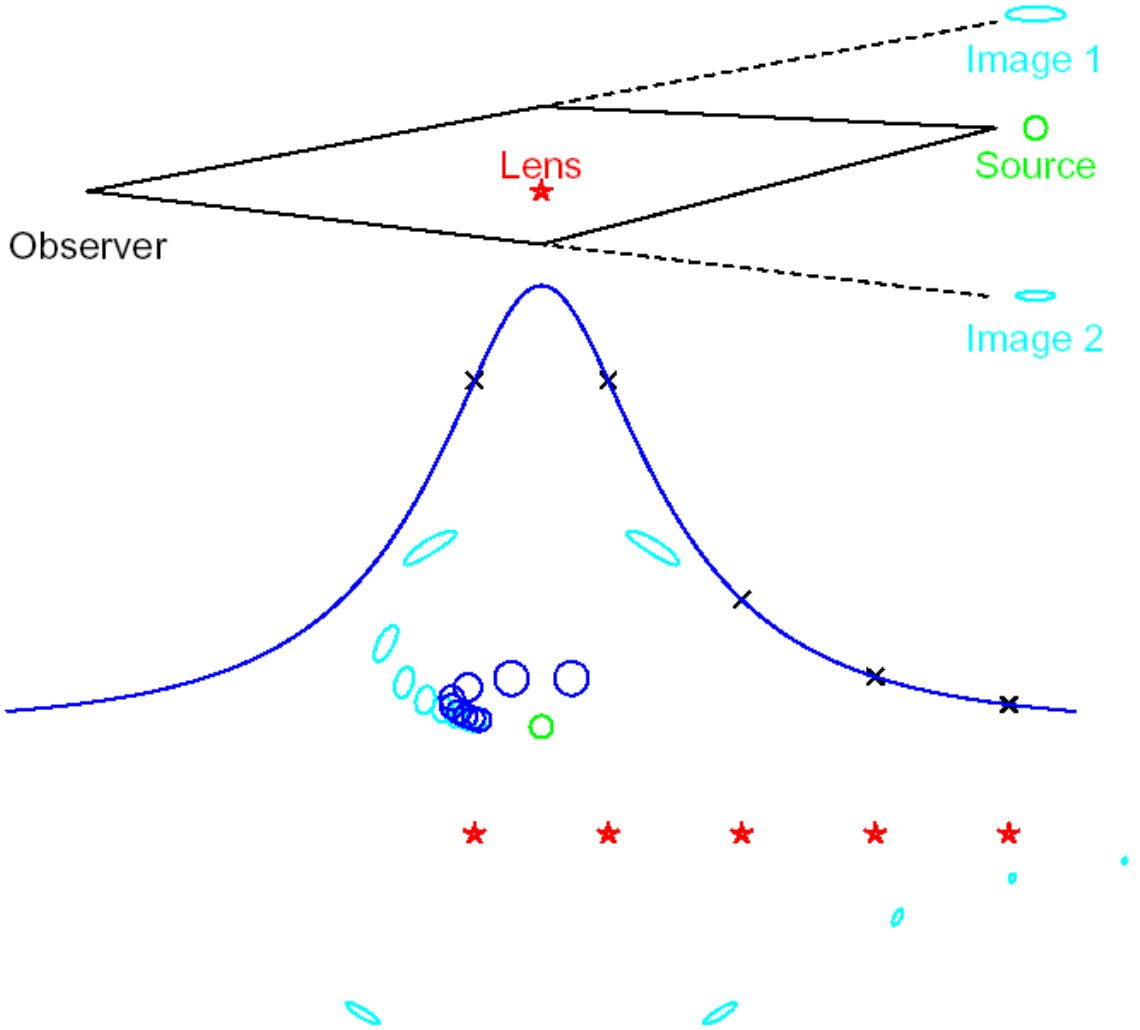
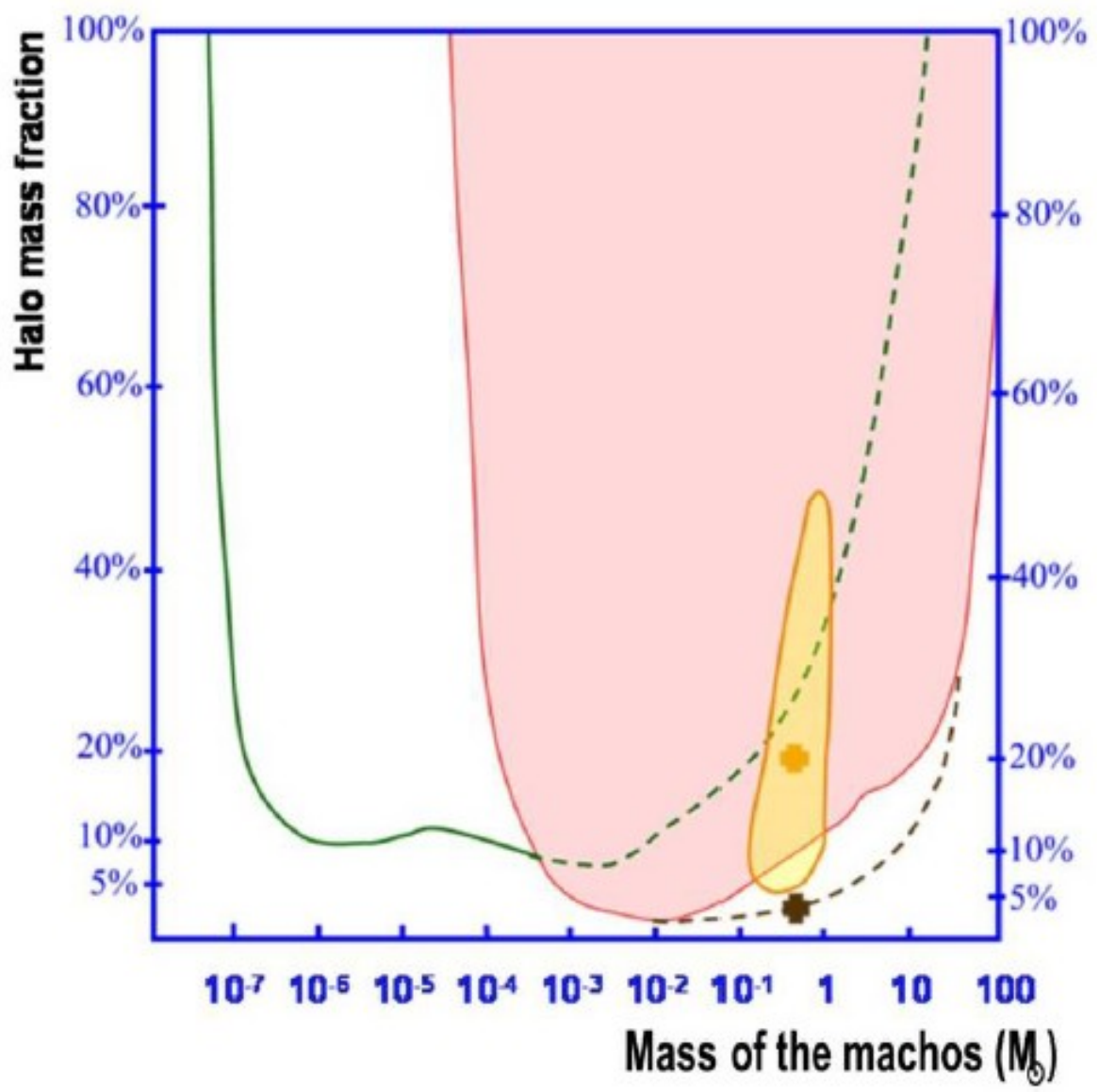
Microlens Parallaxes with warm Spitzer

Andy Gould (Ohio State)

