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Simulations for Planning Upcoming Exoplanet Surveys

Future direct imaging missions such as WFIRST, HabEx, and LUVOIR aim to catalog and characterize Earth-analogs around nearby stars. The observing strategy and science yield are strongly dependent on the frequency of Earth-like planets, and precursor knowledge of which stars specifically host suitable planetary systems. Ground- or space-based radial velocity surveys can potentially identify targets and optimal observations times at a fraction of the cost of blind direct imaging surveys. We present the first phases of simulations of such surveys. We consider multiple telescopes, including their locations, weather conditions, observation time limitations, and instrument sensitivities. Multiple target selection algorithms and cadences are considered. We calculate realistic radial velocity uncertainties based upon the known stellar properties of nearby direct imaging targets including effective temperature, metallicity, and surface gravity. We next inject and recover the masses and orbital parameters of simulated planets using current demographics, estimating the effectiveness of the different configurations.

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