Simulations of SIM Astrometric Stability: the Benefits of Estimating Acceleration Parameters

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Abstract

The Space Interferometer Mission (SIM) is currently being designed to measure stellar positions with a full sky accuracy of 4 micro-arcseconds. To meet this goal suitable objects must be found that have stable positions at this level. We present the results of simulations of the stability of K-III giant stars at a distance of 1 kpc. Both planetary and stellar companions are likely to gravitationally induce reflex motions that are larger than 4 micro-arcsec for such objects.

We present simulations that support a two fold strategy for reducing the effects of reflex motion to below 4 micro-arcsec by using a combination of ground-based radial velocity measurements and the estimation of stellar accelerations based on the SIM data itself. We conclude that if stars with radial velocity RMS > 50 to 100 m/s are rejected that companions with orbital periods short compared to the 5 year mission lifetime will be effectively filtered out of the pre-launch candidate list. We present the results of estimating acceleration parameters in RA and declination to model the trajectory of systems with companions. This is most effective for long period orbits (> 10 yr). Our simulations model a full-sky astrometric solution that accounts for the need to estimate an interferometer baseline that is shared by multiple stars.

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