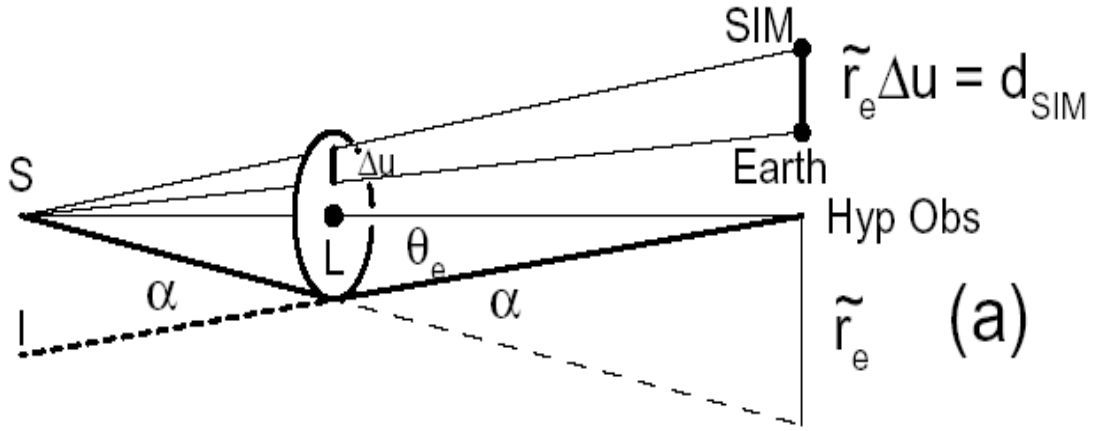


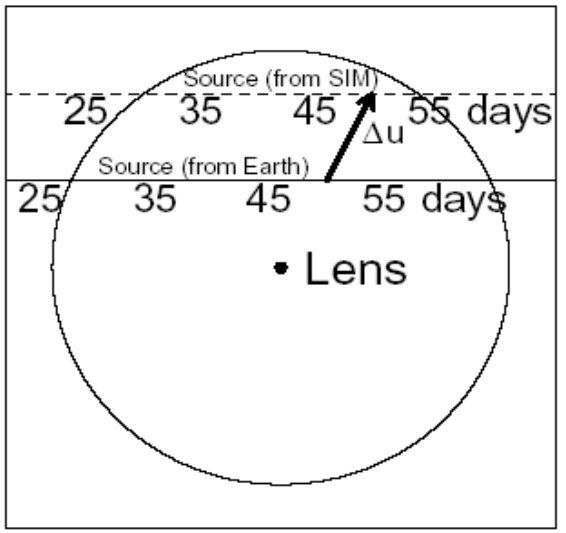
Halo Macho Dark Matter?

MACHO "yes"/EROS "upper limits"



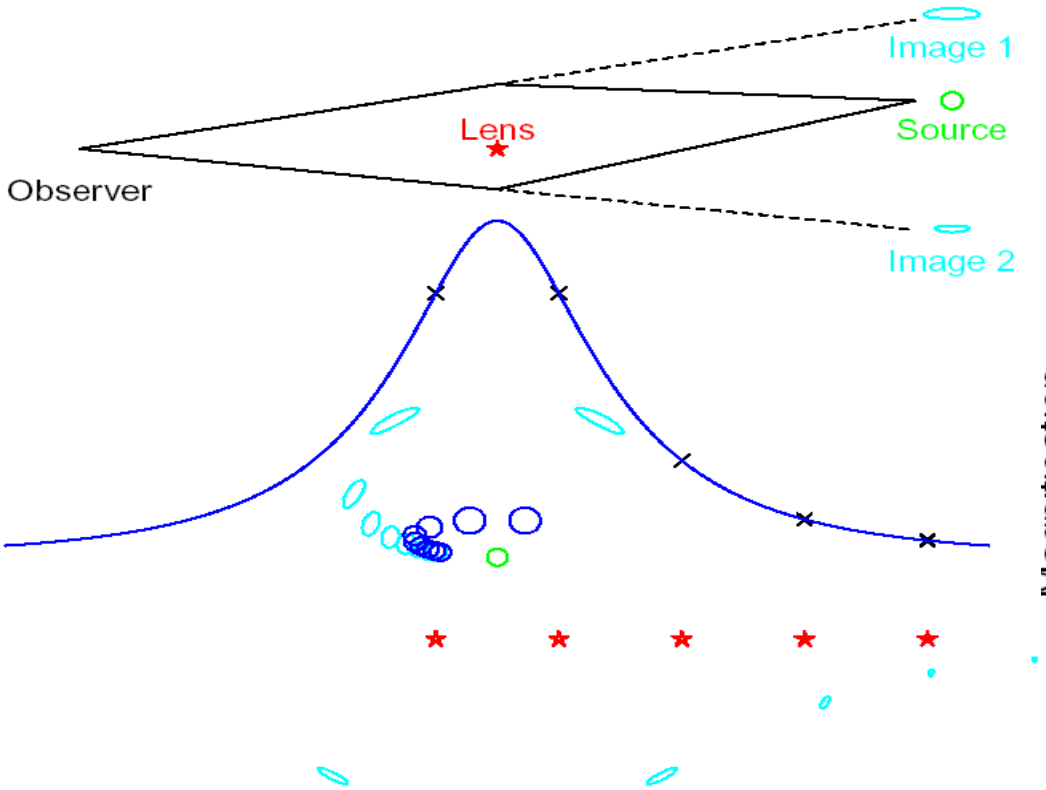
To Fully Determine Lens Nature: SIM

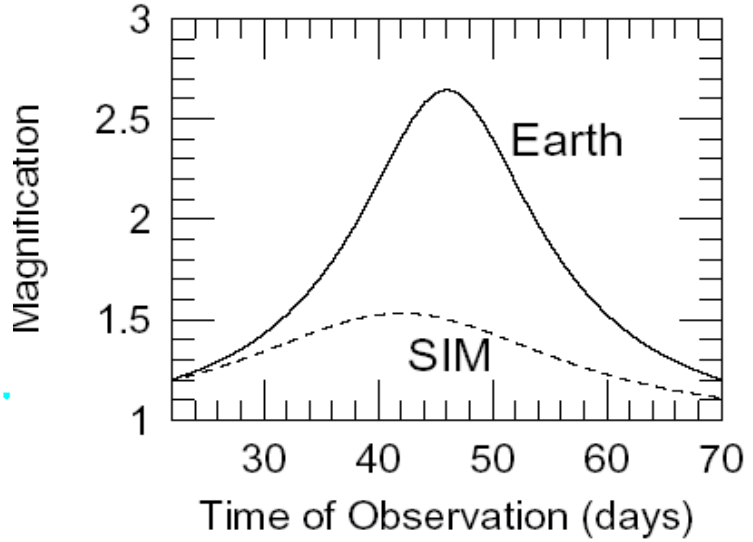




$$\tilde{r}_e = \frac{d_{SIM}}{\Delta u}$$

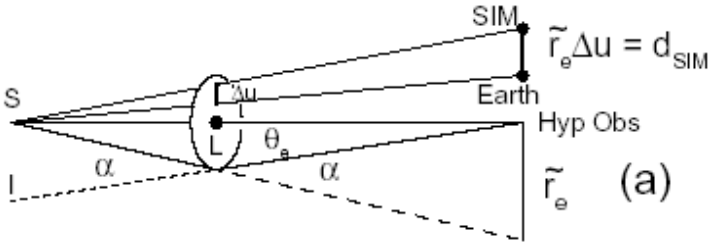
(b)

