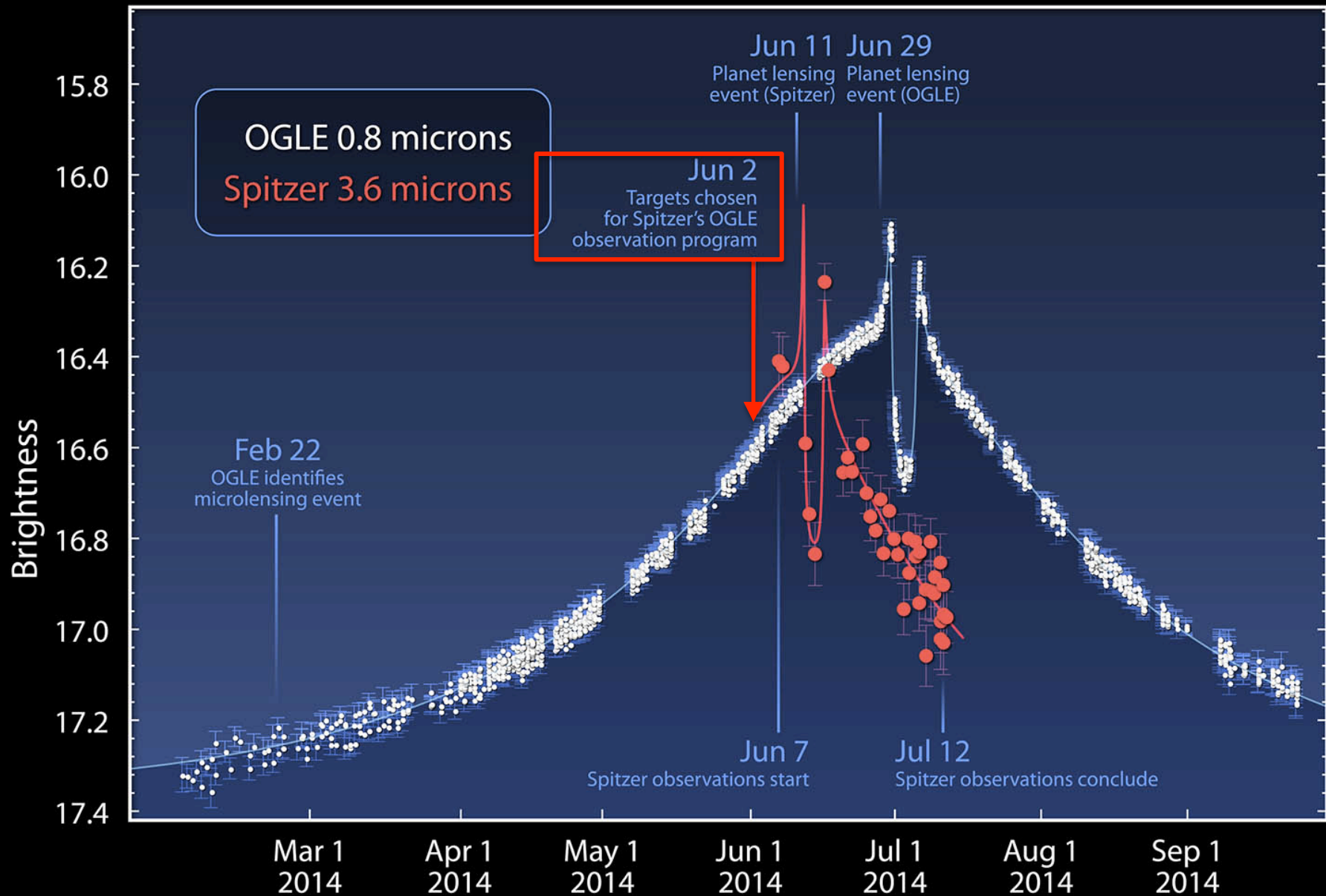


Microlens Parallax Vector of OGLE-2014-BLG-0124L

