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Light -curve Analyses on TRAPPIST-1 d & e for Mass Estimation

TRAPPIST-1 system is one of the most interesting targets for detail observation. Small seven planets are orbiting very closely ($< 0.1\text{au}$) around a tiny M-dwarf star, and three of its planets (e, f, g) are thought to orbit inside the star's habitable zone. For further discussion about their habitability, it is important to know their bulk densities and compositions, using their accurate radii and masses. Radial velocity method is difficult to use for TRAPPIST-1, and instead we are using Transit Timing Variation(TTV) method for the planets mass estimation. Using the MuSCAT camera at the Okayama Astrophysical Observatory, we observed consecutive transits of TRAPPIST-1 d & e in z-band. We analyzed the derived light-curve by model fitting, and as a result, we were able to add one new data point to each TTV data set of TRAPPIST-1 d and e. From this study, we can restrict the masses of the planets which are in orbital resonance with TRAPPIST-1 d and e.