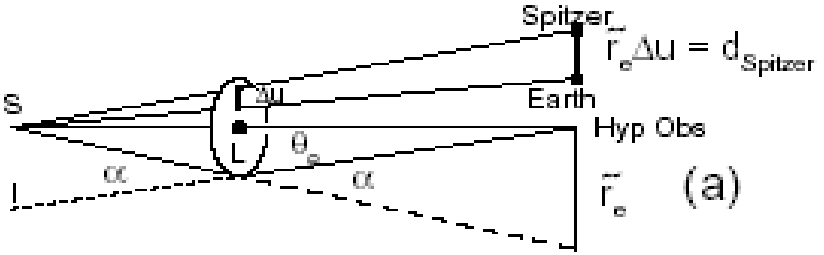


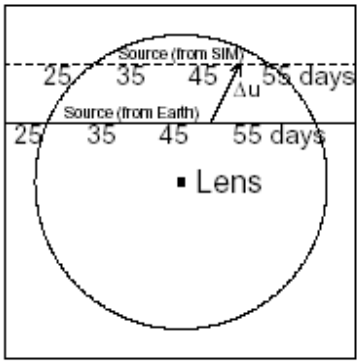


(c)

... or, more immediately: Spitzer

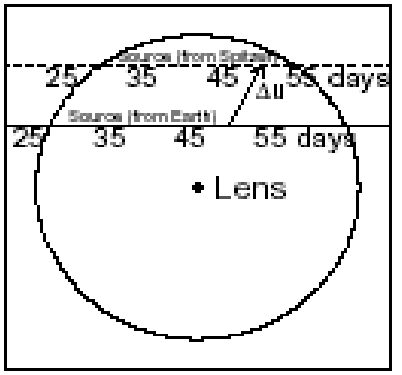






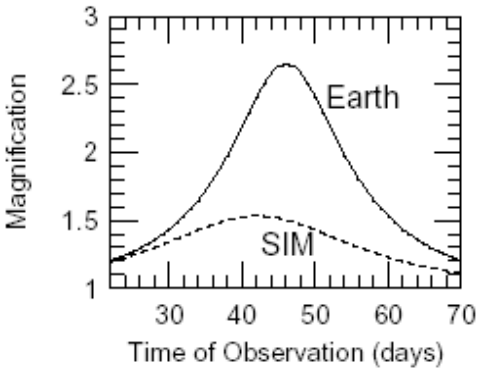
$$\tilde{r}_e = \frac{d_{SIM}}{\Delta u}$$

(b)

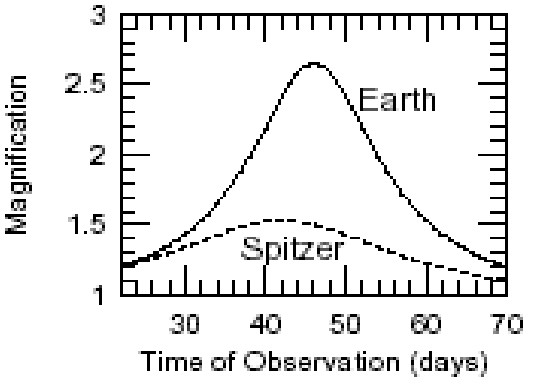


$$\tilde{r}_e = \frac{d_{Spitzer}}{\Delta u}$$

(b)



(c)



(c)

From a paper written 8 years ago ...

THE ASTROPHYSICAL JOURNAL, 514:869–877, 1999 April 1

MICROLENS PARALLAXES WITH SIRTF

ANDREW GOULD[1]
Ohio State University, Department of Astronomy, 174 West 18th Avenue, Columbus, OH 43210; gould@astronomy.ohio-state.edu
Received 1998 July 27; accepted 1998 November 2

$$t_{0,S} = t_{0,\oplus} + \Delta t_0 \ ,$$

$$\frac{\Delta t_0}{t_{e,\oplus}} = \Delta u_x \cos\theta - 2(\Omega_\oplus t_{e,\oplus})^{-2}\gamma_\oplus \sin^2\theta \ ; \qquad (13)$$

$$\beta_S = |\beta_\oplus \pm \Delta\beta| \ , \quad \Delta\beta = \Delta u_x \sin\theta + (\Omega_\oplus t_{e,\oplus})^{-2}\gamma_\oplus \sin 2\theta \ ; \qquad (14)$$

$$t_{e,S} = t_{e,\oplus} + \Delta t_e \ ,$$

$$\frac{\Delta t_e}{t_{e,\oplus}} = \Delta u_x \Omega_\oplus t_{e,\oplus} \sin\theta + (\Omega_\oplus t_{e,\oplus})^{-1}\gamma_\oplus \sin 2\theta \ ; \qquad (15)$$

$$\gamma_S = \Delta u_x (\Omega_\oplus t_{e,\oplus})^2 \cos\theta + \gamma_\oplus \cos 2\theta \ . \qquad (16)$$

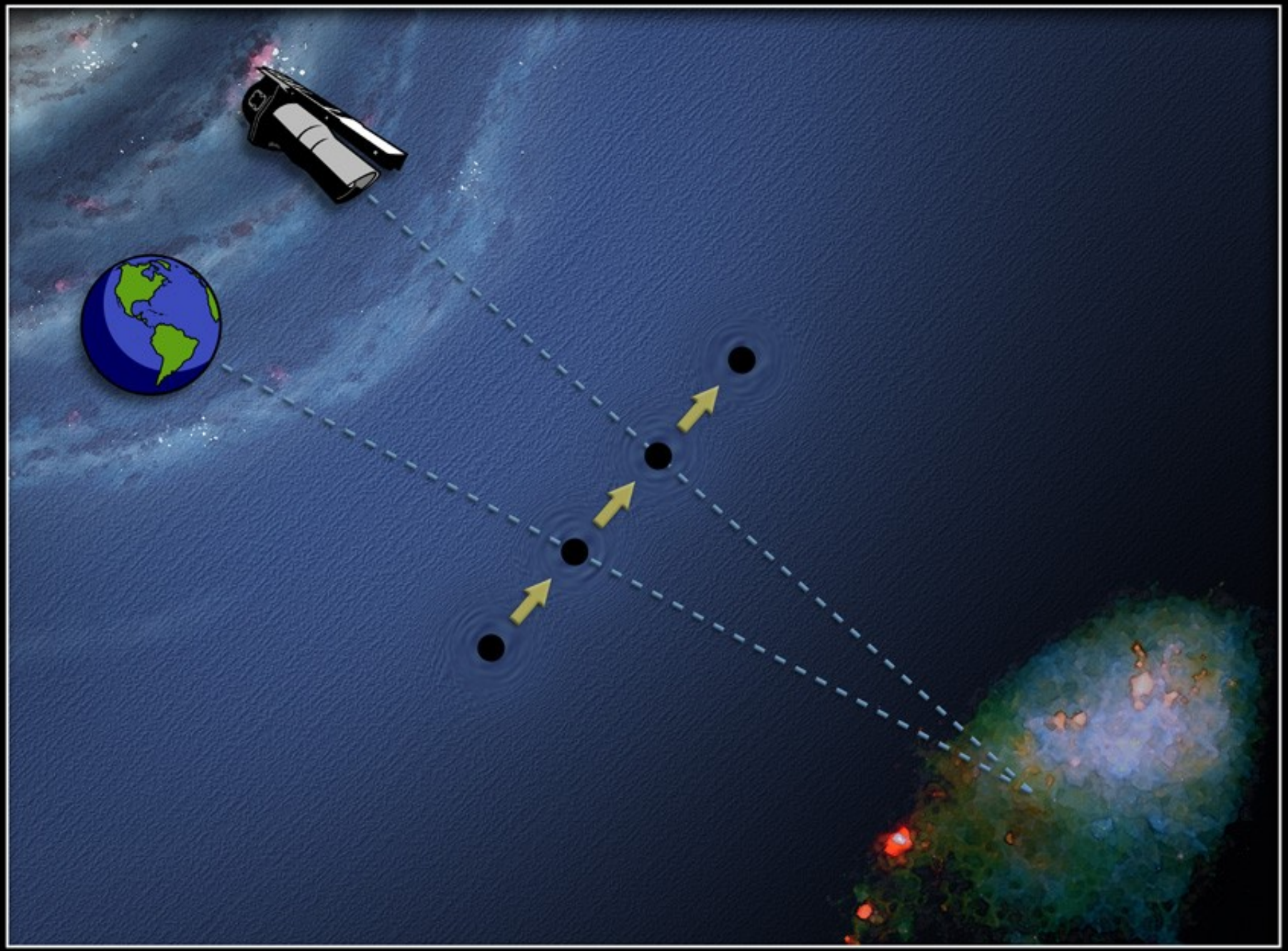
$$\frac{\sigma_{\Delta u_y}}{\Delta u} = \frac{\sigma_\gamma}{\gamma \sec\phi}$$

