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PERC 超小型衛星プロジェクト：流星観測キューブサット S-CUBE (S3)
PERC CubeSat project: Meteor-observing satellite S-CUBE (S3)

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Introduction: A CubeSat is a type of miniaturized satellite for space research. The standard 10∗10∗10 cm cubic satellite is often called a 1U CubeSat meaning one unit, and has a mass of 1 kilogram. CubeSat has been a familiar tool for engineers to test new technologies in space and often used for Earth remote-sensing, too. On the other hand, use of CubeSat for astronomical and planetary sciences has been rare because of severe constraints on payload. We propose in this work to use a CubeSat for the first time in planetary sciences, specifically to observe meteors entering into Earth's atmosphere. A development of a science-oriented CubeSat brings about many difficulties, but our challenge can possibly open a new field of observational research in astronomy and planetary sciences. An advantage to use a CubeSat in comparison with previous missions led by national space agency is that a CubeSat project can be carried out within a limit of cost, technology, and organization available in academy. This allows a development of a satellite in a few years.

Our new project is called "Shooting star Sensing Satellite (S3: S-CUBE) Project." The S-CUBE Project was a project started by a partnership between Planetary Exploration Research Center of Chiba Institute of Technology (PERC/Chitech) and Tohoku University to develop a 3U CubeSat (30∗10∗10 cm; 4 kg) based on the design of RAIKO that was developed and launched by Tohoku University in October, 2012. The S-CUBE is equipped with optical sensors, such as a camera and photomultipliers, to observe luminous emission of meteors from a low-Earth orbit. The launch date is planned in the 2014. For command uplink and data downlink, an UHF antenna and an S-band antenna at Chitech are used.

Scientific Objectives: Meteors are luminous phenomena induced by hypervelocity entry of meteoroids into the Earth's atmosphere. Because most meteoroids are thought to be originated from comets and asteroids, the meteor give us valuable opportunities of an indirect exploration of the primordial objects in the solar system.

Although meteors have been observed mainly from the ground so far, the ground-based observations have weak points: narrow observational range and weather dependent. In contrast to the ground-based observations, a space-based observation by an earth-orbiting satellite enables a continuous global observation of meteors. Further, a space-based observation can detect ultraviolet emission from meteors because it is not hindered by ozone layer.

The S-CUBE is designed to be equipped with one camera and 2 (or possibly 4) photo multiplier. The camera points nadir direction to take images of meteors during flight over the night side of the Earth. We can estimate the meteoroid size from brightness of meteors. The photo-multipliers are attached with UV band-pass filters so as to extract UV light of meteors from lights from the Earth. Detection of UV light of meteors is used as a trigger of the camera. It is also suggested that UV light of meteors includes emissions of some light elements, such as sulfur, which have not been observed by previous ground-based observations.

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