# Coronagraphy for segmented apertures: results from demonstrations on the HICAT testbed

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Control (LDFC) and sensor fusion. We also describe early results from PSF calibration techniques.

**280.07 — HabEx Space Telescope: Instruments and Capabilities.**

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The Habitable Exoplanet Observatory (HabEx) is one of four major observatory missions that have been extensively studied in preparation for the National Academies' 2020 Decadal Survey on Astronomy and Astrophysics. HabEx is a space telescope with a 4 m diameter primary mirror, carrying a complement of two general astrophysics camera/spectrographs with coverage from the far UV to the near infrared, providing the capability for a huge range of general astrophysics science from solar system science to the life cycle of baryons in the universe at large. General astrophysics observations will claim 50% of the mission time. HabEx also carries two instruments capable of extraordinary exoplanet science. The first is a high performance coronagraph suitable for survey observations of the nearest stars, allowing portraits of the nearest systems to be built up, together with orbital information. Specific system-level engineering design decisions permit high contrast coronagraphy at the $10^{-10}$ contrast level. The second exoplanet instrument is a formation flying occulter, consisting of a 52 m diameter starshade deployed from a second launch vehicle and flying some tens of megameters in front of the telescope. The starshade forms an instrument complementary to the coronagraph and will be used for broad band spectral observations of the systems identified in survey mode. The starshade benefits from the current technology development activities being undertaken by NASA, with an eye to WFIRST, to bring starshade readiness up to TRL5. The information given here is provided for planning and discussion purposes only. This work was conducted at the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration. 

**280.08 — Coronagraphy for segmented apertures: Results from demonstrations on the HICAT testbed**

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Achieving high contrast on segmented, obscured apertures requires the combination of state-of-the-art wavefront control with coronagraph designs carefully optimized for segmented apertures. The Apodized Pupil Lyot Coronagraph (APLC) architecture has emerged as a promising approach, as apodizer shapes can be tailored to any arbitrary pupil geometry, and optimized to maximize science yield while varying constraints such as required inner working angle. Our team has been testing such apodizers, fabricated with carbon nanotubes on silicon and silver substrates, on the High-contrast imager for Complex Aperture Telescopes (HiCAT) testbed. As part of our overall full-system investigation into high contrast on segmented apertures, we have also been assessing performance of several strategies for image-based wavefront sensing on the obscured APLC pupils, and developing numerical models for contrast error budgeting. In this poster we present the latest updates on performance results with APLC coronagraphy from the HICAT testbed, as part of our ongoing TDEM technology program.

**280.09 — WFIRST CGI Precursor Imaging**

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Of the various techniques for discovering exoplanets, direct imaging is one of the most challenging, yet most rewarding. It allows us to not only visibly see a planetary companion, but to determine its orbit and atmospheric composition. The Wide Field Infrared Survey Telescope (WFIRST) will launch in