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Detectability of Orbital Motion in Stellar Binary and Planetary Microlenses

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(Submitted on 28 Oct 2010)

A standard binary microlensing event lightcurve allows just two parameters of the lensing system to be measured: the mass ratio of the companion to its host, and the projected separation of the components in units of the Einstein radius. However, other exotic effects can provide more information about the lensing system. Orbital motion in the lens is one such effect, which if detected, can be used to constrain the physical properties of the lens. To determine the fraction of binary lens lightcurves affected by orbital motion (the detection efficiency) we simulate lightcurves of orbiting binary star and star-planet (planetary) lenses and simulate the continuous, high-cadence photometric monitoring that will be conducted by the next generation of microlensing surveys that are beginning to enter operation. The effect of orbital motion is measured by fitting simulated lightcurve data with standard static binary microlensing models; lightcurves that are poorly fit by these models are considered to be detections of orbital motion. We correct for systematic false positive detections by also fitting the lightcurves of static binary lenses. For a continuous monitoring survey without intensive follow-up of high magnification events, we find the orbital motion detection efficiency for planetary events with caustic crossings to be 0.061+-0.010, consistent with observational results, and 0.0130+-0.0055 for events without caustic crossings (smooth events). Similarly for stellar binaries, the orbital motion detection efficiency is 0.098+-0.011 for events with caustic crossings and is 0.048+-0.006 for smooth events. These result in combined (caustic crossing and smooth) orbital motion detection efficiencies of 0.029+-0.005 for planetary lenses and 0.070+-0.006 for stellar binary lenses. We also investigate how various microlensing parameters affect the orbital motion detectability. [Abridged]

Comments:	21 pages, 22 figures, 5 tables
Subjects:	**Galaxy Astrophysics (astro-ph.GA)**; Earth and Planetary Astrophysics (astro-ph.EP); Solar and Stellar Astrophysics (astro-ph.SR)
MSC classes:	85-02
Cite as:	**arXiv:1010.5940v1 [astro-ph.GA]**

Submission history

From: Matthew Penny [view email]
[v1] Thu, 28 Oct 2010 12:36:44 GMT (6571kb,D)

Which authors of this paper are endorsers?