Vortex Coronagraph High Contrast Demonstrations
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Our objective is to carry out critical performance demonstrations of the optical vortex coronagraph, by extending our previous work to deeper contrasts, broader bandwidths, and segmented apertures. Our specific goals are demonstrations of broadband pseudostarlight rejection with a clear aperture at the 10e-10 level (first for 10% bandwidth, and then 20%) on JPL's HCIT-2 testbed, and also to carry out complementary high-contrast demonstrations on a segmented aperture testbed.

We plan to carry out initial vortex mask and polarizer/quarter-wave-plate characterization on existing test facilities available to us at JPL and Caltech, including a polarizing microscope, a Muller Matrix Imaging Polarimeter, and cross-polarization spectroscopy in the existing Infrared Coronagraphic Testbed at JPL (which also operates in the visible). Muller matrix imaging and cross-polarization spectroscopy are extremely valuable initial evaluation tools that can immediately characterize a vortex's quality, thereby allowing us to better focus on the best vortices in the HCIT-2 facility. Likewise, the High Contrast Segmented Testbed at Caltech will allow initial testing of apodizers and segmented pupil configurations, prior to final tests in JPL's Decadal Segmented Testbed (DST). The HCIT and DST would thus only be used for final deep coronagraphic testing of already vetted vortex masks and apodizers, thus minimizing chamber time and cost, and maximizing efficiency and chamber sharing.

Due to their small inner working angle and high throughput, optical vortex coronagraphs are of great interest to potential NASA coronagraphic missions such as Exo-C, HabEx, and LUVOIR, as well as to forthcoming large ground-based telescopes. Indeed, the vortex coronagraph is the primary coronagraphic mode selected by the HabEx design study. Moreover, a broadband vortex coronagraph is also planned for the NASA-funded balloon project Picture-C. The vortex coronagraph thus has a very prominent role in NASA's exoplanet plans.