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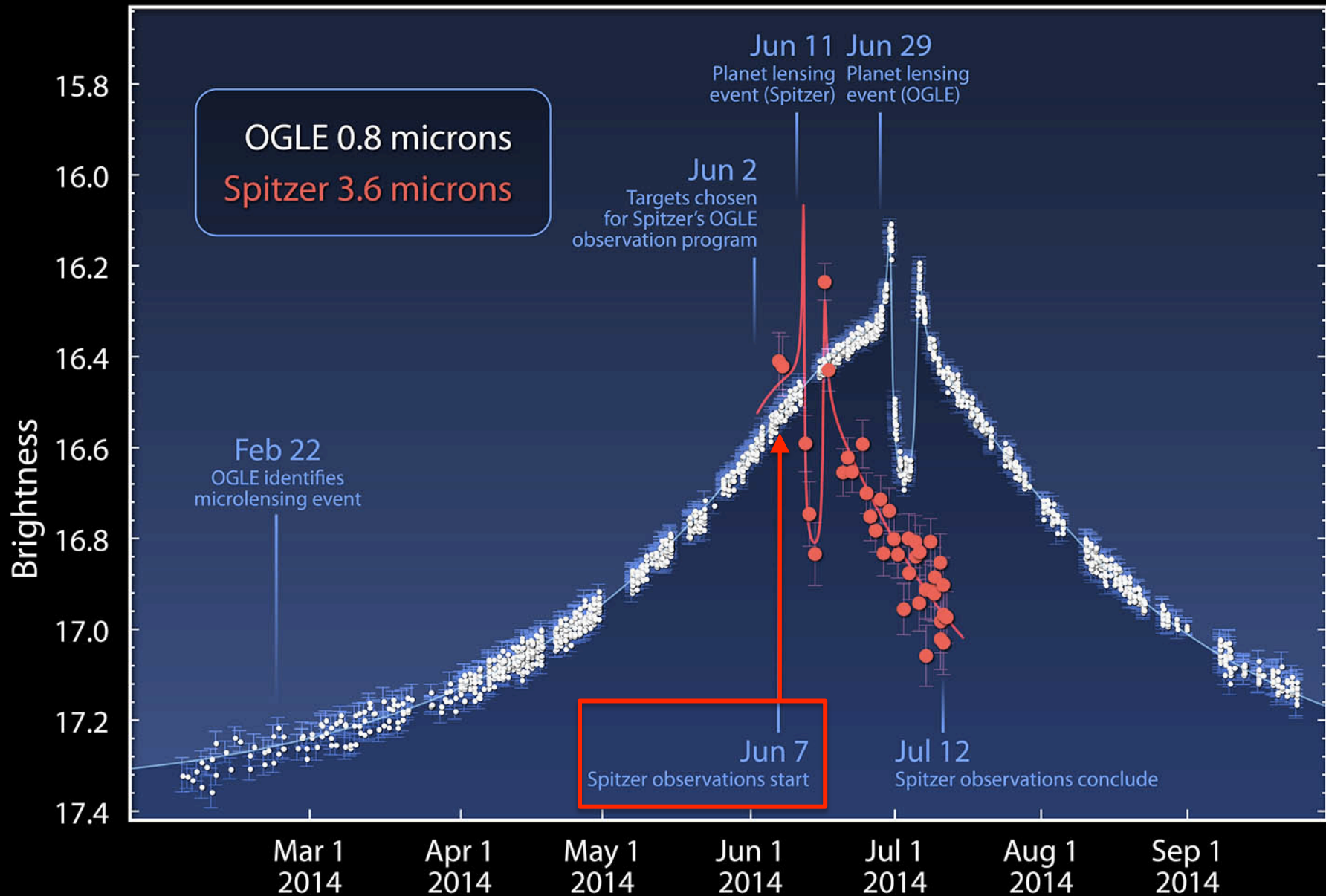


