This dataset contains the following subdirectories with data in the directory

Imaging/:

Raw/:

Comet images:	**filter**	**exposure (sec)**
wa220030.fits	I	300.000
wa220031.fits	V	420.000
wa220032.fits	V	420.000
wa220033.fits	R	300.000
wa220034.fits	I	300.000
Biases:		
wa220001.fits	"1 Free"	0.000
wa220017.fits	"1 Free"	0.000
wa220027.fits	"1 Free"	0.000
Sky flats:		
wa220008.fits	V	0.800
wa220009.fits	V	1.199
wa220010.fits	V	2.000
wa220011.fits	R	3.000
wa220012.fits	R	4.000
wa220013.fits	R	6.000
wa220014.fits	I	8.000
wa220016.fits	I	28.000

CalibrationFrames/:

Zero.fits	Master Bias	
FlatI.fits	Master Flat	I
FlatR.fits	Master Flat	R
FlatV.fits	Master Flat	V

Processed/:

`cc' - means cosmic ray cleaned, `f' - flat-fielded and `b' – de-biased, 'r' – means aligned – registered on the comet.

Non-aligned frames:			***Aligned frames:***
fbwa220029.fits	I	ccfbwa220029.fits	rccfbwa220029.fits
fbwa220030.fits	I	ccfbwa220030.fits	rccfbwa220030.fits
fbwa220031.fits	V	ccfbwa220031.fits	rccfbwa220031.fits
fbwa220032.fits	V	ccfbwa220032.fits	rccfbwa220032.fits
fbwa220033.fits	R	ccfbwa220033.fits	rccfbwa220033.fits
fbwa220034.fits	R	ccfbwa220034.fits	rccfbwa220034.fits

Document/:

January2013_Imaging.pdf	-	This document
preprocessing.cl	-	Preprocessing IRAF code
cosmic_rays.cl	-	IRAF code for cosmic rays removal

HFOSC CCD characteristics and Reduction procedure:

CCD:

Photometric data was obtained on January 22, 2013, using the Himalayan Faint Object Spectrograph and Camera (HFOSC) mounted on the 2.0-m 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 x 2048 pixels with a pixel scale of 0.296”/pix and a field of view of ~10 x 10 arcmin. The readout noise, gain and readout time of the CCD are 4.87 e, 1.22 e/ADU, and 90 sec, respectively.

Reduction Procedure.

Basic reduction was performed by using IRAF-based script that employs IRAF procedure *ccdproc*, and includes trimming the frames to [100:1945,100:1945], *zerocombine* for bias subtraction, and *flatcombine* for flat-fielding. The code creates Master bias frame called **Zero.fits**, and Master flat frames for each filter: **FlatI.fits**, **FlatR.fits** and **FlatV.fits**. The code ***preprocessing.cl*** is attached. Cosmic rays were removed using IRAF-based script that employs IRAF task *crmedian*. The code c***osmic_rays.cl*** is attached.

Alignment.

All images are aligned on the brightest part of the comet (optocentre) using IRAF procedure *imalign*. After debiasing and flat-fielding, we register the images on the brightest part of the comet as if it were a star. Since the images were taken very close in time, the focal length of the telescope did not change and a translation only is required. We find the brightest pixel, or the location of the peak brightness of the coma, using the IRAF task *imexamine* with the command that prints 11x11 grid of pixel values and integer coordinates. These integer coordinates and user-calculated shifts are supplied to the task as the initial estimate for each image of the shift in each axis relative to the reference image. The sense of the shifts is such that: Xshift=Xref-Xin and Yshift=Yref-Yin. The task *imalign* will cause the image to be shifted such that the object is positioned at the same pixel location as in the reference. The IRAF task *imalign* measures the *x* and *y* shifts between a list of input images and a reference image, registers the input images to the reference image using the computed shifts, and trims the input images to a common overlap region (if required). The basic operation of the task is to find centres for the list of registration objects or features in the coordinate frame of each image and then to subtract the corresponding centres found in the reference image. In the final centering, all the sources are recentred in each image using the initial estimate of the relative shift for each image. The centroiding algorithm used here is *centroid, which* computes the intensity weighted mean and mean error of the centering box *x* and *y* marginal distributions using points in the marginal arrays above (below) the minimum (maximum) data pixel plus (minus) a threshold value. The centroid is calculated with respect to the level specified by background. The images are shifted using the *imshift* of the task *imalign* with `linear' interpolation function, where output image grey levels are determined by interpolating in the input image at the positions of the shifted output pixels. Note that *imshift* task does not calculate the shifts; this is done by the centroiding algorithm of the task *imalign*, which is not limited by the initial integer inputs and can calculate sub-pixels shifts.