Performance Evaluation of the Pyramid Wavefront Sensor for GPI 2.0

Saavidra Perera*[1], Jerome Maire[1], Clarissa Do O[2], Jayke Nguyen[2], Vincent Chambouleyron[3], Daniel Levinstein[2], Quinn Konopacky[2], Jeffery Chilcote[4], Joeleff Fitzsimmons[5], Randall Hamper[4], Dan Kerley[5], Bruce Macintosh[3], Christian Marois[5], Fredrik Rantakyro[6], Dmitry Savransky[7], Jean-Pierre Veran[5], Guido Agapito[8], S. Mark Ammons[9], Marco Bonaglia[8], Marc-Andre Boucher[10], Jennifer Dunn[5], Simone Esposito[8], Guillaume Filion[10], Jean Thomas Landry[10], Olivier Lardière[5], Duan Li[7], Daren Dillon[3], Alex Madurowicz[11], Dillon Peng[4], Lisa Poyneer[9], and Eckhart Spalding[4]

[1]University of California [San Diego] – United States
[2]University of California, San Diego – United States
[3]University of California [Santa Cruz] – United States
[4]University of Notre Dame [Indiana] – United States
[5]National Research Council of Canada – Canada
[6]Gemini Observatory – United States
[7]Cornell University – United States
[8]INAF - Osservatorio Astrofisico di Arcetri – Italy
[9]Lawrence Livermore National Laboratory – United States
[10]Opto-Mecanique de Precision – Canada
[11]Standford University – United States

Abstract

The Gemini Planet Imager (GPI) is a high-contrast imaging instrument designed to directly detect and characterize young, Jupiter-mass exoplanets. After six years of operation at Gemini South in Chile, the instrument is being upgraded and moved to Gemini North in Hawaii as GPI 2.0. As part of this upgrade, several improvements will be made to the adaptive optics (AO) system. This includes replacing the current Shack-Hartmann wavefront sensor (WFS) with a pyramid wavefront sensor (PWFS) and a custom EMCCD. These changes are expected to increase GPI's sky coverage by accessing fainter targets, improving corrections on fainter stars and allowing faster and ultra-low latency operations on brighter targets. The PWFS subsystem was independently built and tested in order to verify its performance before its integration into the GPI 2.0 instrument. Here, we will present the results from these pre-integration tests, which will include assessing the throughput, pupil image quality and linearity with and without modulation of the PWFS.

Keywords: pyramid wavefront sensor, adaptive optics, gemini planet imager, atmospheric turbulence

*Speaker