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99942 Apophis is an Sq-type Aten group Near-Earth Asteroid (NEA) with an estimated size of 370 m. It will approach the Earth to come within the geostationary orbit during the upcoming encounter on April 13, 2029 to offer a unique chance to study its 1) global properties, 2) surface arrangements, and 3) their detectable changes expected to happen, in sub-meter scale. What measurable scientific goals for the asteroid in this "once a millennium" event could transform our knowledge of planetary science and defense?

The Apophis rendezvous mission aims to understand the characteristics of the small solar system body's nature. It also prepares for potential threats from natural objects by measuring in-situ surface, shape, rotation, and orbit changes expected to occur when the target asteroid passes close to the Earth in 2029. We will present an overview of the mission scheduled to be launched from late 2026 to early 2027 and introduce scientific objectives.

[구 SS-10] Apophis Rendezvous Mission: II. Payloads and Operation Scenario

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We plan to visit the Apophis, a Potentially Hazardous Asteroid (PHA). Apophis will have an extremely close encounter with the Earth on April, 2029. At the closest position, Apophis approaches 0.1 lunar distances from the Earth. The science goals are 1) mapping the surface of the asteroid before and after the encounter, 2) measuring surface roughness before and after the encounter, and 3) measuring interplanetary space environments such as magnetic field and dust particles. For the science goal, we are planning to employ five instruments for this mission, which are Polarimetric Asteroid Camera (PolACam), Asteroid Terrain Mapping Camera (MapCam), Laser Altimeter, Dust Particle Detector (DPDetector), Magnetometer (Mag). In this presentation, we plan to give a talk on the instruments.한기로 나누어 보면, 흑점의 관측 빈도는 두 기간에서 비슷하지만, 오로라는 냉한기에 집중적으로 관측된다. 특이하게도, 크기가 큰 흑점의 경우는 냉한기보다 온난기에서 관측 빈도가 세 배 이상 높다. 또한, 흑점과 관련된 오로라의 강도를 분석해보면 크기가 큰 흑점은 작은 흑점보다 2~3배 이상 지구영향성이 높다는 것을 알 수 있다.

[구 SS-11] Rotational instability as a source of asteroidal dust near Earth

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As implied by the zodiacal light and spacecraft impact measurements, the space between large bodies in our Solar System is filled with interplanetary dust particles (IDPs). IDPs give us deeper insight into the composition and evolution of the Solar System, as well as being a crucial reference for extrasolar research. IDPs can be interpreted as bearers of carbon and organic materials, and thus, their interaction with Earth can be considered as important factors for the birth of terrestrial life.

One of the key routes of IDPs entering Earth is via meteoroid streams (Love and Brownlee 1993).

The Geminid meteoroid stream is a notable example. Together with its source asteroid (3200) Phaethon, the Phaethon-Geminid stream complex (PGC) (Whipple 1983; Gustafson 1989) can potentially provide information on the properties and evolution of IDPs in near-Earth space. DESTINY+* is a JAXA/ISAS spacecraft planned to launch in 2024 to explore the physical and chemical features of near-Earth IDPs and uncover the dust ejection mechanism of active near-Earth asteroids, especially Phaethon (Arai et al. 2018).

Previous studies on the dust ejection mechanism of Phaethon have various degrees of success in explaining the ejection of submillimeter particles and try to recreate the dust replenishment rate of the Geminid stream. However, none of them are satisfactory for explaining the observed Geminid stream, especially for larger particles of a millimeter and centimeter scales. Inspired by the discovery of rotational mass shedding in the Main Belt region (Jewitt et al., 2014), we investigate a dust ejection scenario by rotational instability on Phaethon. Using the N-body integrator MERCURY6 (Chambers 1999; modified by Jeong 2014), we performed a long-term integration of dust particles of various sizes ejected at ~1 m/s. Through this process, we discuss the implications Phaethon's rotation may have on its ejection, the formation and evolution of IDP by this mechanism, and contribute to the DESTINY+ mission.

* Demonstration and Experiment of Space Technology for Interplanetary voYage Phaethon