A Wide-field Survey for Small Main-belt Asteroids in High Inclination

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The orbital distribution of main-belt asteroids (MBAs) indicates that a dynamical excitation event in the early solar system pumped up the eccentricities and inclinations of primordial asteroids [1]. In the excitation phase, collision velocities between asteroids are higher than at present [2]. The critical specific energy for catastrophic disruption, expressed by Q_D, under such a hypervelocity collision velocity is unknown precisely. The collisional evolution of the size distribution in the main belt during the dynamical excitation phase could have been different from what is estimated by some models.

We focus MBAs in high inclination (*i*) to reveal the Q_D function of asteroid diameter with a collision velocity of _10 km/s [3]. We investigate the size frequency distribution (SFD) of high-*i* MBAs using both observation data taken by the 8.2m Subaru Telescope and published asteroid catalogs.

Our observation was performed with the Subaru Prime Focus Camera in the high ecliptic latitude _elds. The acquired data allows us to estimate the SFD of high-*i* MBAs whose diameter is _1 km or less. In addition, we analyzed the catalog data of asteroids observed by the Sloan Digital Sky Survey Moving Object Catalog (SDSS MOC) [4] .

The SFDs estimated from the Subaru data, SDSS MOC, and numbered asteroid database were combined. We found that the high-*i* (*i* >15_) MBAs have a shallower SFD than the low-*i* MBAs (*i* <15_) over any sizes down to 0.7 km in diameter. The general slope of the SFD approximated a power law in the gravity-scaled regime is given by the power-law index of Q_D function of asteroid diameter in the gravity-scaled regime [5]. As the result of several considerations about a cause of the difference of the SFD slopes between low-*i* and high-*i* MBAs, we conclude that the Q_D slope in the gravity-scaled regime with the collision velocities for high-*i* MBAs is steeper than that for low-*i* MBAs.

References

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