$$= 0.17 N^{-1/2} \frac{\sigma_0}{0.01} \frac{\tilde{v}}{275 \text{ km s}^{-1}} \left(\frac{t_e}{40 \text{ days}}\right)^{-3/2} \frac{S(\beta)}{8} \ . \qquad (21)$$

$$b_{ij}\left(\frac{t_0}{t_e}, \gamma\right) = \frac{64}{u^5(u^2+4)^{5/2}(u^2+2)\sigma_0^2} \begin{pmatrix} 2\tau^2 & -\tau^4 \\ -\tau^4 & \tau^6/2 \end{pmatrix} , \qquad (22)$$

$$\frac{\sigma_{t_0}}{t_e} \sim \left(\frac{25}{12}\right)^{1/2} \beta\sigma_* \ , \quad \sigma_* = \left(\frac{5}{3}\right)^{1/4} \beta^{1/2}\sigma_0$$

$$\left[\text{at } \tau = \left(\frac{2}{3}\right)^{1/2}\beta\right] , \qquad (23)$$

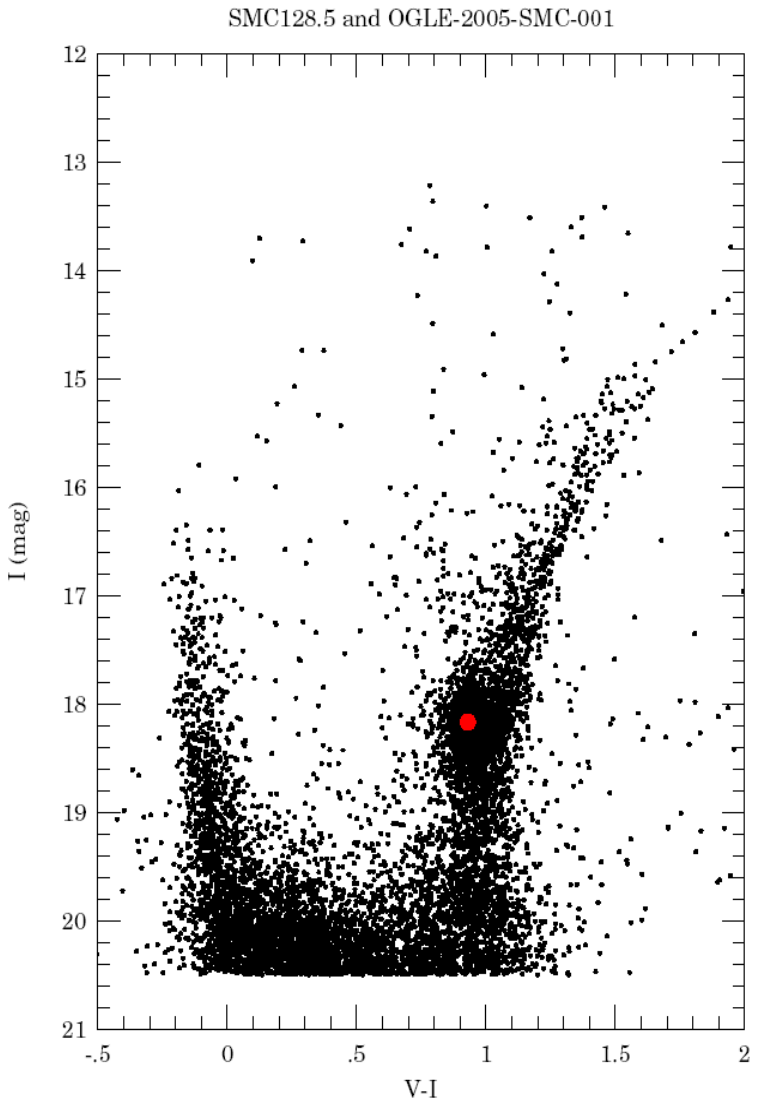


Microlens Parallax Observations of OGLE-2005-SMC-001 Spitzer Space Telescope • IRAC

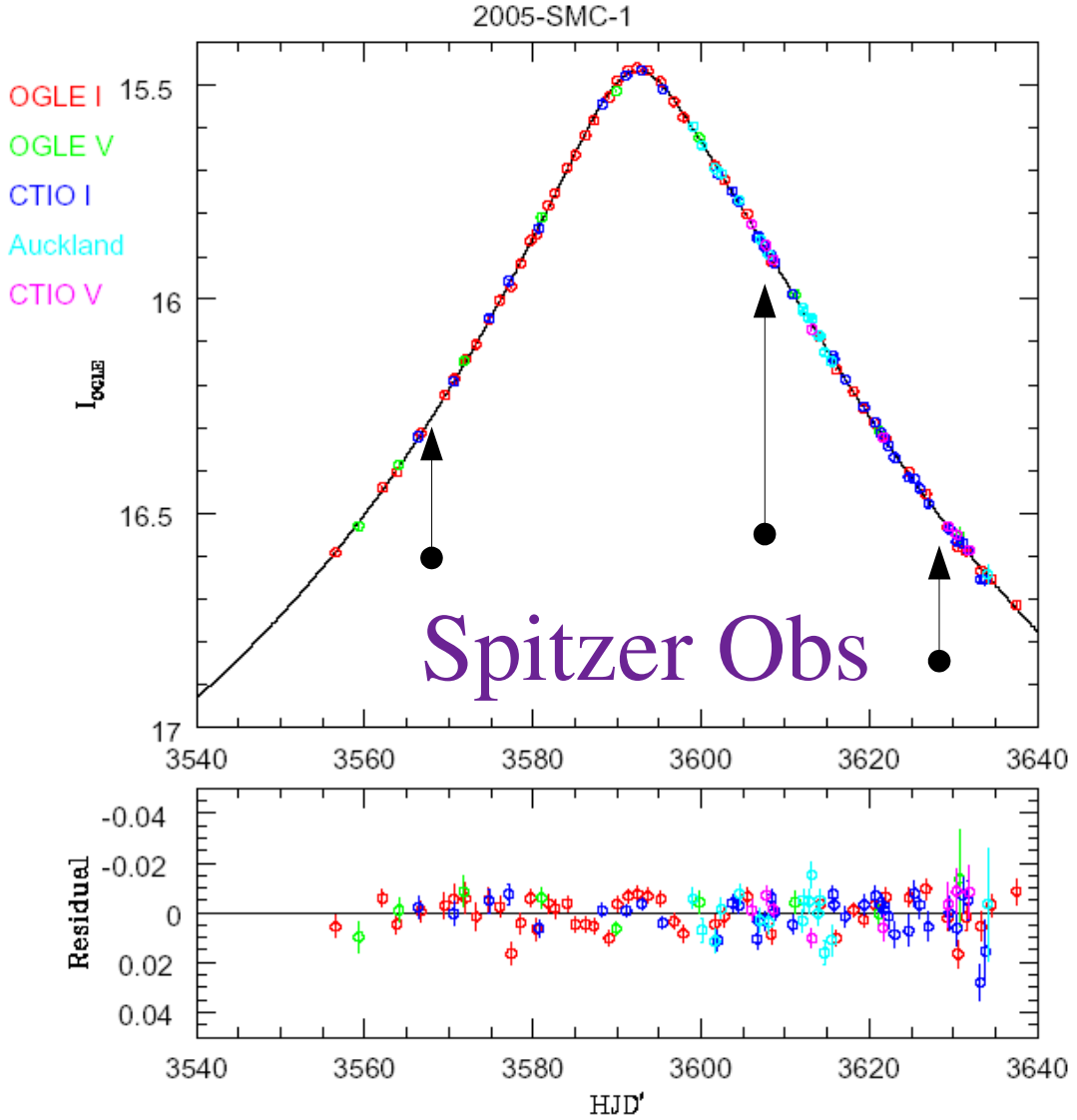
NASA / JPL-Caltech / S. Dong (Ohio State University) ssc2007-XX