Microlens Parallax Vector of OGLE-2014-BLG-0124L

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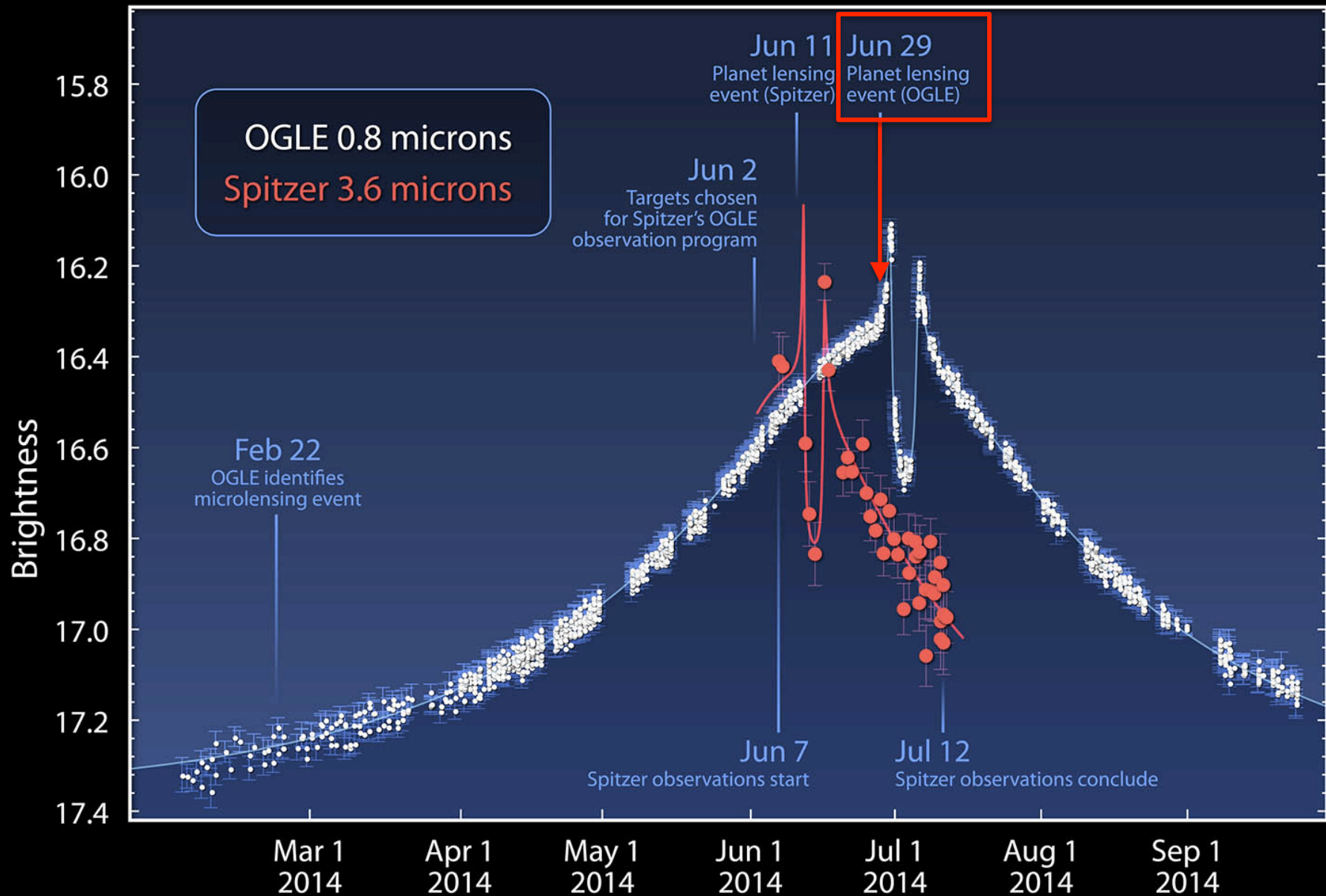


