





### *Gemini South Laser Guide Star*

In the early morning of January 22, 2011 at 4:38 am, Chile Summer Time, a new era in high-resolution astronomy began with the successful propagation of a 5-star sodium laser guide star “constellation” in the skies over Cerro Pachón in Chile. The event, captured by a series of remarkable images, includes one that clearly shows the five laser-produced stars shining in the sky. This first propagation of the Gemini South telescope laser system marks the beginning of on-sky commissioning for the next-generation adaptive optics system called GeMS or the Gemini Multi-Conjugate Adaptive Optics (MCAO) System. GeMS will allow relatively wide-field imaging at extremely high resolution over an exceptionally large portion of the sky.

Maxime Boccas, who heads the Gemini Observatory’s Optical Systems Group captured the event using a digital camera and 500mm lens as the 50-watt laser, split into five beams, caused sodium atoms about 90 kilometers overhead to glow. The resulting image (inset, on reverse) shows the distinctive 5-point grouping that resembles the pattern on a single die or domino.

According to Gemini Observatory’s Senior Laser Engineer Céline d’Orgeville, “We can now truthfully say that Gemini is one observatory, two telescopes, and six laser guide stars!” (Gemini North has a lower power 14-watt single laser guide star system that saw first light in 2005 and is a key capability for the Gemini telescope on Mauna Kea, Hawai’i.)

The GeMS system is designed to produce remarkably sharp images for the study of a wide range of topics ranging from the birth and evolution of stars to the dynamics of distant galaxies.

MCAO is a revolutionary approach to astronomical adaptive optics. The technique samples the turbulence structure in the atmosphere at several levels and then uses a technique similar to medical tomography to reconstruct a 3-D snapshot of how the atmosphere is distorting starlight. This is then used to shape a series of deformable mirrors to cancel out this distortion. All of this happens about 1000 times a second.

The GeMS system is setting the stage for the next generation of large ground-based telescopes which will have mirrors 30-meters in diameter or larger. These telescopes will require the latest adaptive optics technologies to produce images of sufficient resolution given the wide column of air they will observe through.

Telescope image by Manuel Paredes.

See full press release and image download at: <http://www.gemini.edu/node/11603>