OGLE-2005-SMC-001

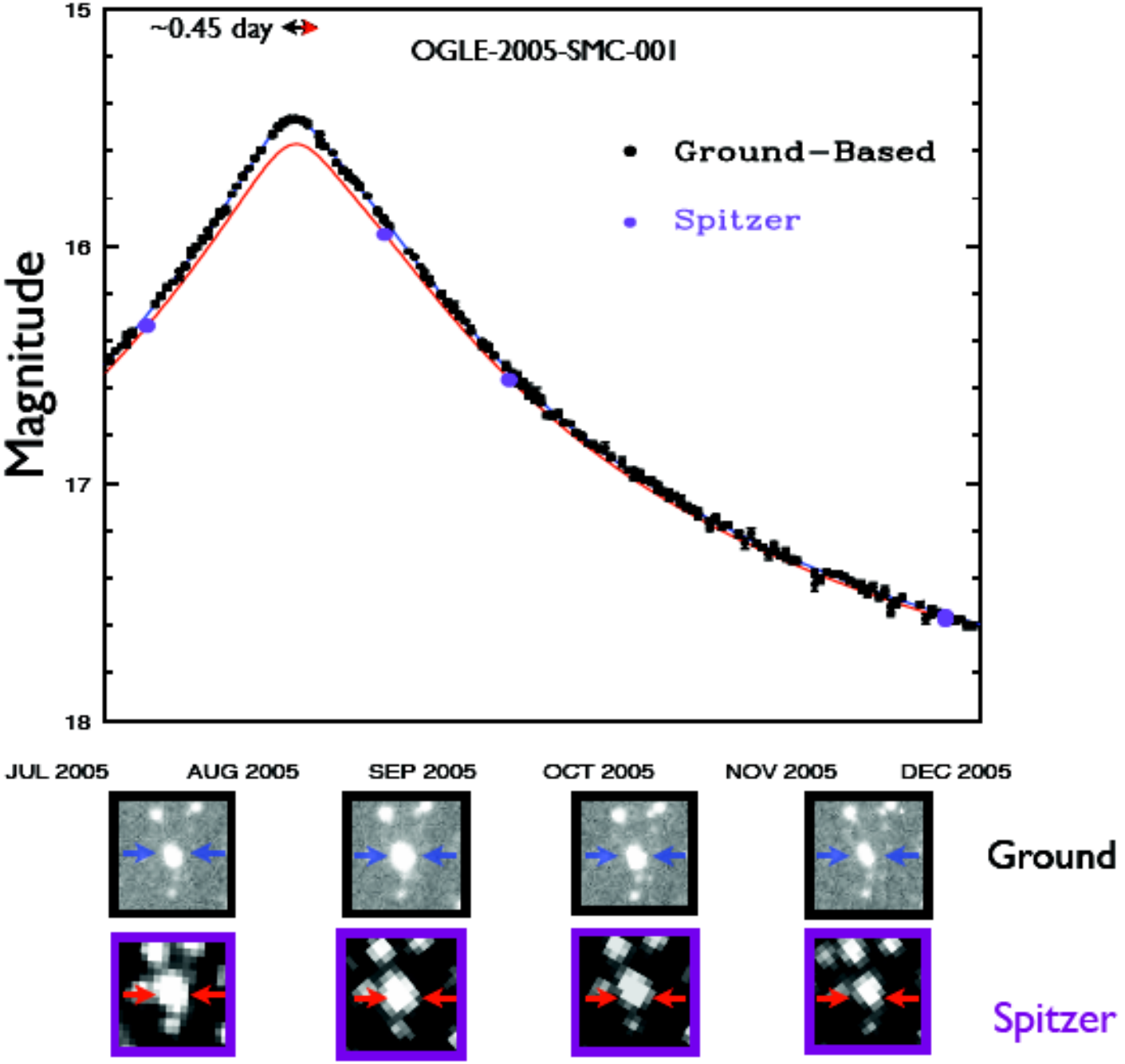
CMD



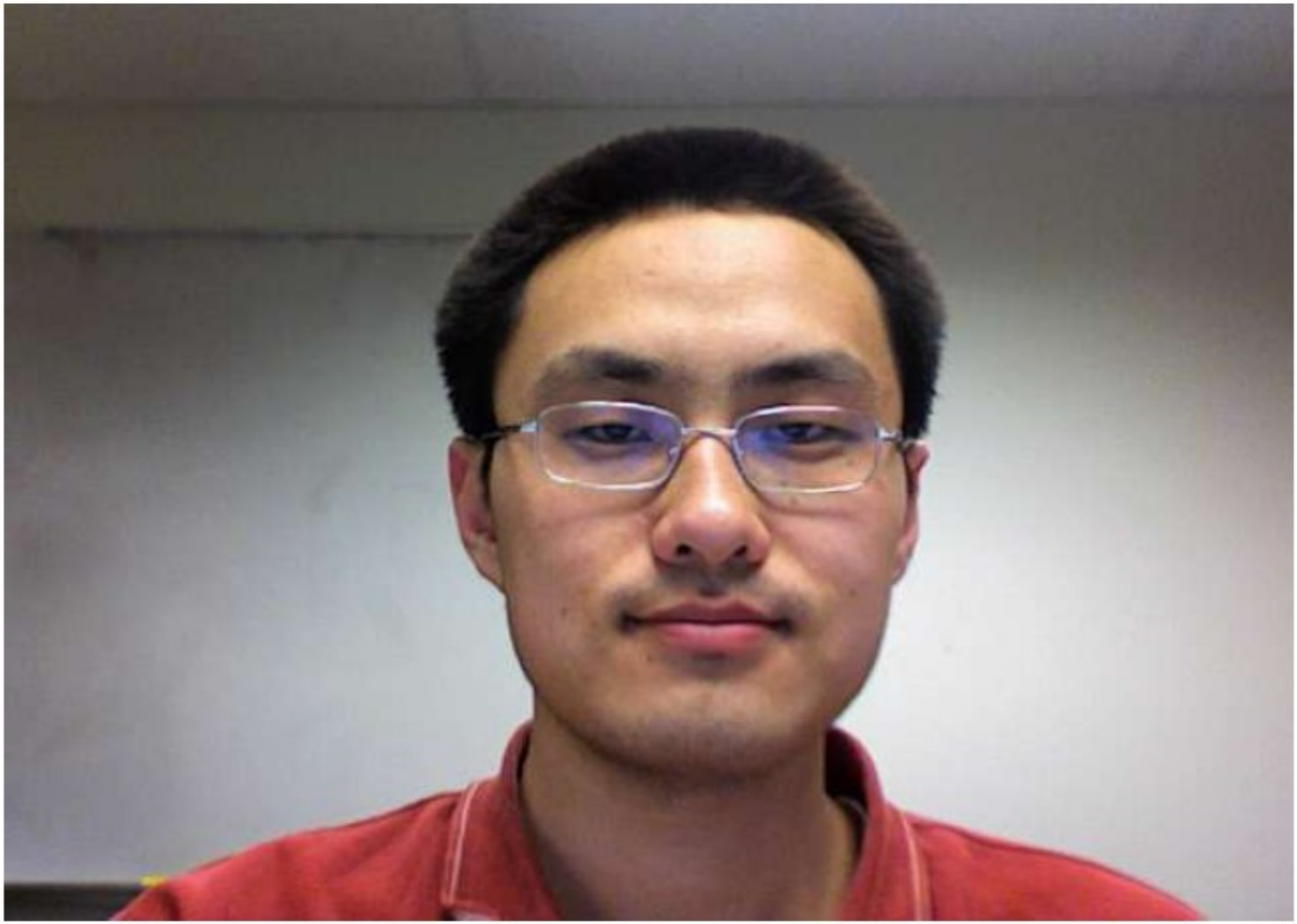
Photometry



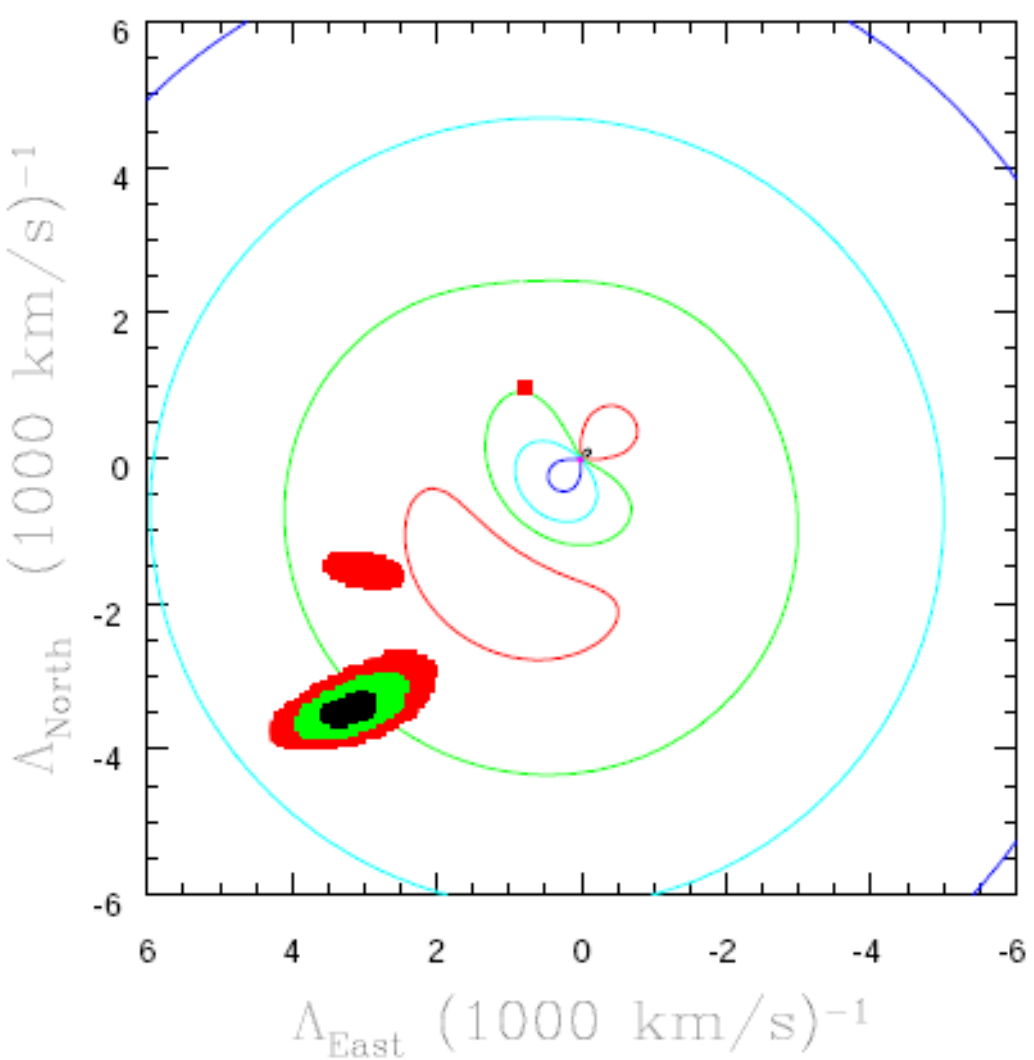
Microlens Parallax