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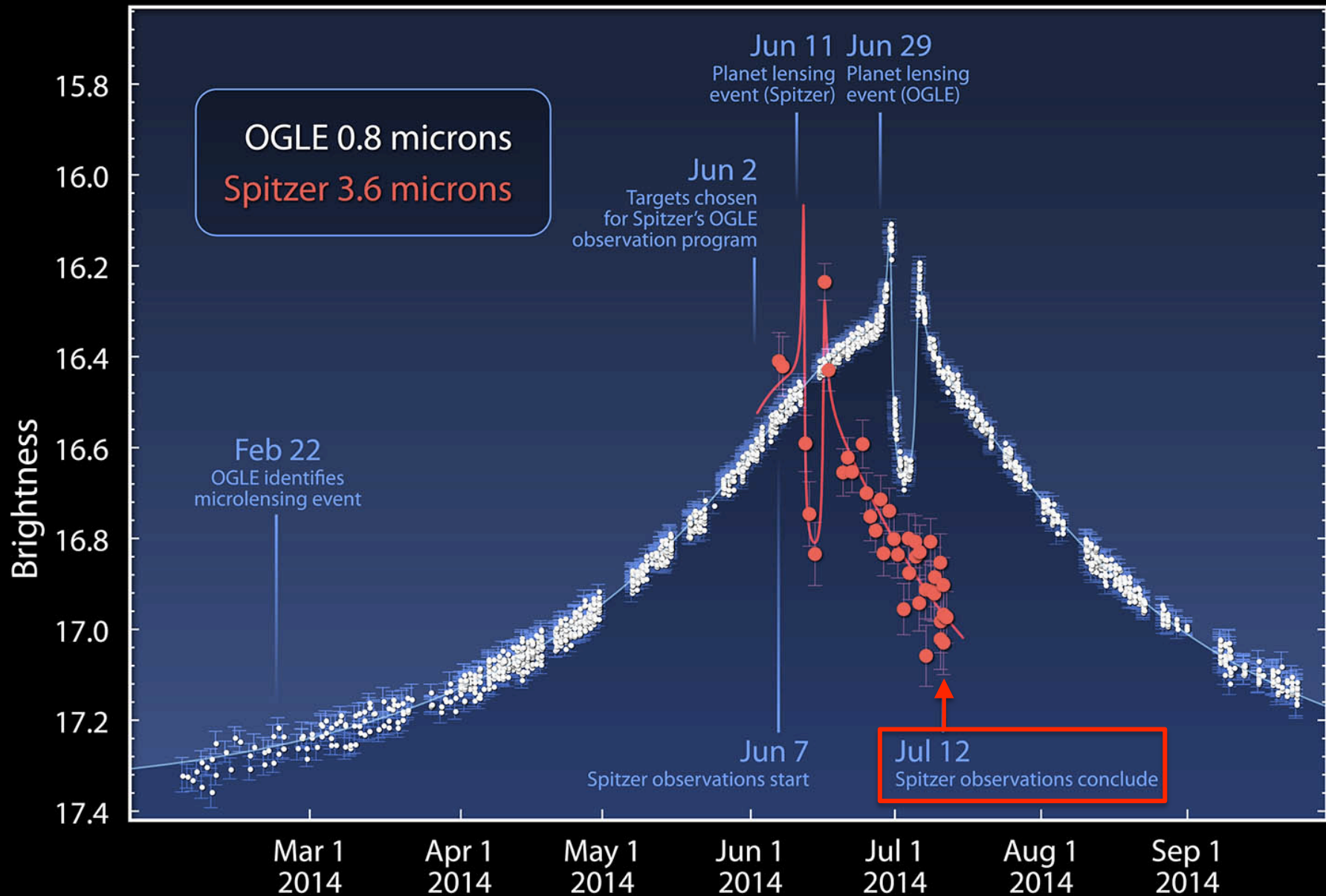


