

Development of Sub-nanometer Racetrack Laser Metrology for External Triangulation Measurement for the Space Interferometry Mission

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ABSTRACT

The external metrology for NASA's Space Interferometry Mission (SIM, <http://sim.jpl.nasa.gov>) uses a laser heterodyne metrology system to measure the distance between one fiducial on the siderostat mirror and a reference fiducial. The orientation of the science interferometer baseline is computed by triangulation of the measurements between the fiducials.

To accomplish micro-arcsecond astrometric measurement, SIM requires the external metrology to provide an accuracy better than 0.1nm in distance measurement. A novel common-path heterodyne interferometer was proposed at JPL to address the cyclic error problem, which has been one of the major error sources in laser interferometers. This concept is based on wavefront-division sampling, and a proof-of-concept experiment has shown encouraging results. In this paper, we will present our work on the prototype development of a laser interferometer suitable for applications for SIM's external metrology.