A WIDE-FIELD SURVEY FOR SMALL MAIN-BELT ASTEROIDS IN HIGH INCLINATION. T. Terai and Y. Itoh[1], [1]Kobe University (terai@stu.kobe-u.ac.jp).

Introduction: The solar system is formed from the Sun's protoplanetary disk, composed of gas with dust. In the first stage of planet formation, the dust grows into a number of kilometer-size planetesimals. Then, they form Mars-size protoplanets in runaway growth [1]. In the process of planet formation, the disk gas acts as aerodynamical or gravitational drag force to objects, decaying object's orbits depending on their diameter. Thus the gas influence significantly to the formation and dynamical evolution of the planets. The observations of circumstellar disks show that the lifetime of disks is 10^6-10^7 years [2, 3]. It is certain that the gas survived until the formation of Jupiter and disappeared at the time of the formation of Uranus or Neptune, but it is unclear in which phase during these processes the gas dissipated. Our aim is to constrain the time of gas dissipation in the solar system. As an approach to this problem, we investigate the dynamical evolution of the main-belt asteroids (MBAs).

Target: The MBAs are fragments formed by collisional disruption among planetesimals. Most MBAs orbit along the ecliptic, i.e., with low inclination, named low-*i* MBAs. On the other hand, the number of high-inclination MBAs, named high-*i* MBAs, is very small. To form such high-*i* ones, strong dynamical excitation mechanisms are needed. It was proposed that the inclinations of MBAs are pumped up by gravitational perturbations from protoplanets and Jupiter [4, 5]. Almost all of the excited MBAs were eliminated from the main belt. The survivors remain as high-*i* MBAs.

Here, we assume the disk gas was still present in the above dynamical excitation stage. A smaller body than kilometer size is strongly affected from aerodynamical gas drag [6, 7]. It damps the inclination gradually. Thus the fraction of small bodies out of high-*i* MBAs should be fewer than that out of low-*i* ones. In the other words, the size distribution is different by their inclination. We can indicate that disk gas remained in the dynamical excitation stage of MBAs and affected their orbital evolution if we show the difference of population of small MBAs between high-*i* ones and low-*i* ones.

Strategy: We are performing a survey for MBAs. Our target is sub-km high-*i* ones whose size distribution is not clarified yet. The previous studies show the size distributions of whole sub-km MBAs, but they did not mention about high-*i* ones [8-10]. On the other hand, Spahr et al. (1996) searched high-*i* bodies in wide field, but they detected only 64 objects with diameter as large as 10 km [11]. Two features are strongly required for our survey. One is use of a large telescope enough to detect faint sub-km MBAs (>21 mag), and the other is massive amounts of data because high-*i* MBAs are very sparse relative to low-*i* ones. A deep and wide-field survey is essential to find a number of our target bodies.

Our survey has two advantages for such requirements. One is to focus the survey field on high ecliptic latitude regions where the probability of detecting high-*i* bodies is higher than low ecliptic latitude ones [12]. The other is that we use data obtained from the archive system of the Subaru Prime Focus Camera mounted on the 8.2m Subaru telescope. We can detect faint asteroids (~24 mag) in the wide field of view (34′×27′). Furthermore, we developed a new image processing method [13] which makes it possible to find asteroids using only two images per one field almost automatically.

To date, we have detected 269 MBA candidates in 8.2 square-degrees fields with the ecliptic latitude of 10°-34°. The detection limit of asteroids is 23.7 mag, corresponding to 0.7 km in diameter (assuming circular orbits and albedo of 0.09 [9]). The number ratios between sub-km MBAs and the larger MBAs are estimated in high-*i* MBAs (*i*>15°) and low-*i* ones (*i*<15°), respectively. It shows a tendency to the population of the small asteroids in high-*i* MBAs is fewer than low-*i* ones. If the difference is significant, it may intend that the orbital evolution of the MBAs occurred under the influence of gas drag.

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