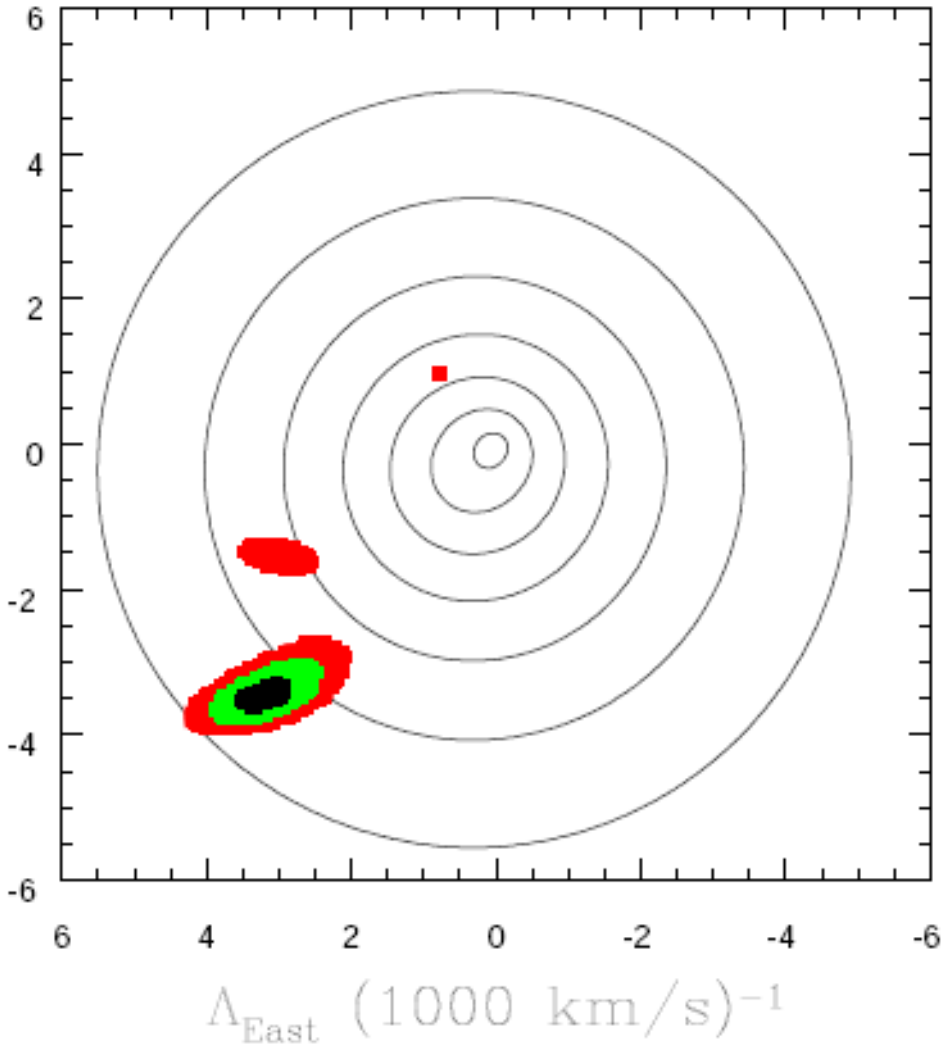


Subo Dong



HALO favored over SMC





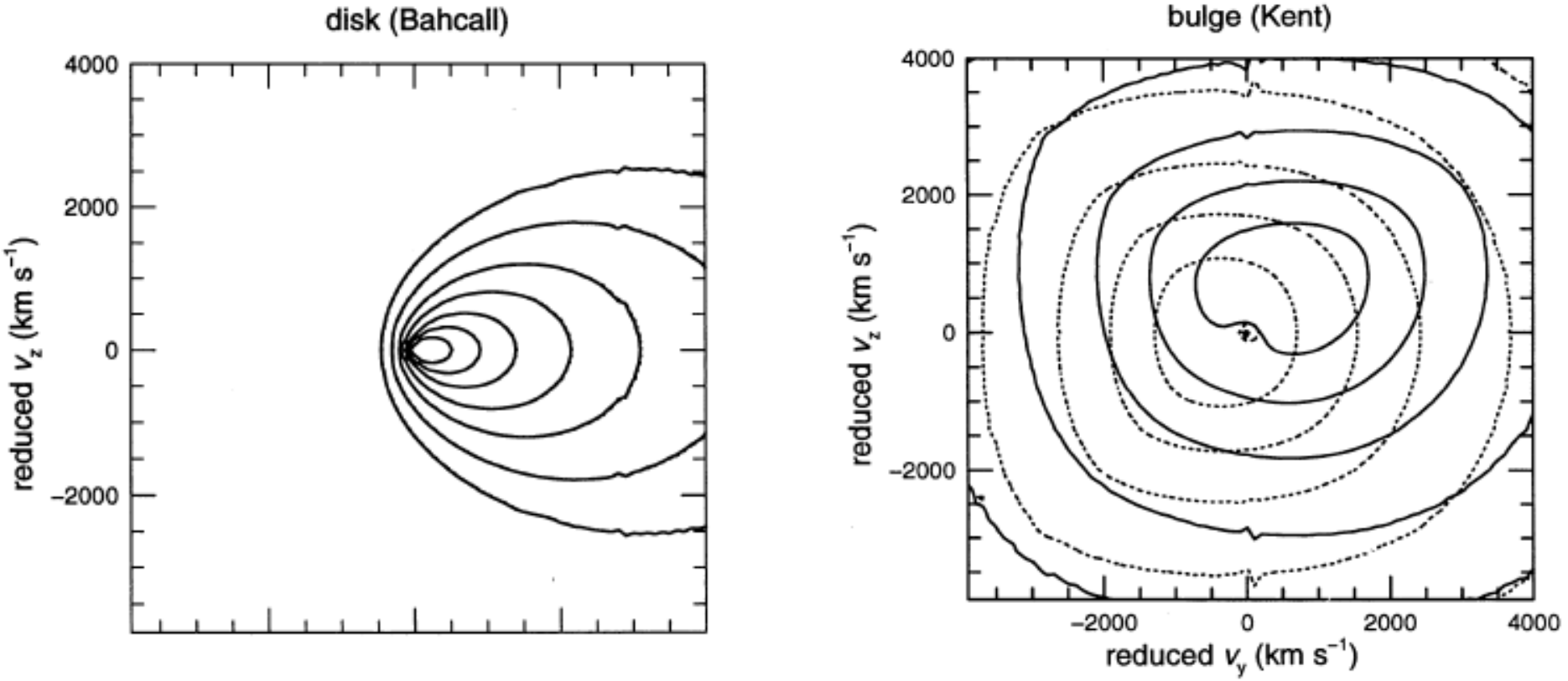
Microlens Parallaxes Toward Bulge

