Paper

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Optimal starshade observation scheduling

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Abstract

An exoplanet direct imaging mission using an external occulter for starlight suppression could potentially achieve higher contrasts and throughputs than an equivalently sized telescope with an internal coronagraph. We consider a formation flying mission where the starshade must station-keep with a telescope, assumed to be on a halo orbit about the Sun-Earth L2 point, during observations and slew between observations as the telescope re-orients to target the next star. We use a parameterization of the slew fuel cost calculation based on interpolation of exact solutions of boundary value problem in the circular restricted three body formalism. Time constraints are imposed based on when stars are observable due to the motion of bright sources in the solar system, integration times, and mission lifetime constraints. Finally, we present a comprehensive cost function incorporating star completeness values as a reward heuristic and retargeting fuel costs to sequentially select the next best star to observe. Ensembles of simulations are conducted for different selection schemes; for a 3 year mission, taking two steps of the linear cost function produces the most unique detections with an average of 7.08± 2.55.

Citation

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