

Automated Detection of Small Bodies by Space Based Observation

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The number of known comets and asteroids is increasing every year. Up till now this number is including approximately 250,000 of the largest minor planets, as they are usually referred. These discoveries are due to the Earth-based observation which has intensified over the previous decades. Additionally larger telescopes and arrays of telescopes are being used for exploring our Solar System. It is believed that all near-Earth and Main-Belt asteroids of diameters above 10 to 30 km have been discovered, leaving these groups of objects as observationally complete. However, the cataloguing of smaller bodies is incomplete as only a very small fraction of the expected number has been discovered. It is estimated that approximately 10^{10} main belt asteroids in the size range 1 m to 1 km are too faint to be observed using Earth-based telescopes. In order to observe these small bodies, space-based search must be initiated to remove atmospheric disturbances and to minimize the distance to the asteroids and thereby minimising the requirement for long camera integration times.

A new method of space-based detection of moving non-stellar objects is currently being developed utilising the Advanced Stellar Compass (ASC) built for spacecraft attitude determination by Ørsted, Danish Technical University. The ASC serves as a backbone technology in the project as it is capable of fully automated distinction of known and unknown celestial objects. By only processing objects of particular interest, i.e. moving objects, it will be possible to discover small bodies with a minimum of ground control, with the ultimate ambition of a fully automated space search probe.

Currently, the ASC is being mounted on the Flying Laptop satellite of the Institute of Space Systems, Universität Stuttgart. It will, after a launch into a low Earth polar orbit in 2008, test the detection method with the ASC equipment that already had significant in-flight experience. A future use of the ASC based automated detection of small bodies is currently on a preliminary stage and known as the Bering project – a deep space survey to the asteroid Main-Belt. With a successful detection method, the Bering mission is expected to discover approximately 6 new small objects per day and

will thus during the course of a few years discover 5,000-10,000 new sub-kilometer asteroids.

Discovery of new small bodies can: 1) Provide further links between groups of meteorites. 2) Constrain the cratering rate at planetary surfaces and thus allow significantly improved cratering ages for terrains on Mars and other planets. 3) Help determine processes that transfer small asteroids from orbits in the asteroid Main-Belt to the inner Solar System.