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Subaru Main-Belt Asteroids Survey: SMBAS

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We are studying physical properties of Main-Belt Asteroids (MBAs) by using Subaru Telescope (SMBAS). SMBAS detected a large number of very small MBAs. The absolute magnitude range of the detected asteroids is $13.6<H<23.0$. It corresponds to the diameter range of $0.1\text{km}<D<9\text{km}$. Such small MBAs have been believed to be a source of Near-Earth Asteroids (NEAs) by dynamical studies. However, this has not been confirmed observationally yet.
The small MBAs from SMBAS have the same size-range as that of NEAs. Here, we examined whether MBAs detected by SMBAS are a possible source of NEA population in aspects of taxonomy and size distribution.
We found that the ratio of S- to C-type in the surface density of MBAs varies from 3:2 in the inner-belt, 3:7 in the middle-belt, to 1:4 in the outer-belt. Basically C-type asteroids dominated in the main-belt. We also found that the size distributions of the S- and C-type are similar each other at the faint end: $D < 1$ km. Their Cumulative Size Distribution slopes (b) (i.e. $N(>D) \propto D^{-b}$) were obtained as: $b = 1.3$, while the size distributions of larger MBAs ($D > 1$km) seem to be different: the bs were 1.8 of S-type and 1.3 of C-type. Considering a large fraction of S-type asteroids in the NEA population comparing with the MBA population, a main source of NEA population should be the inner-belt MBAs because of the large fraction of S-type asteroids there. However, there is an inconsistency on the size distributions between the NEAs and S-type MBAs in the inner-belt. There must thus be some selection mechanisms in the transportation process from the main-belt to near Earth region (e.g. Yarkovsky effect). Our data on small MBAs can be a base in the study on a quantitative evaluation of the dynamical evolution of NEAs.

References

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