THE ASTROPHYSICAL JOURNAL, 447:53–61, 1995 July 1

THE MASS SPECTRUM OF MACHOs FROM PARALLAX MEASUREMENTS

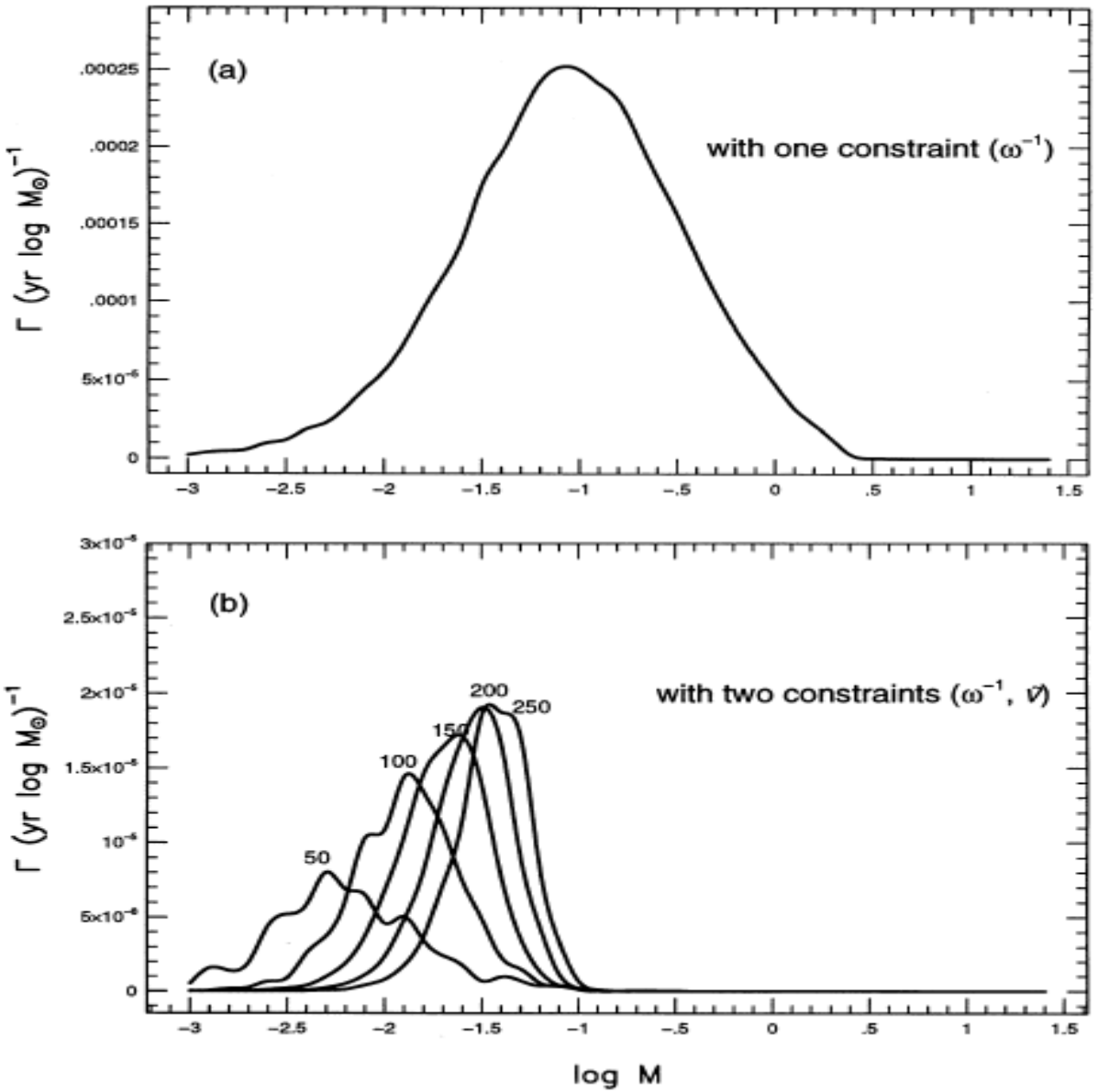
CHEONGHO HAN AND ANDREW GOULD[1]