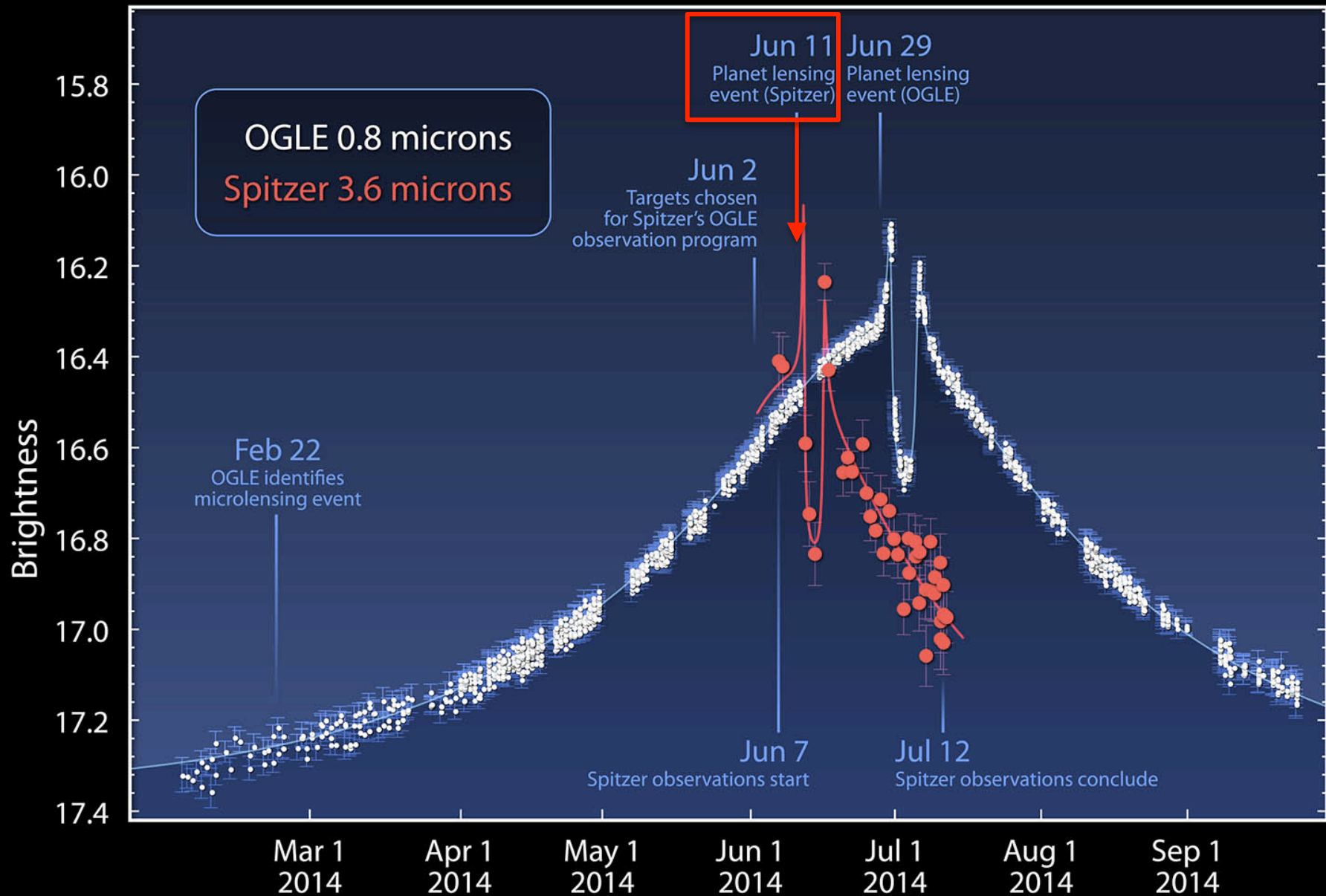
Microlens Parallax Vector of OGLE-2014-BLG-0124L

