EPSC Abstracts
Vol. 6, EPSC-DPS2011-55, 2011
EPSC-DPS Joint Meeting 2011

Long-Term Monitoring of Comet 103P/Hartley 2 in 2010

Z.-Y. Lin (1,2), L.M. Lara (1) ,W.-H. Ip (2) and F. Moreno (1)
(1) Instituto de Astrofísica de Andalucía (CSIC), Glorieta de la Astronomía s/n, ES-18008 Granada (2) Institute of Astronomy, National Central University, Taiwan (zlin@iaa.es, d919002@astro.ncu.edu.tw / Fax: 886 3 4262304)

Abstract

NASA's EPOXI mission encountered the comet 103P/Hartely 2 at 14:00 UT on November 4, 2010. The space- and ground-based observations can provide synergistic information, i.e. the morphology of gas and dust features, for EPOXI mission by using data over longer timescales. Here, we present our monitoring result of coma morphology in optical wavelength of comet Hartely 2 from April to December 2010 by using Lulin one-meter telescope. The dust feature at sunward direction, not dust tail, was detected starting from the end of September until the beginning of December when is our last observation at Lulin observatory. We found the dust feature not only looks like a prominent jet but shows the multiple jets. In parallel, the CN images revealed two jets which are nearly at the line perpendicular to the Sun-nucleus direction. It means the sources of CN and dust could come from different active regions on comatary surface.

1. Introduction

Comet 103P/Hartley 2, hereafter Hartley 2, with an orbital period of 6.46 years was discovered photographically by Malcolm Hartley in March 1986. Because this comet is the second of three periodic comets discovered by M. Hartley, it goes by the name "Hartley 2". Comet Hartley 2 was an interesting object in the end of 2010, not only because it becomes a naked-eye comet, but also because NASA's Deep Impact spacecraft is scheduled for a close flyby to study it on November 4 2010. Comet Hartley 2 which is the fifth comet nucleus visited by spacecraft (the other four comets are: 1P/Halley, 19P/Borrelly, 81P/Wild 2 and 9P/Tempel 1) is the target of NASA' EPOXI mission. On November 4, 2010, about one week after perihelion (1.60 AU, October 28, 2010), two weeks after its closest to Earth (0.12 AU, Ocorber 20, 2010) the spacecraft made its closest approach to Hartley 2 at a distance of about 700km.
We began observing Hartley 2 in April 2010 and observations continue into early December 2010. Some observations were done using both Asahi R broadband filter and the narrowband filters of Rosetta filter set. But some of them were obtained only by only using R filter due to low signal-to-noise ratio of narrowband filters before the end August and after the end November or only using narrowband filter to avoid the moon influence in end of Octorber.

2. Dust feature

In April and May the signal to noise ratio of images are quite lower and therefore we didn't get any structure in inner coma even the dust tail is too faint to detect. In July and August, we only detected the dust tail which is roughly toward to the anti-solar direction. In the end of September, we first found a dust jet pointed at sunward direction and this jet feature can be detected from the end of September until the beginning of December when is our last observation at Lulin observatory.
The dust jet feature sometimes looks like a prominent jet but sometimes it shows the multiple jets features. Mostly, we didn't find the dust jet changed from prominent jet to multiple jets in one night observation. But we did fortunately observe this phenomenon during the nights on October 10 and October 11. There are two dust jets found (Figure 1, in all images presented here, north is at the top and east is at the left), the main one that streams toward the Sun does not change a lot but another one that perpendicular to sun-tail direction is to switch on at the end time of these two days. This particular jet switched on/off could be a seasonal effect or caused by the projected effect during our observation run.

3. CN feature

The processed CN filter images from our observations between October 10 and November 2 revealed two jets in the inner coma of comet Hartley 2 (Figure 2). These CN jets are nearly at the line perpendicular to the Sun-nucleus direction. To compare the morphology

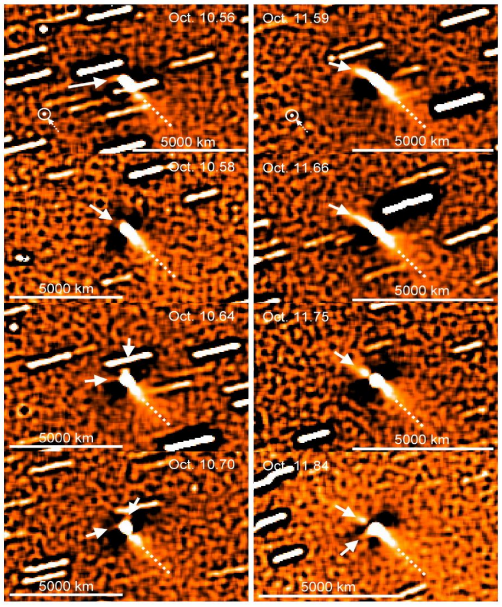

Figure 1: After image processing by using the adaptive Laplace filter, broadband images obtained on October 10 (left panel) and Octobel 11 (right panel) show the evolution of dust feature.

of CN jets found in comet C/2004 Q2 (Machholz), we found that the CN jets of comet Hartley 2 did not show the spiral-like structure. This could be the observing limit of field of view. The FOV in between Hartley 2 and Machholz are 20000 km and 80000km, respectively. In addition, we found these two CN jets are asymmetry. One of their brightness is always stronger than that in another. For example, the southern jet of the images obtained from October 25 to October 27 is slightly stronger than northern jet of those images. This means one of them could be toward to Earth. The main one moves to the south of the line-of-sight before the end of October. From our observation on October 11, comet Hartley 2 shows its clockwise rotation by using the morphology changed of CN jets

4. Summary

1. The turn on/off effect of dust jet feature is clearly seen during ouvservation run.
2. The series of dust feature can be used to estimate the rotation period of comet Hartley 2.

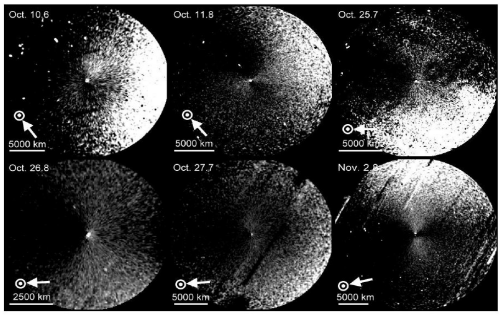

Figure 2: The CN images subtracted dust continuum are all processedby using azimuthal average profile subtraction The Sun symbol and arrow indicate the projected direction towards the Sun

3. Twice CN jet features found in October and November are asymmetry. One of them cound be toward to Earth.
4. The morphology of CN and dust features are quite diferent and this means the sources of CN and dust could come from different active regions on comatary surface.

Acknowledgements

This work was based on observations obtained at Lulin Observatory, Taiwan. We thank the staff members for assistances in the observations. The research carried out was supported by the project AyA2009-08011 of the Ministerio de Ciencia e Innovación. Zhong Yi Lin acknowledges a post-doctoral grant awarded by the Junta de Andalucía through the project P07-TIC-274. This work was also supported by NSC 99-2923-M-008-002-MY3 of the Formosa Program.

References

[1] K.J. Meech et al. 2011, EPOXI: Comet 103P/Hartely 2 Observation from a worldwide campaign. ApJ, 734, L1

[2] Z.-Y.Lin et al, 2007, Photometry and Imaging of comet C/2004 Q2 (Machholz) at Lulin and La Silla. A&A, 469, 771

[3] N.H. Samarasinha et al. 2011, Rotation of comet 103P/Hartley 2 from structures in the coma. ApJ, 734, L3