Received 1994 September 15; accepted 1995 January 13



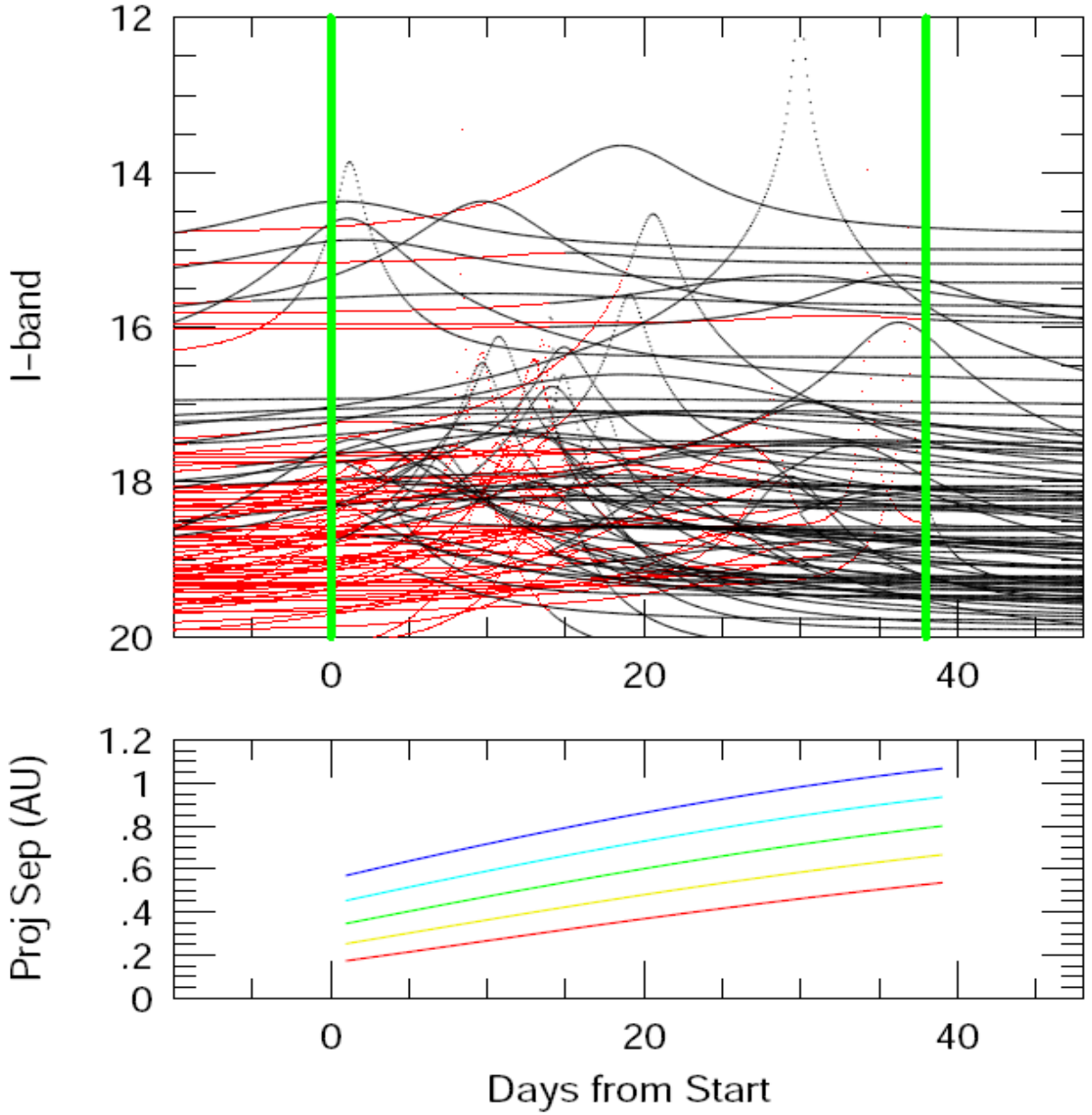
Mass Estimates of t_E=10 day event:

With and Without Microlens Parallax



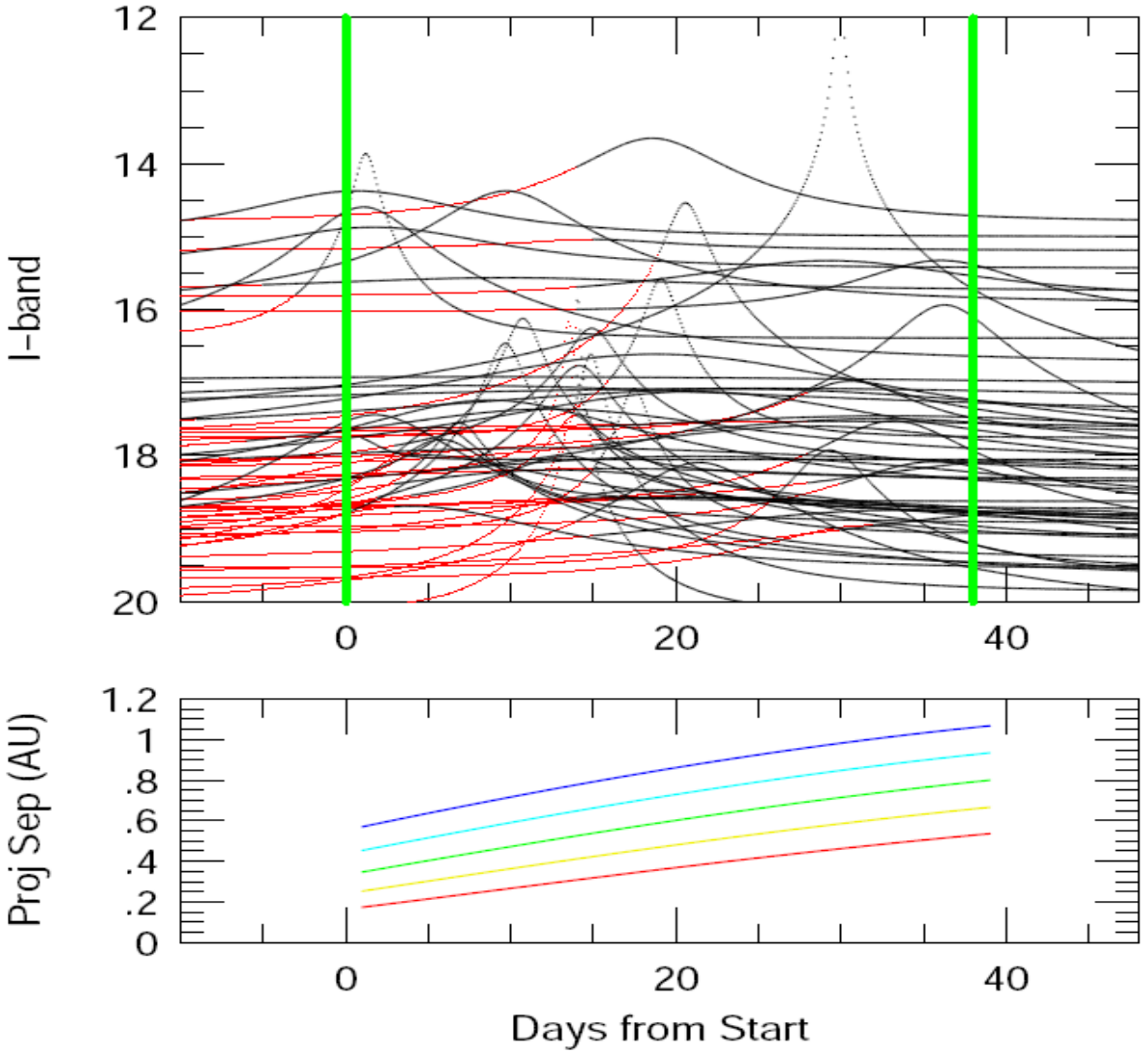
90 OGLE Bulge Events

Peak in 38 days



... of which: 66 detected before peak

(24 with I_peak < 17)



Conclusions

- A few Spitzer microlens parallaxes toward LMC/SMC would settle nature of lenses
- 120 Bulge Parallaxes over 5 years would give good statistical information on disk brown-dwarf mass function