Meetings International SciTechnol

Yuki Mando et al., J Phys Res Appl 2018, Volume: 2

International Conference on
APPLIED PHYSICS AND MATHEMATICS

World Congress on
MATERIALS RESEARCH AND TECHNOLOGY

October 22-23, 2018
Tokyo, Japan

Basic study on plasma generation excited by hypervelocity impact of space debris

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There are more than 500,000 pieces of debris in orbits of the Earth which no longer serves a useful function. They are called "space debris". They travel at speed up to 7-8km/s (i.e. hypervelocity). Hypervelocity impact induced electrical phenomena such as plasma generation, radiofrequency radiation, generation of luminous cloud and variation in electrical potential of an impacted target as well as mechanical ones such as generations of a crater and secondary debris. In particular, plasma generation excited by hypervelocity impact may result in an electrical failure of spacecraft, but the phenomenon has not been studied well. To simulate the debris impact, we conducted the ground-based impact experiments using the two-stage light gas gun installed at ISAS/JAXA and investigated the plasma generation as shown in Fig.1. Plasma and luminous cloud expansion from the impact were measured by arrays of plasma probes distributed near the impact point, a high-speed video camera, and a streak camera spectroscopy. We used various aluminum alloy plates with the thickness of 40 mm as targets and nylon sphere with a diameter of 7 mm as a projectile. The projectile was accelerated at a velocity of approximately 7 km/s and impacted to the target at an angle of 90 degrees. In the presentation, we will describe the plasma generation excited by hypervelocity impact.

Biography

Yuki Mando is pursuing PhD at The Graduate University for Advanced Studies under a supervisor Prof. Koji Tanaka, who belongs to ISAS/JAXA. His research work focuses on electrical phenomena such as radiofrequency emission, plasma generation, expansion of luminous cloud from space debris impact. He is also interested in space solar power satellite (SPS), which is the concept of collecting solar power in space and distributing it to the Earth via wireless power transmission (i.e. microwave transmission) and researches the interaction between intensity microwave and ionosphere plasma.

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