

A search for the non-water ices on the icy Galilean moons of Jupiter with ground-based telescope

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In the outer region of the Solar System, the Jovian system and beyond, most of solid bodies are generally covered with the solid water ice on their surfaces, and thus they are called as icy bodies. In addition, various non-water ice(s) can be found on the many objects, e.g., CH₄ and NH₃ in the Saturn moons and N₂ and CO in the Neptunian moon Triton and the icy dwarf planet Pluto. As a first approximation, highly volatile ices exist in a farther region from the Sun, thus such distribution of non-water ices in the outer Solar System seem to reflect the temperature environment during the formation of the Solar System and the positional relationship between the snowline and the place where the planetary system formed.

In the Jovian system, the only non-water volatiles which have been inferred is CO₂, by the presence of an absorption band at ~4.26 microns in reflectance spectra returned by the Near Infrared Mapping Spectrometer (NIMS) aboard the Galileo spacecraft. On Callisto, trailing hemisphere and several fresh impact craters show enrichment in carbon dioxide. On the other hand, no such distributions of CO₂ can be seen on Ganymede. Thus the origin of CO₂ on their moons, whether these are primordial and degassed from the interior or are exogenic and delivered through the impact, is still controversial. Identifying the presence of non-water ices on the Jovian system could be an important key to know the formation environment of the outer Solar System, by comparing the material distribution on the other giant planet systems, Saturnian system and beyond.

We search the non-water ices, e.g., CH₄ and NH₃, on the icy Galilean moons of Jupiter; Europa, Ganymede and Callisto, using the ground-based telescope of Hokkaido University (Pirka telescope, the primary mirror is 1.6 m in diameter). The Pirka telescope and its on-board observation device has started full-scale operation in 2011 with priority to observe planetary bodies in the Solar System. The multi spectral imaging device has been installed at the Cassegrain focus of the telescope and it allow us to obtain surface spectral data with wavelength between 350 and 1050 nm. Here we will report the investigation.

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