Mid-infrared observations of sungrazing comet C/2012 S1 (ISON) with the Subaru Telescope

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Comets are the frozen reservoirs of the early solar nebula and are made of ice and dust. The determination of the properties for cometary dust provides us insight into both the early-solar-nebula environment and the formation process of the planetary system. A silicate feature is often observed in comet spectra in the mid-infrared region and may be used for probing the early history of the solar system. In most cases, the feature shows the existence of crystalline silicate (for example, 11.3 microns) together with amorphous silicate [1,2]. Since the crystallization of silicates from amorphous ones generally requires high-temperature annealing above 800 K (e.g., [3,4]), it is believed that the crystalline silicate grains produced at the inner part of the disk were transported to the outer cold regions where the comet nuclei formed.

Comet C/2012 S1 (ISON) is a long-period Oort Cloud comet, discovered in September 2012. In particular, comet ISON is a sungrazing comet, which was predicted to pass close by the Sun and the Earth and becoming a bright object. Mid-infrared observations of this new comet and investigation of the 10-micron silicate feature help us understand the formation of crystalline silicate grains in the early solar nebula.

We conducted observations of comet ISON in the mid-infrared wavelength region with the Cooled Mid-Infrared Camera and Spectrometer (COMICS) on the Subaru Telescope on Mauna Kea, Hawaii [5,6,7]. The observation of comet ISON was carried out on 2013 October 19 and 21 UT. Since the weather conditions were not so good when we observed, we carried out N-band imaging observations (8.8 and 12.4 microns) and N-band low-resolution spectroscopy. The spectrum of comet ISON can be fit with the 260–265-K blackbody spectrum when we use the regions of 7.8–8.2 and 12.4–13.0 microns as the continuum. The spectrum has only a weak silicate excess feature, which may be able to attribute to small amorphous olivine grains. We could not detect a clear crystalline silicate feature in the spectrum of our observations. We will compare the spectrum with other Oort Cloud comets, such as comets C/2011 L4 (PanSTARRS) and C/2013 R1 (Lovejoy), and discuss the dust properties and the birthplace of comet ISON.

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