

The Preliminary Design and Innovative Technical Solutions of the HISPEC Instrument

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HISPEC (High-resolution Infrared Spectrograph for Exoplanet Characterization) is an infrared (0.95 to 2.46 microns) cross-dispersed, $R=100,000$ echelle spectrograph for the Keck II telescope, with EPRV, transit spectroscopy and direct imaging spectroscopy science drivers. HISPEC consists of two single-mode fiber-fed diffraction-limited spectrographs with a blue (γ J) and red (HK) channel located in the basement of the Keck observatory. To facilitate efficient coupling, the Keck adaptive optics system, with its soon-to-arrive HAKA upgrade to a ~ 4000 actuator deformable mirror will deliver high Strehl ratios across the near infrared to a dedicated dual-band (γ J and HK) single-mode fiber injection that will stabilize and maintain the target on low loss silica and ZBLAN fibers. The system will benefit from two laser frequency combs, an Etalon, as well as absorption cells for spectral calibration as well as the ability to flat field the science detectors throughout the lifetime of the instrument. Mechanical switches will be used to re-route science and calibration light to the various sub-modules of the instrument.

With the ambitious goals of reaching an internal radial velocity precision of 30 cm/s, being able to track on targets as faint as 15th magnitude from z-K band and obtaining high SNR with a single-mode fiber fed system, HISPEC poses numerous technical challenges. We present the detailed overview of the HISPEC instrument design after the preliminary design phase and highlight several unique technical innovations we plan to implement to achieve these goals.