

CN Morphology of Comet 103P/Hartley 2

Matthew M. Knight¹ and David G. Schleicher¹,
¹Lowell Observatory, 1400 W. Mars Hill Rd., Flagstaff, AZ 86001, (knight@lowell.edu)

We present results from our ongoing observing campaign of Comet 103P/Hartley 2. The 2010 apparition of 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 widely observed from the ground. As a result, simultaneous ground-based, space-based, and in situ observations were obtained by numerous observers which, when analyzed and combined, will provide a richer understanding of cometary activity.

To date, we have imaged Hartley 2 for a total of 35 nights using the Hall 1.1-m and the 0.8-m telescopes at Lowell Observatory. The comet was monitored throughout the night for most 1.1-m nights while all 0.8-m nights consisted of one to five snapshot observations per night and were acquired robotically. We primarily imaged the comet with broadband R and narrowband CN filters, but additional HB narrowband filters [1] were occasionally used as well. Our observations began in 2010 July, however, at that time it was too faint to discern coma morphology. We observed it regularly throughout the remainder of 2010, obtaining images on five nights in August, five nights in September, eight nights in October, 13 nights in November, and three nights in December.

Observations and analysis are ongoing and will be reported in more detail in a forthcoming paper (Knight & Schleicher, 2011, in prep.). We summarize preliminary results using the CN images below:

Coma morphology: Enhancement of our August CN images revealed a jet-like feature (Figure 1) which varied in appearance throughout each night [2]. The presence of morphology implied the nucleus was not $\sim 100\%$ active, but instead contained discrete source regions. Such regions were, in fact, observed by the EPOXI spacecraft during the flyby. One or more CN features have continued to be observed in all of our subsequent observations. Comparable features are not seen in the dust images.

Rotation period: The CN morphology repeated quasi-periodically, allowing us to measure a rotation period of the nucleus during each of our 1.1-m observing runs. We found a rotation period of 16.6 ± 0.5 hr from August 13–17 [2]. Subsequent runs showed evidence of an increasing rotation period. Our rotation periods are consistent with those reported by other observers [3, 4, 5, 6] and indicate that the rotation period of Hartley 2 increased from 2010 August until 2010 December.

Non-principal axis rotation: The CN morphology var-

ied somewhat from cycle-to-cycle, indicating that the nucleus is not in simple, principle axis rotation. However, the deviations from cycle-to-cycle were relatively small and we conclude that the dominant rotation is the 16–19 hr period.

Evidence for seasonal activity: As shown in Figure 1, we observed one discrete CN feature in August and September, but at least two features during October, November, and December [7]. The apparent brightness of the two features varied with time: the northern feature was initially always brighter but the southern feature was often brighter by November. These morphological changes suggest that Hartley 2 experienced a seasonal change in activity during the apparition, with the southern source receiving progressively more sunlight and the northern source receiving relatively less.

Pole solution: The changing viewing geometry throughout the apparition allows a determination of the orientation of the spin axis. Numerical modeling of our full dataset is ongoing and will be discussed at the meeting.

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References

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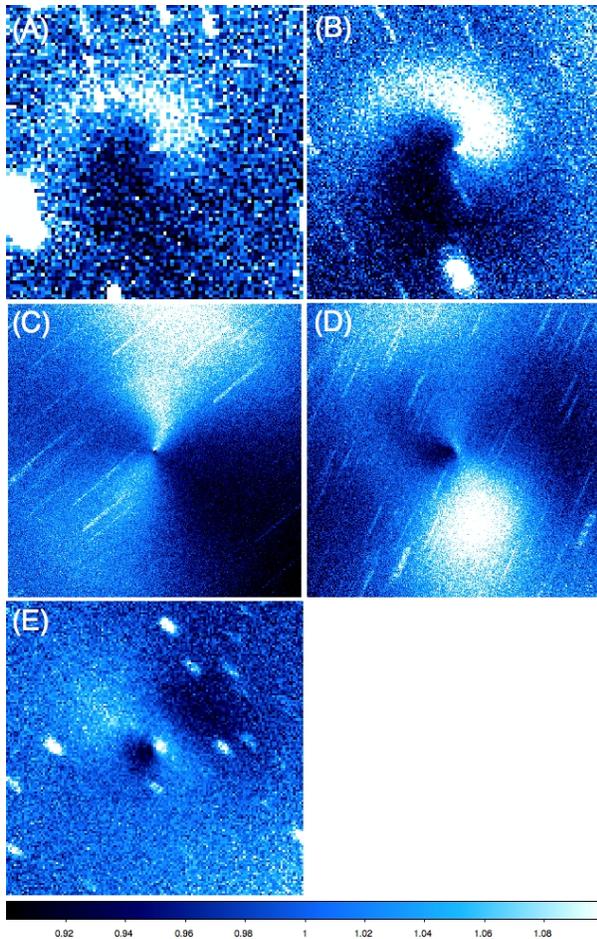


Figure 1: Sample CN morphology from 2010 August 13 (A), 2010 September 10 (B), 2010 October 17 (C), 2010 November 4 (D), and 2010 December 10 (E). Each image has been enhanced by dividing by an azimuthal median profile to remove the bulk coma brightness and reveal more subtle underlying features. Each image is centered on the nucleus with north up and east to the left, and is approximately 52,000 km across at the comet. The images were trailed at the comets' rate of motion so stars appear as diagonal streaks. White is brighter and blue/black is darker. Note that the viewing geometry changed significantly during the apparition. During August (A) and September (B) the morphology appeared as a nearly face-on spiral. However, during October (C), November (D), and December (E) it appeared as a side-on corkscrew.