

Telescope to Observe Planetary Systems (TOPS)

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The Telescope to Observe Planetary Systems (TOPS) is a proposed space mission to image in the visible (0.4-0.9 micron) planetary systems of nearby stars simultaneously in 16 spectral bands (resolution $R \sim 20$). For the ~ 10 most favorable stars, it will have the sensitivity to discover 2 R_E rocky planets within habitable zones and characterize their surfaces or atmospheres through spectrophotometry. Many more massive planets and debris discs will be imaged and characterized for the first time. Combining results from these surveys will enable, for the first time, a comprehensive view of evolving solar systems including gas giant and terrestrial mass planets, as well as dust-producing belts of planetesimals such as are found in our own solar system. With a 1.2m visible telescope, the proposed mission achieves its power by exploiting the most efficient and robust coronagraphic and wavefront control techniques. The Phase-Induced Amplitude Apodization (PIAA) coronagraph used by TOPS allows planet detection at $2 \lambda/d$ with nearly 100% throughput and preserves the telescope angular resolution. An efficient focal plane wavefront sensing scheme accurately measures wavefront aberrations which are fed back to the telescope active primary mirror. Fine wavefront control is also performed independently in each of 4 spectral channels, resulting in a system that is robust to wavefront chromaticity.