Robo-AO

Autonomous laser adaptive optics and visible/NIR imaging for few-meter class telescopes

http://www.astro.caltech.edu/Robo-AO/

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Overview

Robo-AO is an autonomous laser guide star adaptive optics (AO) system, delivering diffraction-limited resolution observing in the visible and near-infrared (0.1"-0.25") for up to hundreds of targets per night on modest sized telescopes. Robo-AO enables the exploration of science parameter spaces such as large (10k+) targeted AO surveys, rapid AO imaging of transient events and long-term AO monitoring not feasible on large diameter telescopes. The first of many envisioned systems is mid-way through its on-sky commissioning period which precedes a month long science demonstration at Palomar Observatory's 60-inch telescope.

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Unique Diffraction-limited Capability

Extensive surveys (10,000+ objects)

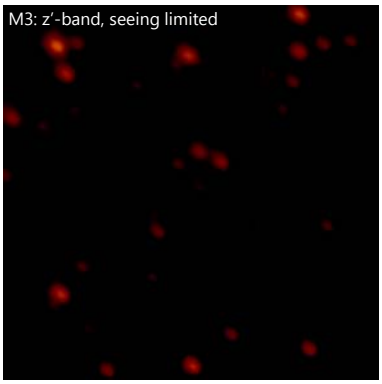
- Stellar, sub-stellar companion searches
- Lensed quasars (300-700 new over a 9 month period of intermittent observing)
- Asteroid binarity surveys
- Validation of planetary transit candidates to <1% false positive probability

Rapid transient characterization

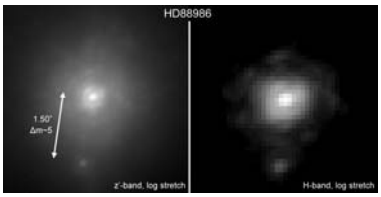
- Respond to transients identified by other systems (Palomar Transient Factory, Catalina Sky Survey, PanSTARRs, LSST, etc.)
- Rapid visible and near-IR photometry
- Separation from nearby sources

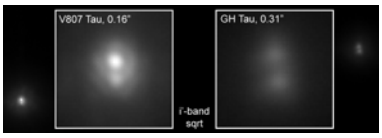
Time-domain astronomy

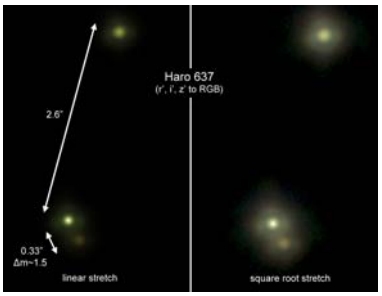
- High-precision orbit characterization
- Monitoring gravitational lenses
- Measuring the dynamic tropospheric cloud activity on Titan

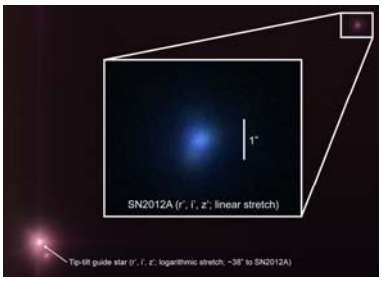


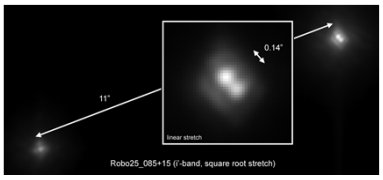
Science

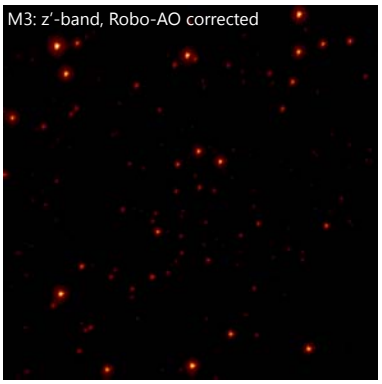


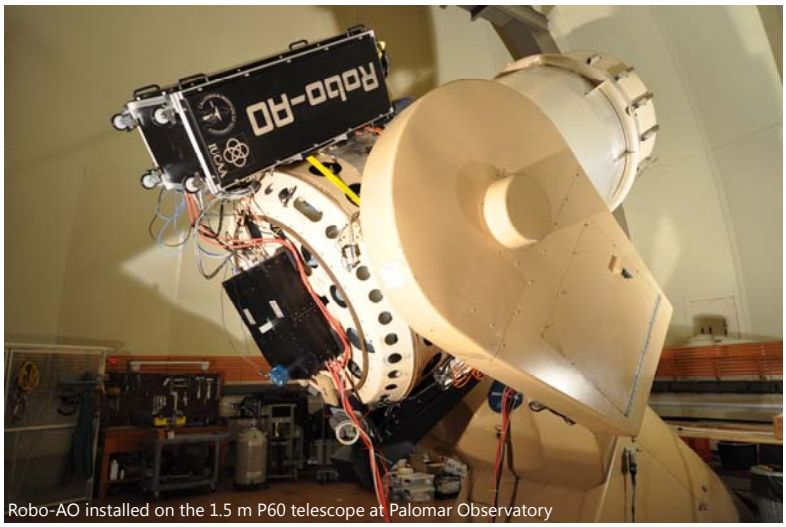












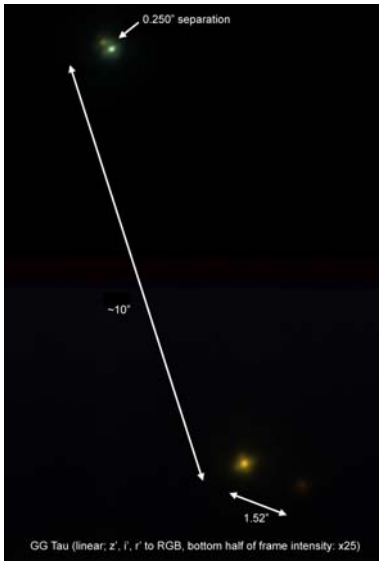
Robo-AO installed on the 1.5 m P60 telescope at Palomar Observatory

Key Features and Components

- Fully automated and robotic operation
- Compact Cassegrain platform for adaptive optics system and science instruments
- 140 actuator MEMS Deformable Mirror
- 12 W 355nm pulsed Rayleigh laser guide star
- Infrared and visible science detectors (which double as tip/tilt sensors)

AO performance / Sky Coverage

Robo-AO will produce diffraction-limited imaging for all targets with a magnitude equal to or brighter than V=17. 30% of the sky will be available with diffraction-limited resolution in the near infrared. 100% sky coverage is available with correction just from the laser guide star leading in a 'seeing improvement' mode.



Project Milestones

December 2009: Lab AO correction at >1.2 kHz
August 2010: Projection of laser guide star
August 2011: High-order closed-loop operation
September 2011: Additional tip-tilt correction
November 2011: Automation of 5 observations
Summer/Fall 2012: Month long science demo

Jupiter (Jan 11, 2012)