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sig15-005



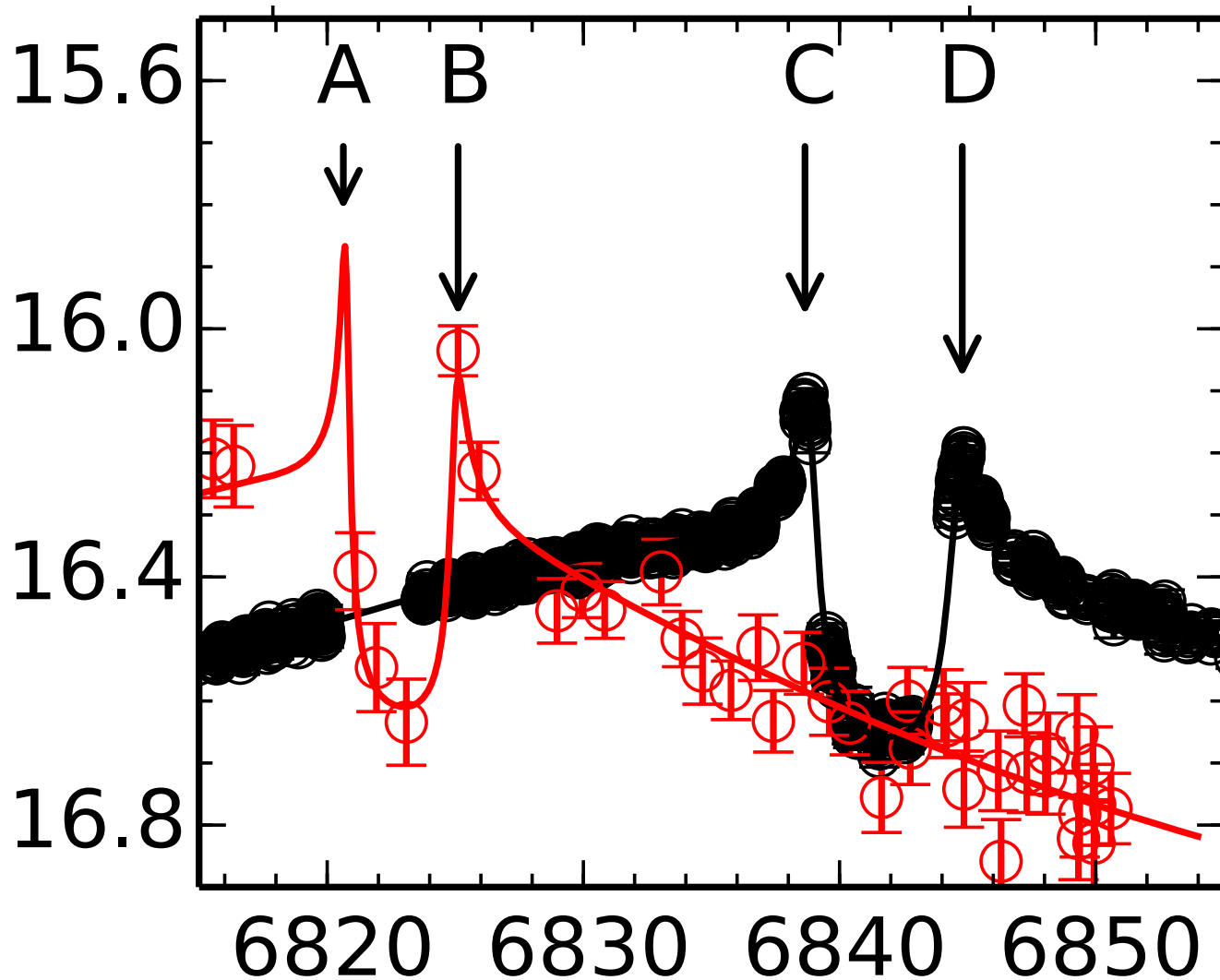


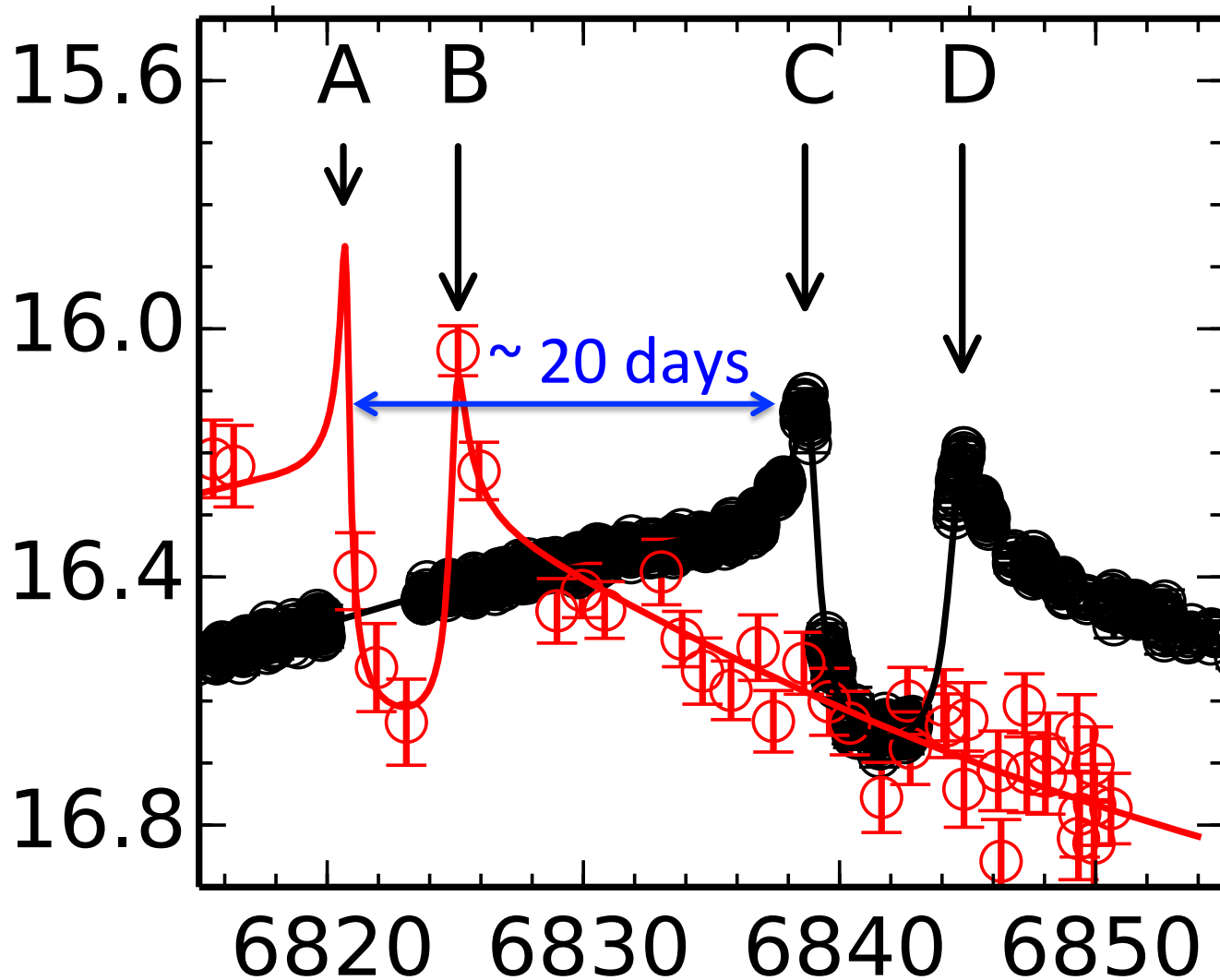
