S2.04 Optical Devices for Starlight Detection and Wavefront Analysis

Lead Center: MSFC

Participating Center(s): GSFC, JPL

This subtopic solicits technology for collecting and controlling star light with advanced optical telescopes and telescope arrays. This topic includes innovative optical subsystems, devices and components that directly collect and process optical signals and images for all regions of the electromagnetic spectrum from X-ray to UV to Visible to Far-IR/Sub-MM. Pre-detection technologies of interest include capabilities to preprocess or analyze an optical wave front or signal to extract time-dependent, spectral, polarization and spatial information from scenes or signals prior to detection. Specific technology area of interest include high reflectance UV coatings and uniform polarization coatings for all wavelengths; high angular resolution imaging enabled via large-baseline segmented-aperture telescopes and sparse aperture telescopes/interferometers; component-level technology needed to enable the characterization and combination of wavefronts from multiple apertures. Innovative technology to integrate, assemble, align and control test large aperture segmented mirrors for x-ray, ambient and cryogenic applications.

Proposed effort must address technical need of a recognized future NASA space science mission, science measurement objective or science sensor for a Discovery, Explorer, Beyond Einstein, Origins, GOESS, New Millennium, Landmark-Discovery, or Vision mission. Specific missions of interest include the following: Constellation-X (http://constellation.gsfc.nasa.gov/); Terrestrial Planet Finder (http://planetquest.jpl.nasa.gov/TPF/tpf_index.cfm); Single Aperture Far-Infrared (http://safir.jpl.nasa.gov/technologies.shtml).

Proposed effort should be conducted to demonstrate technical feasibility during Phase 1 and show a path toward a Phase 2 breadboard or prototype demonstration.

Proposals in the following areas are specifically solicited:
• Optical coatings: broad-band polarization preserving and polarizing for UV to Far-IR/Sub-MM; high-reflectivity EUV; large area, high acceptance angle narrow-band optical filters; broad-band wide-acceptance angle UV anti-reflection on PMMA substrates; environmentally stable protected silver.

• High throughput, radiation hard, large area, X-ray imaging devices such as Fresnel Zone plates and masks.

• Innovative mounting/support and metrology/control technologies to integrate, assemble, align and control large aperture lightweight low-cost segmented mirrors for x-ray, ambient and cryogenic normal incidence applications - also, systems with extreme alignment tolerances such as PIAA.

• Techniques to mitigate optical surface errors includes phase retrieval and wavefront sensing and control techniques and instrumentation, optical systems with high-precision controls, active and/or adaptive mirrors, shape control of deformable telescope mirrors, and image stabilization systems; techniques to sense/control segmented primary mirrors.

• Techniques to combine beams for wavelength-resolved fringe measurements from a large number of independent apertures with flat response over a broad wavelength range.