P226a

Solving For The Orbital Elements Of Binary Systems Using Markov Chain Monte Carlo Simulations

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Through the search for extrasolar planets, surveys are finding many planets exist in systems with multiple stars. The existence of a companion star to a planet hosting primary further complicates the evolution of the planet's orbit. In order to investigate the possible evolution mechanisms, the orbits of the stellar companions need to be accurately determined first. The commonly used radial velocity technique is only capable of detecting companions at separations under about 20AU. The orbits of these systems are normally determined with a least-squares reduction of the Thiele-Innes equations, with an accuracy determined by how well the radial velocity curve is known. Now with the advancement of high-contrast instruments, such as HiCIAO on the Subaru telescope, direct imaging out to about 1000AU is possible. Multiple works by Liu et al. over the past 5 years has shown that Markov Chain Monte Carlo (MCMC) simulations can produce more constrained orbital parameter predictions than the methods of the past. We are in the process of developing a similar MCMC simulator that utilizes the Metropolis-Hasting algorithm to determine the orbits of binary systems. Currently the simulator is undergoing testing to verify it can make similar orbital predictions of systems previously investigated. Once complete, we hope this simulator may be used to help understand the effects on planetary orbit evolution in multiple star systems.