

A Legacy Archive PSF Library And Circumstellar Environments (LAPLACE) Investigation

Principal Investigator: Dr. Glenn Schneider

Institution: University of Arizona

Electronic Mail: gschneider@as.arizona.edu

Scientific Category: ISM AND CIRCUMSTELLAR MATTER

Scientific Keywords: EXTRA-SOLAR PLANETS, PROTO-PLANETARY DISKS, SURVEY, T TAURI STARS, HOST GALAXIES

Total Budget Amount: \$531,000 (Budget split over 3 years)

Legacy: Yes

Abstract

NICMOS coronagraphy, with well-matched template Point Spread Function (PSF) subtraction, probes the closest environments of occulted targets with the highest imaging sensitivity in intrinsically high contrast fields at the smallest radial distances afforded, uniquely, by HST. NICMOS PSF-subtracted coronagraphy has been invoked in a wide variety of HST programs with science themes as divergent as detecting and characterizing disks of circumstellar material in neo-natal stellar environments, to studying faint nebulosity associated with luminous active galaxies, to searching for planetary-mass companions in extrasolar planetary systems recently born and in the "stellar graveyard." The investment in HST time in the execution of these and other programs, which has resulted in more than 8450 NICMOS coronagraphic images to date, has met with mixed returns. Stunning (but infrequent) successes, importantly advancing their fields highlight much more frequent, unfortunately common, failures arising from highly compromised technically-achievable performance due to the lack of suitable template PSFs required to produce high-fidelity, photometrically robust, high contrast coronagraphic images. We propose to remedy this situation by undertaking a rigorous, homogeneous, and complete recalibration and analysis of the full archival set of raw NICMOS coronagraphic images previously obtained and residing in the MAST to create a Legacy library of template PSFs enabling the recovery of the large body of science otherwise lost. This PSF library, along with generically applicable analysis software that we will deliver to STScI, will: (1) critically augment the needs of future observational programs reliant on high-fidelity PSF subtractions, (2) increase their yields and photometric efficacy, (3) reduce the observing time (HST orbit allocations) otherwise required for near-contemporaneous reference PSF observations, and (4) greatly enrich the yet-unrealized potential of the many NICMOS coronagraphic observations already acquired from the broad spectrum of science programs previously executed. We will then use the enabling power of the PSF library to re-reduce and re-analyze all archival NICMOS coronagraphic observations of circumstellar disk and VLM stellar, brown dwarf, and EJP companion candidate stars (~ 400 targets) to probe for previously undetected circumstellar disks. Through image analysis and modeling we will ascertain the physical properties of newly-discovered disks and their constituent grains. With a very large and homogeneously contrast-limited sample of optimally PSF-subtracted images, we will also set spatially resolved dust-scattered light flux density limits from non-detections to constrain the properties of the many IR-excess (and other) sources in this sample.

Investigators:

	Investigator	Institution	Country
PI	Dr. Glenn Schneider	University of Arizona	USA/AZ
CoI	Dr. Murray Silverstone	University of Arizona	USA/AZ
CoI	Dr. Dean C. Hines	Space Science Institute	USA/CO
CoI	Dr. Joseph Rhee	University of California - Los Angeles	USA/CA

Number of investigators: 4

Dataset Summary:

Instrument	No. of Datasets	Retrieval Method	Retrieval Plan
NICMOS	8450	DVD	<p>Because of the volume of data to be reprocessed, i.e., the totality of all archival coronagraphic and ancillary data files, internet transfer via ftp is not practical. The number of data sets we report in this summary includes all coronagraphic images at the exposure level, and all target acquisition and supporting calibration images at the association level. We therefore are requesting initial delivery of all germane and publicly available data sets on DVD as we have already discussed with STScI Archive branch personnel in preparing this proposal, or on a removable (e.g. firewire) hard drive which we would provide to STScI archive operations staff for data transfer. Subsequently, we would request incremental delivery of newly public data sets by DVD every 3 months as new data through the start of Cycle 16 observations, become public. For our reprocessing, we require raw, rwb, rwf, spt, jit, jif, and trl files. We also request OPUS on-the-fly reprocessed cal files (to compare and evaluate the improvements in our processing of the same raw data). We do not need OPUS generated ima, mos, epc, and asn files.</p>