Mid-infrared Spectroscopic Observations of Comet 17P/Holmes
- COMICSによるアウトバースト直後のホームズ彗星の中間赤外線観測 -

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Abstract

We have carried out mid-infrared observations of comet 17P/Holmes with the Cooled Mid-Infrared Camera and Spectrometer (COMICS) on the 8.2-m Subaru Telescope on 2007 October 25-28 UT. We detected an isolated dust cloud that moved toward a south-west direction from the nucleus. The color temperature of the isolated dust cloud is estimated to be ~ 200K, which is slightly higher than the black-body temperature. Our analysis of the motion indicates the isolated cloud moved anti-sunward. For spectroscopy, we set the slit position along the direction from the nucleus to the isolated dust cloud. The Mg-rich crystalline olivine features at 11.2 and 11.9 micron are clearly observed in both spectra of the near nucleus region and the central part of the isolated dust cloud. The shapes of both spectra are basically similar and they also closely resemble in shape the spectra of comet Hale-Bopp and ejecta dust of 9P/Tempel excavated by the "Deep Impact" event.

Introduction

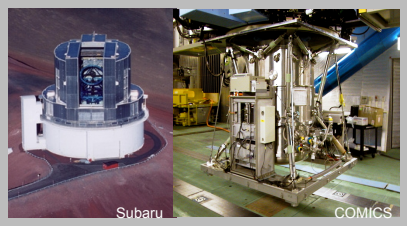
Comet 17P/Holmes is one of the short-period comets, and showed a large outburst on late October 2007. Our group recognized that this outburst was so extraordinary that we observed this comet with the Subaru telescope. The Cooled Mid-Infrared Camera and Spectrometer (COMICS) was being attached to the Subaru telescope at that time, which is suitable to study the mineralogy and morphology of dust particles in a comet. As a result of imaging, we found an isolated dust cloud moving away from the central condensation, which may give clues to know the mechanism of the outburst. We also carried out the spectroscopic observations of this comet with COMICS. In this poster, we present the observational evidences of this isolated dust cloud and results on spectroscopy of both the isolated dust cloud and the central condasation.

Observations

Target: comet 17P/Holmes (short-period comet)

Date: 2007/10/25-28 UT
r = 2.45 AU, Δ = 1.63 AU

Telescope: Subaru+COMICS
mid-IR imaging
8.8, 12.4, 18.8, and 24.5 micron
Lmid-IR ow-resolution spectroscopy
8-13 micron; R~250
0.33 arcsec wide slit



Results

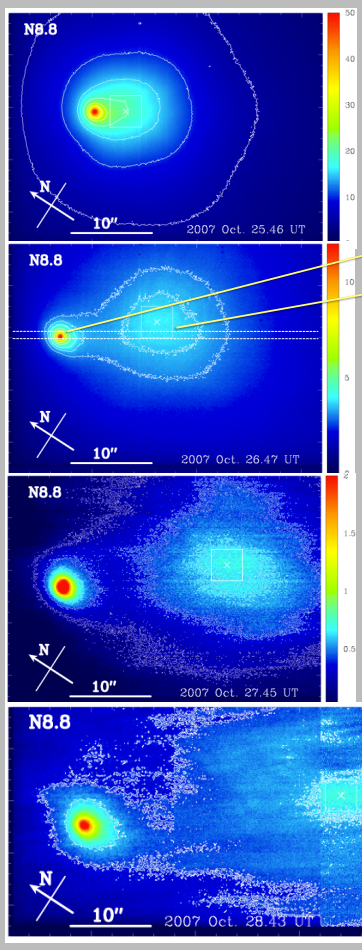


Figure 1. - The 8.8 micron images of comet Holmes on Octorber 25-28UT. In the image taken at the first night (October 25.5), the dust cloud was not so clearly detached from the central condensation. Then, it was clearly isolated after the next night. It is clear that the distance between the nucleus and the center of the isolated cloud increased monotonically with time. We also found that the moving direction exactly coincided with the projected position angle of the sun–comet vector to an accuracy of several degrees. For the spectroscopy, we set the slit position along the direction from the nucleus to the isolated dust cloud (213 degree position angle).

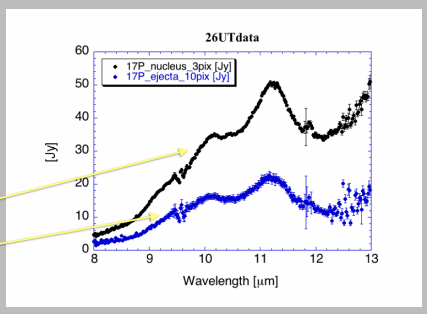


Figure 2. - Spectra of the central condensation and the central part of the isolated dust cloud.

Although there is a difference in the emission strength, the shapes of both spectra are basically similar. They also remarkably similar in shape to the spectra of comet Hale-Bopp (Crovisier et al. 1997; Wooden et al. 1999) and ejecta dust of 9P/Tempel excavated by the Deep Impact event (Sugita et al. 2005; Ootsubo et al. 2007a). The Mg-rich crystalline olivine features at 11.2 and 11.9 micon are clearly observed in both spectra of comet 17P/Holmes.

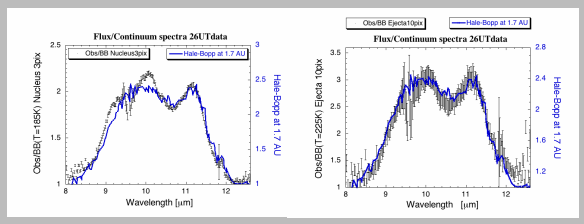


Figure 3. - Comparison of flux/continuum (blackbody) spectra of comet Holmes with comet Hale-Bopp. These two comets have a quite similar 10-micron silicate feature.

These features originate not only from small silicate grains of crystalline Mg-rich olivines together with the amorphous grains, but also from large fluffy particles including crystalline Mg-rich olivines. The latter case was suggested in the observations of comet 1P/Halley, which shows infrared features of Mg-rich olivines in its spectra (Hanner 1999) while in-situ measurements of dust particles in its coma shows that the total cross section of the coma is dominated by large particles (McDonnell et al. 1987). Therefore, dust particles in our observation may have been large fluffy grains.

reference

Watanabe, J., et al. 2009, PASJ, 61, 679