Starshade Petal Fabrication and Accuracy Demonstration at Full-Scale for the IR/O/UV Great Observatory

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The proposed effort will design, mature, and experimentally verify the accuracy of manufacturing methods for a starshade petal, at full-scale relative to starshade sizes needed for the 6 m-class IR/O/UV Great Observatory recommended by the 2020 Decadal Survey of Astronomy and Astrophysics (Astro2020). External occulters or *starshades*, paired with future space telescopes, are a candidate mechanism for starlight suppression and exo-Earth detection and characterization.

A preliminary UV starshade concept for the IR/O/UV Great Observatory has 9 m-long petals. The demonstration petal here matches this dimension. A previous effort demonstrated petal manufacturing shape accuracy with a 6 m-long petal. Our proposal builds on an ongoing activity that is demonstrating petal manufacture accuracy for small sections of an 8 m-long petal. Constructing a 9 m-long petal presents new challenges in scaling up existing designs for fabrication methods. This demonstration is important because manufactured petal shape accuracy is both the single largest contributor to instrument contrast and the contributor considered most sensitive to increasing size.

The primary goal of the proposed effort is to demonstrate ±200 μm manufacturing shape accuracy of a 9 m-long starshade petal, consistent with a starshade designed to operate with a 6 m-diameter IR/O/UV space telescope. We will demonstrate this manufacturing accuracy experimentally, through the construction and measurement of a full-scale petal prototype realized at a medium level of fidelity.

Additionally, we will develop and validate numerical structural finite element models of assembly process, and assess scalability of manufacturing and metrology processes to all petals for a future starshade, using mathematical models informed by data and error statistics collected during fabrication.