DETECTING EARTH'S TEMPORARY NATURAL SATELLITES
Planetary Science

Overview:

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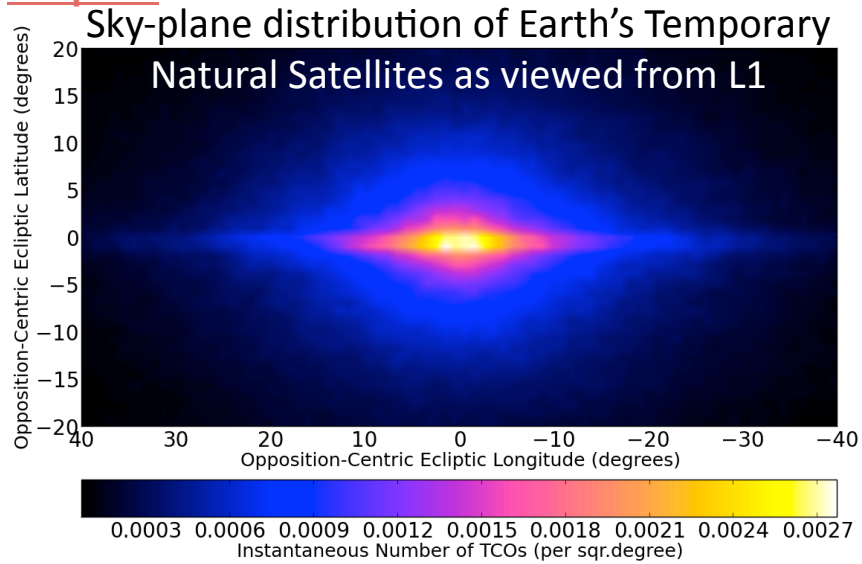
Goals:
Discover small temporary natural Earth satellites (~0.5 to 2 meters diameter) suitable for robotic or manned spacecraft retrieval missions.

Graphic:



Description:

Earth is surrounded by innumerable 'mini-moons', small temporarily captured natural objects (TCO). Our work indicates that the largest TCOs in the steady state population are 1 to 2 meters in diameter, sizable enough to be both scientifically interesting and potentially suitable as destinations for human and robotic missions. The population of Temporarily Captured Fly-bys (TCF) might be 10x greater with the largest object at any time being 5 to 10 meters in diameter. We propose an optical survey of the region within about 4-5 lunar distances of Earth to detect the largest members of the TCO and TCF populations using the Large Space Optics (LSO) system at the Earth-Sun L1 point. The population of about a dozen TCOs larger than 0.5m diameter, and 10x that number of TCFs, are extremely low delta-V targets for robotic spacecraft. We envision a robotic or even a human mission(s) that could retrieve an entire object and return it to the space station or Earth. In this manner, they could provide NASA with a viable, practical, and cost-effective stepping-stone capable of testing the technology required for manned missions to larger asteroids on heliocentric orbits.

Value to NASA:

The proposed mission concept will uncover and study a new population of asteroids for which only a single prototype object has ever been discovered. In doing so it will provide 1) ultra low delta-V asteroid targets on *geocentric* orbits for robotic and manned spacecraft missions 2) low delta-V asteroid targets on *heliocentric* orbits for robotic and manned spacecraft missions 3) measure the orbit distribution of small asteroids to derive a better estimate of their Earth impact risk and 4) be a prototype system for a future space-based early impact warning system.