

Comet Lovejoy shows asymmetric behavior at perihelion

July 26 2016, by Tomasz Nowakowski



Photograph of the comet C/2014 Q2 (Lovejoy) taken on Jan. 19, 2015, from Tucson, Arizona, using a Sky-Watcher 100mm APO telescope and SBIG STL-11000M camera. Credit: John Vermette

(Phys.org)—Indian astronomers have recently conducted spectrographic observations of long-period Comet Lovejoy to study its gas emission.

They found that this comet showcases an asymmetric behavior at perihelion and an increase in the activity during the post-perihelion phase. The findings were detailed in a paper published July 22 on the arXiv pre-print server.

Comet Lovejoy, formally designated C/2014 Q2, is an Oort cloud [comet](#), discovered by Terry Lovejoy in August 2014. Its perihelion was on January 30, 2015 at a heliocentric distance of 1.29 AU, offering astronomers an excellent opportunity to observe its activity—in particular, the emission of numerous organic molecules in gas.

The scientists, led by Kumar Venkataramani of the Physical Research Laboratory in Ahmedabad, India, utilized the LISA spectrograph to obtain spectra of the comet. LISA is a low-resolution, high luminosity spectrograph, designed for the spectroscopic study of faint and extended objects. The instrument is installed on the 0.5 m telescope at the Mount Abu Infra-Red Observatory (MIRO), Mount Abu, India.

The observation campaign lasted from January to May 2015. It covered the period during which the comet's heliocentric distance varied from 1.29 AU, just prior to perihelion, to around 2.05 AU post perihelion. The spectra obtained by the researchers show strong molecular emission bands of diatomic carbon, tricarbon, cyanide, amidogen, hydridocarbon and neutral oxygen.

"Various molecular emission lines like C₂, C₃, CN, NH₂, CH, O were clearly seen in the comet spectrum throughout this range. The most prominent of them being the C₂ molecule, which was quite dominant throughout the time that we have followed the comet. Apart from the C₂ emission band, those of CN and C₃ were also quite prominent," the scientist wrote in the paper.

When a cold icy body like the Comet Lovejoy passes by the sun near

perihelion, its ices start sublimating, releasing a mixture of gas and dust, which form the coma. Studying these emissions is crucial for scientists as comets could hold the key to our understanding of the solar system's evolution and the origin of life in the universe. Therefore, the abundance of [volatile material](#) in comets is the target of many scientific studies that seek to reveal the secrets of planet formation and demonstrate the conditions that occurred when our solar system was born.

According to the study, the gas production rate increased after perihelion and exhibited a decreasing trend only after February 2015. The researchers also noted a simultaneous increase in gas and dust, indicating an increase in the overall activity of the comet after its perihelion passage.

"This kind of asymmetry has been seen in many comets. (...) Although we do not have data points at exactly the same distance for pre- and post-perihelion passages, we can, perhaps, say that this comet may have a large positive asymmetry," the paper reads.

The scientists concluded that this asymmetry suggests that there might be volatile material present beneath the surface of the comet. It is also possible that the surface of the comet's nucleus consists of layers of ice that have different vaporization rates.

However, as the team noted, more exhaustive study is required to confirm their conclusions.

More information: Optical Spectroscopy of Comet C/2014 Q2 (Lovejoy) from MIRO, arXiv:1607.06682 [astro-ph.EP]
arxiv.org/abs/1607.06682

Abstract

Spectra of comet C/2014 Q2 (Lovejoy) were taken with a low resolution

spectrograph mounted on the 0.5 m telescope at the Mount Abu Infrared Observatory (MIRO), India during January to May 2015 covering the perihelion and post-perihelion periods. The spectra showed strong molecular emission bands (C2, C3 and CN) in January, close to perihelion. We have obtained the scale lengths for these molecules by fitting the Haser model to the observed column densities. The variation of gas production rates and production rate ratios with heliocentric distance were studied. The extent of the dust continuum using the Af-rho parameter and its variation with the heliocentric distance were also investigated. The comet is seen to become more active in the post-perihelion phase, thereby showing an asymmetric behaviour about the perihelion.

© 2016 Phys.org

Citation: Comet Lovejoy shows asymmetric behavior at perihelion (2016, July 26) retrieved 26 April 2024 from

<https://phys.org/news/2016-07-comet-lovejoy-asymmetric-behavior-perihelion.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--