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System of Observation of Daytime Asteroids (SODA)

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ABSTRACT

Potentially hazardous decameter size asteroids are considered as the most actual source of impactors in the coming decades. That is why close approaches of asteroids larger than 10 m to the Earth, especially those coming from daytime sky, are subject to study. We think the only realistic way to detect daytime asteroids is to use a space telescope located relatively far from the Earth.
INASAN has developed a conceptual design of the SODA (System of Observation of Daytime Asteroids) space mission to operate at the vicinity of L1 point. The mission is to be capable to detect most of the 10 m class bodies coming from the day sky and to ensure a warning time of about 10 h in the case of possible impact. SODA can detect 2000 decameter asteroids per year coming into a 1 million km vicinity of the Earth. For 10 years of operation several possible small impactors will be detected by SODA.
We have presented the SODA Project the at PDC-2021. Here an updated concept of the SODA is described. The concept is considered as a part of the concept of the national project “Mlechny Put” (The Milky way).

A new design includes a full-rotative pre-aperture mirror which makes easier to blind scattered light from the Earth. Recent progress in manufacturing CMOS detectors with small pixels (3-5 um) makes it possible to essentially improve the angular resolution of 20-30 cm class wide field telescopes of the SODA Project. Potentially two-telescopes with full-rotative mirrors are as efficient as the previous three-telescopes. This approach also helps us to improve redundancy and simplify the payload layout.
We consider proposed by other groups two variants aimed to increase the warning time for daytime asteroids. The first variant is to put the SODA-like spacecraft at a Forced Stationary Point (FSP) beyond L1, say at 3 mln. km from the Earth. The SODA payload will be efficient at FSP, but the current technology of the solar sail and low-thrust ion engine does not allow to keep the spacecraft stable at FSP for 5-10 years. The second variant is to put the telescope on Earth-leading heliocentric orbit. We have demonstrated, that because of poor phase angles, even a 1 m class telescope on such an orbit will not be efficient for the detection of 10 m class day-time asteroids.
We suggest either a concept of small (~30 kg) and cheap SODA technological demonstrator. It can be an additional payload for other spacecraft at L1. The international collaboration is welcome as well as cooperation with other ground-based projects focused on the detection of decameter class NEOs in the Earth vicinity.

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