Orbit and Size Distribution of Faint Meteors by MU Radar

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Solar system small bodies ranging between 10-15 and 1015g are continuously colliding with the Earth. Majority of them are so called meteoroids or IDPs (Interplanetary Dust Particles) whose diameters are estimated between 10 and several 100 μm. It is indicated by ground-based optical and radar observations or in-situ measurements that a daily mass influx of meteoroids is ranging from 100 to 300 tones. However, it is still a matter of determining size distributions of influx meteoroids and finding parent bodies of them, while parent bodies of major meteor showers have been identified as comets or dormant comets. Their physical and chemical aspects such as orbits, composition and structure are also poorly known. The influx rate of interplanetary dusts onto the Earth's surface is essential for the human space activities. Thus, it is also very important to investigate influx rate, orbits and mechanical strength of meteoroids.

High power large aperture (HPLA) radar observations have enabled to provide information on individual meteoroids' orbits, their influx and ablation processes in the upper atmosphere. The meteor head echo observation has been carried out using the middle and upper atmosphere radar (MU radar) of Kyoto University at Shigaraki (34.9N, 136.1S), which is large atmospheric VHF radar with 46.5 MHz frequency, 1 MW output transmission power and 8330 m2 aperture array antenna. We have revolutionary achieved to determine the most precise orbits of approximately 180,000 meteoroids observed between 2009 and 2016. In order to investigate the size distribution of these meteoroids, simultaneous observations using MU radar and high-sensitive optical observations, about 9th limiting magnitude, were achieved to obtain the relationship between Radar Cross Section (RCS) and visual magnitude that can provide the size of meteoroids.

This paper describes size distributions and orbital parameters of faint meteors observed by MU radar and a high-sentive camera with limiting magnitude ~9th. Simultaneous optical observation plan using 105cm Schimidt telescope with 2Hz ultra-sensitive camera will be introduced.