Spectroscopy and photometry of interstellar comet 2I/Borisov on 2-m HTC telescope.

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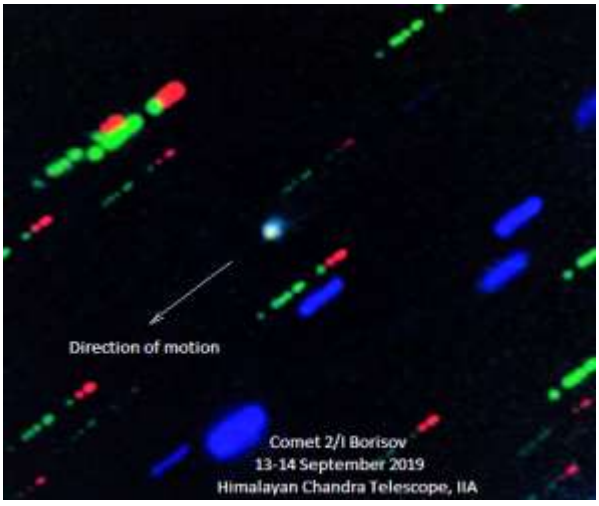
Introduction: Comet 2I/Borisov (hereafter 2I), the second detected interstellar object in the Solar System, was discovered on 30 August 2019. The object is not gravitationally bound to the Sun with eccentricity e=3.08, and the velocity at the moment of entering interstellar space was 30.7 km/s. Apparently, this comet was ejected from the planetary system of another star, and it is of interest to compare its physical properties with properties of our Solar System comets.

We present here the results of spectroscopic and photometric observations of the interstellar comet 2I obtained on the 2.0-m telescope Himalayan Chandra Telescope (HCT) of the Indian Astronomical Observatory.

Observations: The observations were performed from September 13, 2019, when heliocentric (r) and geocentric (Δ) distances of the comet were 2.77 and 3.41 AU, respectively, at 14.5 degrees phase angle (α), to December 16, 2019, when heliocentric and geocentric distances were 2.01 and 1.96 AU, and phase angle was 28.66 degrees. A 2048×4096 CCD with a full field of view of 10'×10' and a pixel scale of 0.29 arcsec/px was used as a detector. Photometric observations of the comet were acquired using the broad-band BVRI filters. Long-slit spectroscopic observations were taken in Grisms 7 (380–800 nm range) and 8 (580–920 nm range).



Fag 1. RGB image of comet 2I/Borisov

Results: Analysis of spectra and of the spatial distribution of intensity and color over the coma revealed the following features:

Spectroscopy.

We searched for the emission lines of the main comet molecules. We also used a polynomial fit to derive the reddening of the spectrum. The polynomial fitting showed linear dependence on wavelengths. Haser model [1] was used to derive the upper limits to the production rates. We compare these results with those obtained for the comets of different other dynamical types.

Photometry.

The comet showed activity with some features in the cometary coma and dust tail. To reveal the low-contrast structures in the cometary coma, we applied the available image enhancement techniques: division by azimuthal average, azimuthal renormalization [2], and rotational gradient method [3]. After processing the image, we reveal bright outflows in the cometary coma. The dust production was estimated in the R and I filters.

Summary and Conclusions: In this study, we present the results of the spectroscopic and photometric observations of the comet 2I in September and December of 2019 using the 2.0-m telescope. We find the dust coma reflectance as a function of wavelength. The chemical composition of the comet 2I shows many similarities to the broader population of the Solar System comets.

Future Work: In addition to comet emission spectra, we have taken the absorption spectra towards two bright stars to measure the absorption features from the comet's tail. These data can provide us important information about the materials in the ejecta and the physical conditions in the gas tail. Detection of CN gas in the comet's tail was already reported [4], there are indications of narrow spectral features in the 5000-5100 A region (Fig.1 in [4]). Our aim is to study these regions in absorption against the background star.

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