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Photometry and Imaging of Comet 103P/Hartley 2 from Lowell Observatory

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Abstract

We will discuss some results based on our imaging and photometric observations of Comet 103P/Hartley 2. Photometry was obtained during the 1991, 1997, and 2010 apparitions. These data reveal a strong secular decrease in production rates from 1991 to 2010 and a strong pre-/post-perihelion asymmetry in 2010. Imaging was obtained over 39 nights from 2010 July through 2011 January and analyses of the data are ongoing. We will discuss the CN coma morphology and make intercomparisons between gas species (CN, OH, C_2, and C_3), investigate the appearance and behavior of a possible dust jet, and refine the pole solution by combining the published results of multiple authors.

1. Introduction

The 2010 apparition of Comet 103P/Hartley 2 was its most favorable to date, passing within 0.12 AU of the Earth in late October. Further, Hartley 2 was the target of the EPOXI spacecraft flyby on 2010 November 4 and was therefore widely observed. We present imaging and photometric observations of Hartley 2 acquired at Lowell Observatory and place them into context with other datasets.

2. Observations

We obtained photometry of Hartley 2 using the Hall 1.1-m telescope at Lowell Observatory over a total of 18 nights during the 1991, 1997, and 2010 apparitions. We imaged Hartley 2 for a total of 39 nights from 2010 July until 2011 January using the Hall 1.1-m and the 0.8-m telescopes at Lowell Observatory. We primarily imaged the comet with broadband R and narrowband CN filters, but additional HB narrowband filters [2] were occasionally used as well.

3. Results

Photometry: The photometry reveals a strong secular decrease in production rates from 1991 to 2010. Additionally, a strong pre-/post-perihelion asymmetry was observed in 2010, with the peak in production occurring some 10–30 days after perihelion.

Gas Coma Morphology: Our analysis of the CN morphology has already been published [4]. We observed distinct CN morphology which varied smoothly during a night and looked similar but not identical from night to night. However, the morphology did not exactly repeat each rotation cycle, suggesting that there is a small non-principal axis rotation. Based on the repetition of the morphology, we find evidence that the fundamental rotation period was increasing, from near 16.7 hr in August to near 18.7 hr in early November.

We will also investigate the large-scale coma morphology observed in other narrowband gas filters: OH, C_2, and C_3 in order to understand whether or not the nucleus is heterogeneous. This will complement the in situ observations of the inner coma made by EPOXI which showed that water vapor has a different spatial distribution than CO_2, organics, and water ice [1].

Dust Jet Morphology: A small dust jet was observed in the EPOXI data and we will investigate this feature in our imaging data. The appearance of the dust jet may be useful for deriving a rotation period or constraining the non-principal axis rotation of the nucleus.

Numerical Modeling: We determined a preliminary, self-consistent pole solution based solely on our CN morphology data [4]. Additional constraints on the pole orientation are now available, e.g., [1, 3, 5]. We are attempting to determine a more generalized solution using these newly published results.

Acknowledgements

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