MODHIS: the first-light single-mode fiber fed high resolution exoplanet characterization spectrograph for the TMT, technical review of the AO fiber feed

Nemanja Jovanovic*[1], Garreth Ruane , Ashley Baker , Dimitri Mawet , Michael Fitzgerald , Quinn Konopacky , Jason Fucik , Rishi Pahuja , Aaron Brown , Eric Wang , and Richard Dekany

[1]California Institute of Technology – United States

Abstract

MODHIS is a first light instrument that will enable high resolution spectroscopy from y-K band on the TMT. It is a single-mode fiber fed spectrograph that relies on the adaptive optics correction provided by NFIRAOS. By operating at the diffraction-limit the MODHIS spectrographs, split into two near identical units with a yJ and HK channel, are extremely compact and can be in the wedge room at the bottom of the building. Injecting light from a 30-m aperture into a single-mode fiber with a core size of the order of 5 microns requires a high-performance adaptive optics correction, schemes to eliminate non-common path errors, a high-quality correction to the differential atmospheric refraction, and precise pointing and tip/tilt control. These issues are currently under investigation with the pathfinder injection unit commissioned at Keck known as the Keck Planet Imager and Characterizer. MODHIS also leverages significant developments from a near identical precursor instrument aimed to be deployed to Keck in 2026: HISPEC.

In this paper we will present a technical overview of the instrument and discuss the subtleties of the single-mode-fiber feed on an ELT. These topics encompass adaptive optics acquisition and correction, tracking, and non-common path error correction.

Keywords: Exoplanets, Diffraction, limited, high resolution spectroscopy, PRV

*Speaker