EPSC Abstracts
Vol. 6, EPSC-DPS2011-1823, 2011
EPSC-DPS Joint Meeting 2011

A near-infrared spectrograph for the Discovery Channel Telescope

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Abstract

Lowell Observatory is constructing the Discovery Channel Telescope (DCT) at Happy Jack, Arizona, approximately an hour from Lowell's main campus in Flagstaff, Arizona. The DCT is a 4.3-m optical/infrared telescope. Construction of the telescope is complete and First Light of the DCT is planned for 2012Q2. In its initial configuration instruments will be co-mounted on a rotatable/selectable cube at the Cassegrain focus. Motorized deployable fold mirrors enable rapid switching amongst instruments. In the future the Nasmyth foci will be available for larger instruments as well.

The first generation of instruments on DCT include: the Large Monolithic Imager (LMI), the Near-Infrared High-Throughput Spectrograph (NIHTS, pronounced "nights"), and the DeVeny optical spectrograph. The LMI contains a single large 6.1x6.1 K detector with a 12.5 arcmin^2 FOV. NIHTS is a low resolution efficient near-infrared spectrograph and is the subject of this presentation. The DeVeny is Lowell's existing optical spectrograph with resolutions available between 500 and 4000.

NIHTS is a low-resolution high-throughput infrared spectrograph covering 0.9-2.4 μm in a single fixed spectral setting at a resolution of $\sim$100. For simplicity and replicability NIHTS contains no moving parts. The science detector is a 1024^2 HAWAII-1 array. The fixed slit plate features an 80" long slit with several different slit widths (2,3,4 and 12 pixels) available along its length. The widest slit width is designed to allow accurate flux calibration, while the 3 and 4-pixel slits are closely matched to typical seeing at the DCT site (0.86" mean). Different resolutions will be rapidly selectable by dithering the telescope, and a typical observation is anticipated to involve a sequence of dithers both at the desired resolution and at SED resolution for calibration purposes.

Offset guiding and wavefront sensing to control the active optics of the primary mirror are provided by the facility via deployable probes in the instrument cube. Target acquisition and slit-guiding is possible in the optical with the LMI or in the near-infrared with an InGaAs slit-viewing camera that is part of NIHTS. Because the fold mirror to NIHTS is a dichroic, simultaneous optical imaging with LMI and near-infrared spectroscopy with NIHTS is enabled.

NASA funded the construction of NIHTS as part of a larger project, the Kuiper Spectral Survey (KSS), and will be available to all users of the DCT.

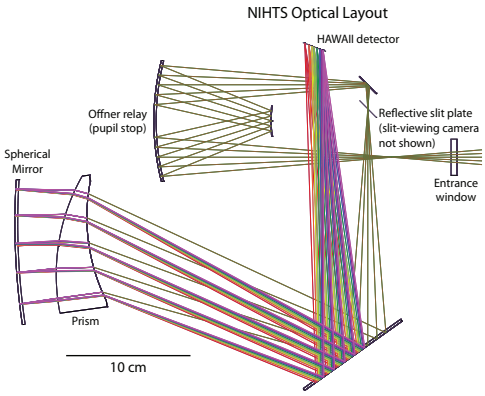

Figure 1: Optical configuration of the Near-Infrared High-Throughput Spectrograph. The optical path includes several gold-coated fold mirrors to keep the instrument volume small as well as an Offner relay to provide a cold pupil stop.

Acknowledgements

Funding for this instrument is provided by NASA through Planetary Major Equipment and Planetary Astronomy program grants.