

spectroscopy/

This dataset contains the following subdirectories with data in the

Raw/

File	Object	Exposure	Grism
xe310026.fits	FeNe	14.000	Grism 8
xe310027.fits	FeAr	28.000	Grism 7
xe310028.fits	bias	0.000	None
xe310029.fits	bias	0.000	None
xe310122.fits	HD195034	5.000	Grism 7
xe310123.fits	HD195034	20.000	Grism 7
xe310124.fits	HD195034	20.000	Grism 8
xe310125.fits	FeNe	14.000	Grism 8
xe310126.fits	FeAr	28.000	Grism 7
xe310127.fits	bias	0.000	None

Processed/

SolarAnalogGr7.fits	HD195034	5.000	Grism 7
MasterFlat.fits	Halogen Lamp	6.0000	Grism 7

Derived/

'*solar_analog.txt*' is the text file of solar analog star HD195034 spectrum obtained from SolarAnalogGr7.fits file. The first column is the wavelength in angstrom, the second column is the relative flux of the solar analog.

'*solar_continuum.txt*' is the text file of solar continuum spectrum obtained from the SolarAnalogGr7.fits file. The first column is the wavelength in angstrom, the second column is the normalized flux of the solar analog.

HFOSC CCD.

The data was taken on May 31 2014, using the Himalayan Faint Object Spectrograph and Camera (HFOSC) mounted on the 2.0 m telescope (HCT) of the Indian Astrophysical Observatory (IAO) of the Indian Institute of Astrophysics (IIA), located at 4500 m above sea level, Hanle, Leh, Ladakh.

HFOSC is equipped with a Thompson CCD of 2048×2048 pixels with a pixel scale of 0.296"/pix and a field of view of ~10×10 arcmin. The readout noise, gain and readout time of the CCD are 4.87 e, 1.22 e/ADU, and 90 sec, respectively. Spectroscopy was performed using a slit width of 1.92 arcsec, and Grisms 7 and 8 with resolution $\lambda/\Delta\lambda = 1330$ for Grism7, and 2190 for Grism8, and bandwidth coverage of 0.38–0.64 μm and 0.58–0.84 μm , for Grisms 7 and 8, respectively. All the spectra are provided here were taken in the *sn-spec* mode. In this mode, the data is binned by a factor of two, along the cross-dispersion axis. For faint, and extended faint objects, this allows for a higher S/N in each pixel, but compresses the dimension of the object along the slit by a factor of two.

Details of the grisms used are as follows:

Instrument/ Telescope	Frame size px	Slit Dimension W×L	Dispersion Å/px	Range Å	Resolution Å
Gr7/ HCT	500×3500	1°.92×11'	1.45	3800--6840	10
Gr 8/HCT	500×3500	1°.92×11'	1.45	5800--8300	10

Reduction Procedure

The spectroscopic data preprocessing was performed using standard routines of the IRAF software by bias subtraction and flat-fielding using the halogen lamp spectra. Since no spectroscopic flats (halogen lamp exposures) were available at early epochs of comet observations (January and May), we used multiple spectroscopic flats and biases taken on two later dates: **2013-09-29** and **2013-10-01**, to construct the Master Flat that we applied to all spectroscopic reduction for 2013 comet and 2014 solar analog spectra. The gain and readout noise on each of these nights were calculated using the photometric sky flats (with average count/pixel = 30,000 to 40,000) and biases taken on the same night by the IRAF utility *findgain*. As the HCT/HFOSC has several regions of bad pixels/hot pixels and other flaws, an average value of these parameters determined from sections of the CCD with no bright field stars or hot/bad pixels was used in the subsequent analysis. On both nights, for each slit and grism combination used here—Grism7/167 and Grism8/1671—spectroscopic flats, along with spectroscopic biases, were taken with a halogen lamp. The position of the slit on the CCD is fixed and does not change from night to night. For each night, the multiple spectroscopic biases were combined using the IRAF utility *zerocombine* (an average value is taken for each pixel, after using a minmax algorithm for cosmic-ray rejection). The combined Master Bias was subtracted from each halogen lamp spectrum. The latter were then combined using IRAF utility *flatcombine* (average combine with an average sigma clipping factor of +/- 3 to reject cosmic rays), to give a spectroscopic Master Flat. A response function of type spline3, order 25, was fitted to the segment of this Master Flat from which useful spectroscopic data would be extracted (i.e lines 200 to 3000 along the dispersion axis). The IRAF utility *response* used this response function to produce the final, normalized spectroscopic Master Flat.

1-D spectra were obtained using the *apall* function in IRAF with multispec format. This algorithm allows us to (a) track and make a polynomial fit to the dispersion axis on the CCD, (b) extract a 1-D target spectrum from a region +/- 10 pixels around the optocenter (maximum of light) at each point on the dispersion axis, (c) estimate the local background at each point along the dispersion axis, and (d) to subtract the modelled background from the raw spectrum. The local background here was obtained by a single polynomial fit to two regions, each 50 pixels wide, located +/- Y pixels on either side of the dispersion axis.

Derived Spectra

We have extracted only Grism7 spectra, because the comet spectra were also extracted for only Grism7. Wavelength calibration was performed using Fe-Ar lamp spectrum. Wavelength-calibrated solar analog spectrum was fitted with a 3rd order polynomial function in IRAF using the *continuum function* to obtain the spectrum of solar continuum. The continuum spectrum was then normalized by dividing by the maximum value to obtain the normalized continuum spectrum.