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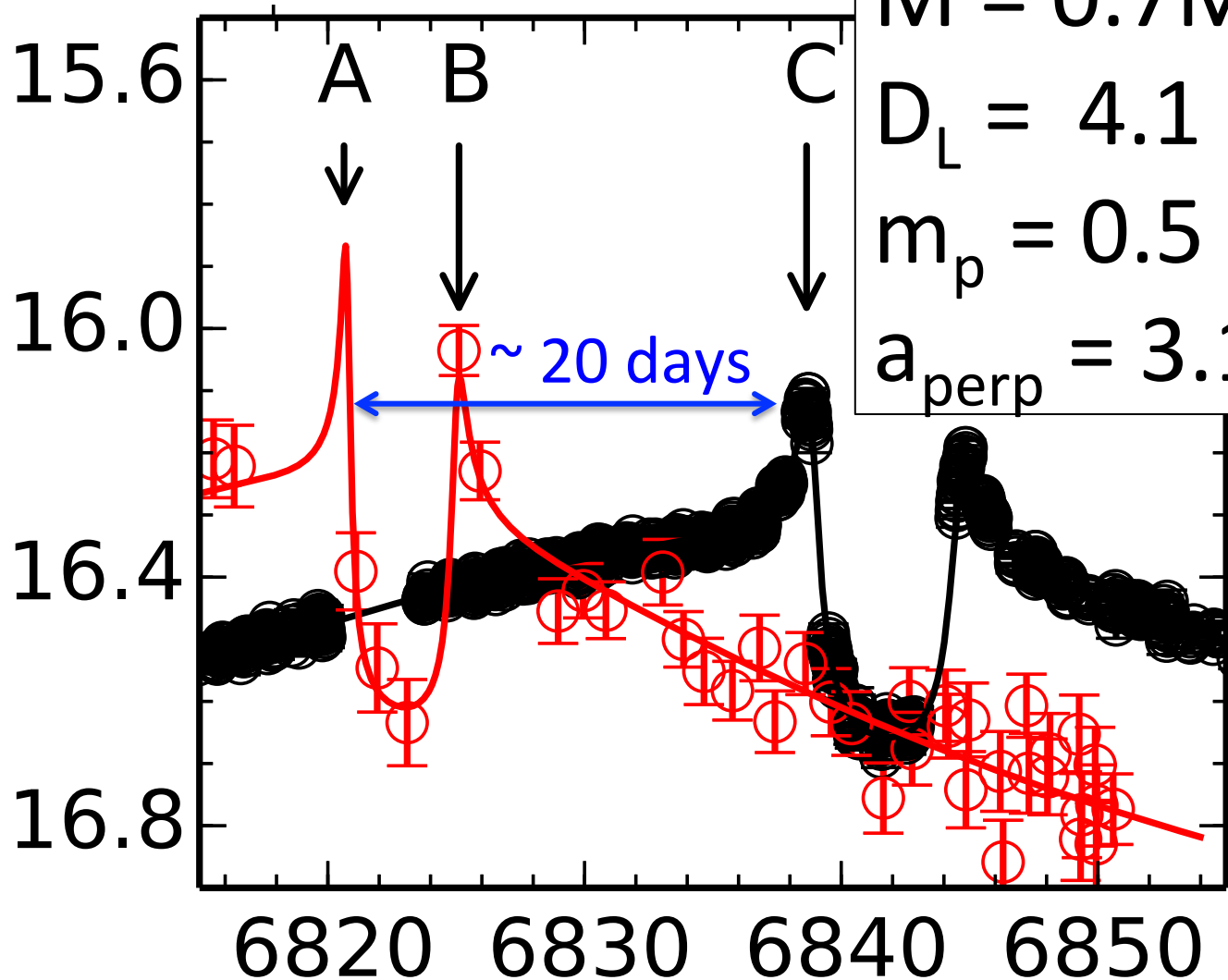
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Spitzer Space Telescope • IRAC

