Internal structure and surface geology of the icy satellites, and implications for Trans-Neptunian Objects

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Ice is one of the most important materials that compose the solar system bodies. In particular, most of the bodies in the outer solar system have a large abundance of the ice, and have various sizes and forms from the planetary size to the smaller comets and ring particles. Above all, the satellites covered by copious amount of ice and orbiting around the giant gas planets are grouped as *Icy Satellites*. According to the large number and the variety of surface appearances, the icy satellites make a wide research field.

The observations by the Voyager spacecrafts had led to a great breakthrough to the knowledge of the icy satellites. The icy satellites have been spotlighted from the finding many signatures of the surface tectonic activities regardless of an extremely cold environment. The notable point is that the relationship between the internal structure and the surface activities, and that the activities do not depend on the size of the satellite. We can see various signatures of the activities on the icy satellites, including strong implication for the existence of the subsurface water ocean in Jovian satellite Europa, liquid lakes on the Saturnian satellite Titan, eruption of water vapor and ice particles from south polar region on Enceladus, and geysering of methane and nitrogen on Neptunian satellite Triton, etc. Such activities and the internal evolution should be controlled due to the large volume fraction of ice within the satellites and the material characteristics of ice. Although the internal structure of the icy satellites has not yet been well understood because of the limiting of observational data, the bulk densities of the satellites is in between 1000 and 2000 kg/m^3 tells that most of the icy satellites have large volume fraction (about 50% or more) of ice.

Moreover, TNOs (Trans-Neptunian Objects) also are mainly composed of the ice. Recently, many TNOs sized as the icy satellites have been founded in Edgeworth-Kuiper Belt Region, and methane and ammonia ice as well as H_2O ice have been detected on their surface due to spectroscopic observations [e.g., Barucci et al. 2005; Brown et al. 2005; Licandro et al. 2006]. More than 20 TNOs including Dwarf Planet Pluto have the size of over 500 km in diameter, and a cryovolcanism has been implied on some large TNOs like the satellite Enceladus and Triton [Cook et al. 2007, Jewitt and Luu 2004]. Thus TNOs have similar characteristics in various aspects as the icy satellites, and I believe that the understanding of the icy satellites can give the strong implications for the TNOs in many points of view. In this talk, I will review the internal structure of the icy satellites and its relation with the surface activities, and discuss the suggestion in the structure of large TNOs.