Experimental comparison of model-free and model-based dark hole algorithms

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Abstract

One of the major scientific endeavors of the astronomical community in the next ten years is to directly detect and spectroscopically characterize exoplanets in pursuit of finding a habitable world. Coronagraphic instruments provide the best chance of enabling high contrast spectroscopy and require high performing focal plane masks in combination with precise control of the wavefront phase and amplitude to achieve dark holes for planet detection. Several wavefront control algorithms have been developed in recent years that might vary in performance when paired with different coronagraphic masks. This study tests and compares model-free and model-based algorithms, primarily self-coherent camera (SCC) and Electric Field Conjugation (EFC), when paired with a vector vortex coronagraph (VVC) or a scalar vortex coronagraph (SVC) in the same laboratory conditions. We present experimental results from the In-Air Coronagraph Testbed (IACT) at JPL in monochromatic and polychromatic light comparing the pros and cons of each of these wavefront sensing and control algorithms.

Keywords: SCC, EFC, coronagraph, WFSC

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