

論文の内容の要旨

The Development and Application of a New 3-D Orbital Fitting Tool for Exoplanet Studies

(系外惑星の研究のための新しい三次元軌道決定ツールの開発と応用)

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I present ExoSOF_T, a toolbox to fit the orbits of binary stars and exoplanets, along with its application to the V450 Andromedae and HR 8799 systems. With its ability to simultaneously fit radial velocity and astrometric data, ExoSOF_T was used to find the complete Keplerian orbital solution of the companion to V450 Andromedae. The dynamical mass of the companion can only be obtained using both radial velocity and astrometric data. I find the companion to be a $0.28 M_{\odot}$ star, and clearly not sub-stellar as previously reported. I also use ExoSOF_T to investigate the coplanarity of the multi-planet system around HR 8799. My Markov Chain Monte Carlo analysis suggests that all four planets reside in a single orbital plane inclined by $\sim 35^{\circ}$, contrary to recent reports that planet d might show a strong mutual inclination of up to 20° with respect to the other three. Similarly, the orbital solutions are consistent with all four residing in circular orbits, with only planet c having a possible eccentricity $e > 0.08$ at the 1σ level. While there has yet to be a planetary mass companion for which both radial velocity and astrometric data are available, upcoming space and ground-based facilities will dramatically increase the number of potential candidates. The joint orbit fitting power and open source design of ExoSOF_T will make it an increasingly useful tool to investigate the masses and orbital elements of newly discovered exoplanets.