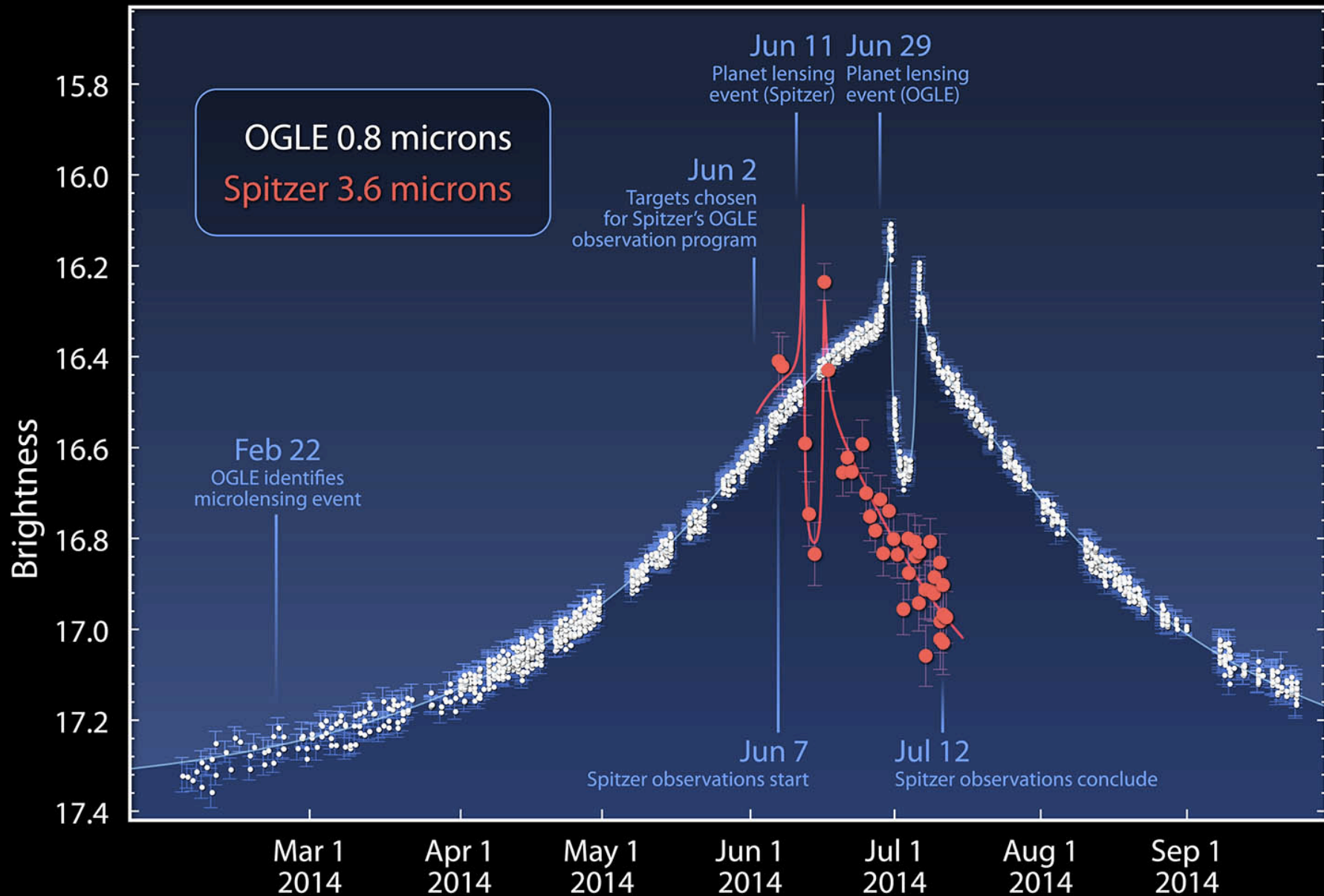
sig15-005







$M = 0.7 M_{\odot}$
 $D_L = 4.1$ kpc
 $m_p = 0.5 M_{\text{jup}}$
 $a_{\text{perp}} = 3.1$ AU



Microlens Parallax Vector of OGLE-2014-BLG-0124L

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sig15-005

Milky Way Galaxy

Most Known
Exoplanets

Our Solar System

Microlensing
Exoplanets

OGLE-2014-BLG-0124L

Milky Way Galaxy

Most Known
Exoplanets



Our Solar System

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Microlensing
Exoplanets

Milky Way Galaxy



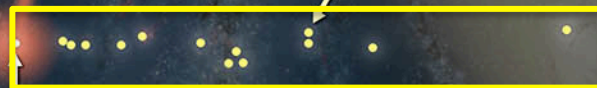
Milky Way Galaxy

Most Known
Exoplanets

OGLE-2014-BLG-0124L

Microlensing
Exoplanets

Our Solar System



Science!

- Masses of individual planets
- Additional planet discoveries
- Mass measurements for binary systems, including brown dwarfs
- The first mass-based measurement of the mass-function
- Galactic distribution of planets