[구SS-05] Why Comets Exhibit Outbursts? A Lesson from Holmes and its Miniature

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Comets are mysterious travelers from outer Solar System. It is considered that comets loose their subsurface ice once they were injected into a snow-line of the solar system, at the same time, develop adiathermic dust layers on the surface in a time scale of ~10,000 years. They eventually become inactive (see also the presentation by Yoonyoung Kim et al.). Optical similarity between comets and asteroids in comet-like orbits suggests the existence of such dormant or inactive comets supporting the evolutionary scenario. However, unforeseen accidents cast a misgiving to modify the stereotype.

A periodic comet, 17P/Holmes, is known as comet with very low activity before 2007. However, the comet suddenly exhibited an outburst in 2007 October, which is known as the most energetic cometary outburst since the beginning of modern astronomy. On the other hand, another periodic comet, P/2010 V1, was not known before 2010 November probably because of low activity and discovered while it experienced outburst. We investigated the time-evolution of the magnitudes and the morphological developments based on the dynamical theory of dust grains, and derived the energy per unit mass of ~10,000 J/kg. From these observational evidences, we suggest that crystallization of buried amorphous ice (even in low-activity comets) can be responsible for the dramatic cometary outbursts.

[구SS-06] Search for Dormant Comets in the Infrared Asteroidal Catalog

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Comet nucleus is a solid body consisting of dark dust grains and ice. Cometary volatiles sublimate from subsurface layer by solar heating, leaving behind large dust grains on the surface. Eventually, the appearance could turn into asteroidal rather than cometary. It is, therefore, expected that there would be "dormant comets" in the list of known asteroids.

Our research group has undertaken the research on the population of dormant comets. We applied a brand-new asteroidal catalog compiled from data garnered by three infrared astronomical observatories, AKARI, IRAS and WISE. We extracted objects which have comet-like orbits on the basis of their orbital properties (Tisserand parameters with respect to Jupiter, T_J, and aphelion distance, Q). We found that (1) there are a considerable number (>100) of asteroids in comet-like orbits, and (2) 80% of them have low albedo consistent with comets. This result suggest that these low albedo objects could be dormant comets.

One unanticipated finding is that 20% of asteroids in comet-like orbit have high albedo similar to S-type asteroids. It is difficult to explain the population of S-type asteroids in comet-like orbits by the classical mechanics theory. We further found that these high-albedo objects are small ($D < 2$ km) bodies distributed in near-Earth space. We suggest that such high-albedo, small, near-Earth asteroids are susceptible to Yarkovsky effect and injected into comet-like orbits.