GEMINI PLANET IMAGER (GPI)
LETTERS OF INTENT FOR CAMPAIGN SCIENCE PROPOSALS

The Gemini Observatory plans to announce a Call for Proposals for GPI Campaign Science. GPI is a technologically advanced instrument designed specifically for obtaining images and low-resolution spectra of faint objects and/or features very near to bright objects. While GPI's primary science goal is the detection and characterization of exoplanets, its high contrast capabilities will allow significant scientific advances in the areas such as circumstellar disks, stellar evolution (and mass transfer), fundamental stellar astrophysics (including binaries), and Solar System objects.

Collaboration of teams from across the Gemini partnership is encouraged, and partner participation is a criterion by which campaign proposals will be evaluated.

Letters of Intent

GPI Campaign proposals are expected to embrace a large, scientifically compelling and statistically significant investigation in the chosen science area. Gemini will select the scientifically compelling proposal or proposals for scheduling. We anticipate considering programs that request from 200 to 1200 queue hours of telescope time, but this does not strictly limit the amount of time that letters of intent may suggest.

Prospective GPI Campaign Projects should submit a Letter of Intent to the Gemini Deputy Director/Head of Science by **January 20, 2011**. Letters should include this information:

a. Title of Project

b. Principal Investigator with full name of institution and contact information (phone and email)

c. Co-Investigators with full names of institutions

d. Broad scientific goals of the program

e. An estimate of the total amount of telescope time that will be requested and the number of semesters over which the project will run

f. A brief justification for the required time, not to exceed three pages

The primary purpose of this Letter is to give the Gemini Science Committee an indication of the level of interest in GPI Campaign time so they can make a recommendation to the Board on the total time available for GPI Campaigns**.** The Letters of Intent will also inform the Gemini partners on the expected lien from GPI Campaign Projects on their usual allotment of Gemini time. Please send letters of intent to Gemini Deputy Director/Head of Science, Nancy Levenson, nlevenson@gemini.edu.

The Instrument

General information about GPI is available from the instruments section of the Gemini website, http://www.gemini.edu/sciops/instruments/GPI, and current updates on GPI can be found at www.planetimager.org. Figure 1 shows the expected H-band contrast vs. separation as a function of guide star I-band magnitude.

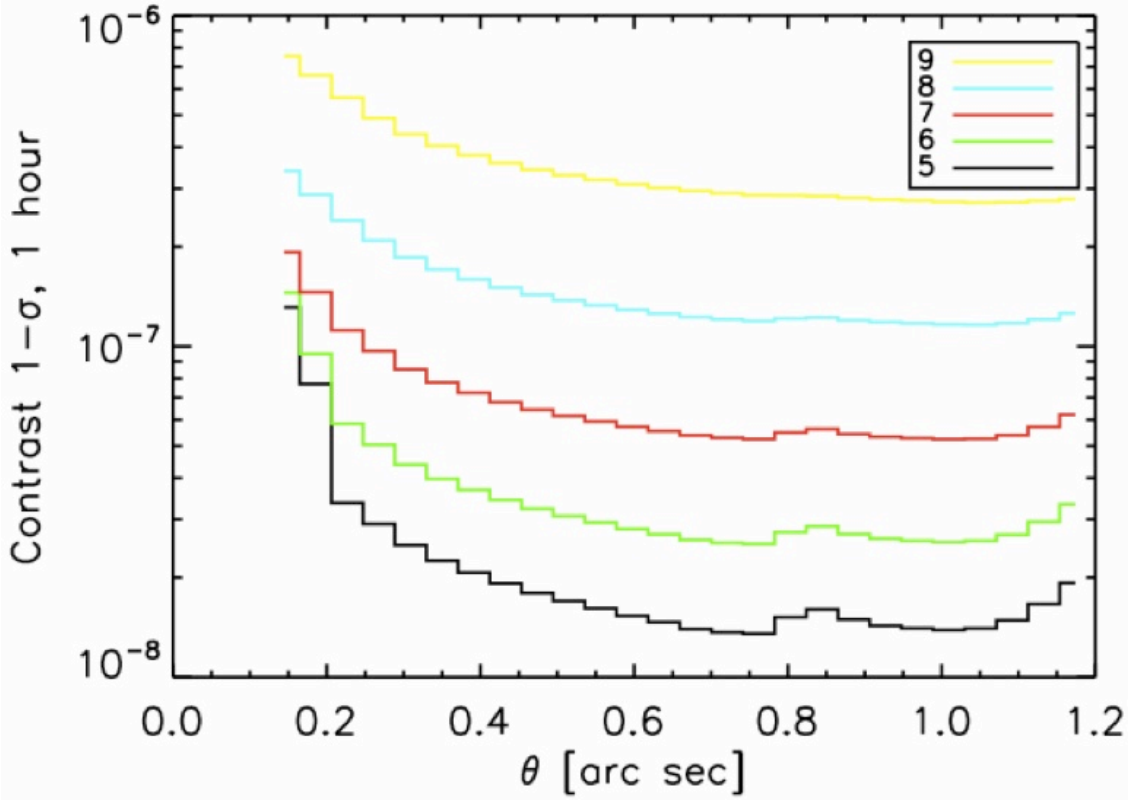

Figure 1: H-band contrast vs. separation as a function of guide star I-band magnitude, for one-hour integration time. The calculated contrast includes speckle noise, photon shot noise, and speckle suppression using elementary angular and spectral differencing techniques assuming a T dwarf spectral signature. The calculation is for a single GPI spectral resolution element (2.5% band-pass). Coronagraph performance is nearly achromatic across the *H* band, so broadband contrasts would be a factor of 3 higher. (Credit: GPI instrument team.)

To achieve its contrast goal, GPI consists of six integrated subsystems:

- The adaptive optics (AO) system, responsible for fast measurement of the instantaneous wave front, and for providing wave front control via deformable mirrors. The optical components and mechanisms for the AO system are provided by the OMSS.
- The calibration unit (CAL) is a high-accuracy infrared wave front sensor tightly integrated with the coronagraph. It provides precise and accurate measurements of the time-averaged wave front at the science wavelength and coronagraph focal plane, so that persistent speckles caused by quasi-static wave front errors not dominate the final image. It also provides pointing, focus, and low-order aberration sensing to keep the target star centered on the coronagraph.
- The coronagraph uses a combination of apodized masks and focal-plane stops to control diffraction and pinned speckles.

- The science instrument—an integral field spectrograph (IFS)—produces the final scientific image or data cube, including simultaneous multiple wavelength channels to suppress residual speckle noise and polarimetric capability. It also provides a diagnostic pupil-viewing mode and contains the final Lyot stop for the coronagraph.
- The upper-level software running on the Top-Level Computer (TLC) coordinates sequencing and communication between subsystems and between GPI and the observatory software. It also provides motion control for all the subsystems. In the previous conceptual design, this was referred to as the Supervisory and Control Computer (SCC).
- The opto-mechanical super structure (OMSS) mounts and connects all the subsystems and mates to the Gemini ISS. The AO optics and elements mount directly to the OMSS optics bench, while a flexure-sensitive frame holds other major subsystems. This is in turn surrounded by an environmental enclosure with attached electronics racks.