Parallax Modelling of OGLE Microlensing Events

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We present a study using microlensing event data from the Optical Gravitational Lensing Experiment (OGLE), recorded in the period 2002-2016 from the Galactic bulge. Our two algorithms are based on the standard point-source-point-lens (PSPL) model, and on the less conventional parallax model respectively. The optimal fit was found for each sample event in the chi-square optimization algorithm, along with the best fit parameters. Out of the 7 best fits, 4 show strong parallax effect. The microlensing fit parameters were then cross-matched with proper motion data from the Naval Observatory Merged Astrometric Dataset (NOMAD), to obtain lens mass estimation for four events. These were estimated to 0.447 solar masses, 0.269 solar masses, 0.269 solar masses and 17.075 solar masses respectively. All masses were within the microlensing mass interval for lenses found in similar studies. In this study, we conclude that the parallax model often better describe long events and demonstrate the importance of utilizing both PSPL fits and parallax fits, instead of only the PSPL model. By varying only 2 of the 7 parallax microlensing parameters instead of all simultaneously, we obtain plausible values for lens direction and lens transverse velocity: a method to investigate microlensing lens properties with no regard to its luminosity. In addition, we also present spectral classes of the NOMAD objects associated with each event, which is vital for future investigations to further confirm mass estimations. We present strategies to further enhance the algorithm to analyze the microlensing event light curve to better find deviations. We also conclude that our double model can potentially unveil the presence of dim lens objects (MACHOs) such as brown dwarfs, exoplanets or black holes.

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