



Radar and Optical Simultaneous Observations of Geminids Faint Meteors

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An active asteroid (3200) Phaethon is the parent body of Geminid meteor shower. However, the age of the Geminid meteor stream is the subject that has been left unsolved. The mass and size distributions of the Geminids' meteoroids provide important information to understand the origin and evolution of the Phaethon-Geminid stream Complex. DESTINY+ (Demonstration and Experiment of Space Technology for INterplanetary voYage with Phaethon fLyby and dUst Science) is a mission for JAXA/ISAS small class program which will be launched in 2024 by an Epsilon S rocket and flyby Phaethon in 2028.

Upper Atmosphere Radar (MU radar) and a mosaic CMOS camera, Tomo-e Gozen, mounted on the 1.05-m Kiso Schmidt Telescope. The relationship between radar cross sections (RCS) and optical V-band magnitudes, -1.5 – 9.5 mag corresponding 10^{-5} – 100 g in mass range, was approximated by a linear function. For sporadic meteors the luminosity function was well approximated by a single power-law function with the population index of $r = 3.52 \pm 0.12$ (Ohsawa et al., 2020).

Simultaneous observations of Geminids were carried out using MU radar and Tomo-e Gozen during Geminid meteor shower maximum in December 2020 and 2022. In order to investigate observational biases not only by entry speed but also by their species, spectroscopic observations for Geminids were also organized which can provide ablated Na/Mg/Fe emission intensity ratio (Abe et al. 2020). This paper will present the luminosity and size distribution functions for faint Geminids' meteors compare with sporadic meteors.

References

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- [2] S. Abe et al., "Sodium variation in Geminid meteoroids from (3200) Phaethon.," *Planetary and space science* **194**, 2020, pp. 1-9, 10.1016/j.pss.2020.105040