Observational Evidence for the Effect of Amplifications Bias in Gravitational Microlensing Experiments

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Recently Alard proposed to detect the shift of a star's image centroid, δx, as a method to identify the lensed source among blended stars. Goldberg & Woźniak actually applied this method to the OGLE-1 database and found that 7 out of 15 events showed significant centroid shifts of $\delta x \gtrsim 0.2$ arcsec. The amount of centroid shift has been estimated theoretically by Goldberg. However, he treated the problem in general and did not apply it to a particular survey or field, and thus based his estimates on simple toy model luminosity functions(i.e., power laws). In this paper, we construct the expected distribution of δx for Galactic bulge events by using the precise stellar LF observed by Holtzman et al. using HST. Their LF is complete up to MI~9.0(MV~12), corresponding to fain M-type stars. In our analysis we find that regular blending cannot produce a large fraction of events with measurable centroid shifts. By contrast, a significant fraction of events would have measurable centroid shifts if they are affected by amplification-bias blending. Therefore, Goldberg & Woźniak's measurements of large centroid shifts for a large fraction of microlensing events confirms the prediction of Han and Aalrd that a large fraction of Galactic bulge events are affected by amplification-bias blending.