Dark Hole Algorithms Working Group

11/13/2020: Kick-off meeting and simulation tools

Links to presentation files: 2020-11-13_Zimmerman_kickoff.pdf 2020-11-13_Pogorelyuk_dark_hole_lightweight_simulator.pdf

At the first meeting, Neil Zimmerman (GSFC) presented an overview of the Roman Coronagraph technology demonstration, the baseline concept for ground-in-theloop implementation of high-order wavefront control, and anticipated HOWFS&C responsibilities of the Coronagraph Technology Center, community participants, and the SSC at IPAC. Neil outlined the motivation, organization, and scope of the new working group, and reviewed the various public simulation tools available for the Roman Coronagraph.

A.J. Riggs (JPL) and Leonid Pogorelyuk (MIT) continued with brief presentations on their respective open source wavefront control simulation tools, the Fast Linearized Coronagraph Optimizer (FALCO) and the Lightweight Space Coronagraph Simulator. A.J.'s Github account hosts John Krist's Phase B CGI PSF modeling scripts written for the PROPER library

(<u>https://github.com/ajeldorado/proper-models</u>), as well as the FALCO scripts for simulating HOWFS with the Phase B mask designs

(<u>https://github.com/ajeldorado/falco-python</u>). Leonid's Lightweight Space Coronagraph Simulator

(<u>https://github.com/leonidprinceton/LightweightSpaceCoronagraphSimulator</u>) is based on FALCO, and models the dark hole maintenance algorithm with wavefront drift and LOWFS residuals.

We ended the meeting with an open discussion on possible future activities, collected here:

• Integrate telemetry and post-processing into the algorithm simulations (proposed by Oliver and several others agreed this is important). Eric Cady points out the CGI team has defined specific LOWFS telemetry and rates, so perhaps these could be incorporated into simulations. For post-processing considerations, Marie's new report on OS9 differential imaging will be a useful reference once it is finalized and released.

- Dark hole control with polarization mode (Frans and Steven)
- Multi-star wavefront control simulations (Dan, Rus, Eduardo; ongoing)

Additional activities suggested offline:

- Start to define a software interface for contributed GITL algorithms. Things like programming language, file formats. Possibly use the baseline HOWFS algorithm as a template. (AJ, Dan)
- STOP model wavefront time series for a science star-only (no reference star) observing scenario (Jeremy)