Rapidly Rotating Lenses: Repeating features in the lightcurves of short period binary microlenses

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Microlensing is most sensitive to binary lenses with relatively large orbital separations, and as such, typical binary microlensing events show little or no orbital motion during the event. However, despite the strength of binary microlensing features falling off rapidly as the lens separation decreases, we show that it is possible to detect repeating features in the lightcurve of binary microlenses that complete several orbits during the microlensing event. We investigate the lightcurve features of such Rapidly Rotating Lens (RRL) events. We derive analytical limits on the range of parameters where these effects are detectable, and confirm these numerically. Using a population synthesis Galactic model we estimate the RRL event rate for a ground-based and space-based microlensing survey to be 0.32fb and 7.8fb events per year respectively, assuming year-round monitoring and where fb is the binary fraction. We detail how RRL event parameters can be quickly estimated from their lightcurves, and suggest a method to model RRL events using timing measurements of lightcurve features. Modelling RRL lightcurves will yield the lens orbital period and possibly measurements of all orbital elements including the inclination and eccentricity. Measurement of the period from the lightcurve allows a mass-distance relation to be defined, which when combined with a measurement of microlens parallax or finite source effects, can yield a mass measurement to a two-fold degeneracy. With sub-percent accuracy photometry it is possible to detect planetary companions, but the likelihood of this is very small.

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