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**AN ASSESSMENT OF CURRENT AND PROPOSED ALTERNATIVES
FOR DETECTING SMALL NEAR EARTH OBJECTS (NEO)**

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ABSTRACT

Ever since the February 2013 Chelyabinsk airburst incident, there is increasing awareness of the potential threat from smaller – 30-50 m diameter – Near Earth Objects (NEO). While NEOs of this size would not cause damage on a global scale, the energy release from their impact—comparable to that of a thermonuclear weapon—would be capable of causing considerable local damage. In this paper, we present the results of an assessment of our ability to detect and track smaller NEOs.

Each of the current and future proposed ground based telescopes is discussed with the conclusion that the inherent limitations of ground-based systems would affect their ability to identify and track small NEOs at a reasonable rate, and that a space-based infrared detector is likely the most effective method for locating NEOs on a timescale of less than a decade.

Two proposed space-based infrared detection alternatives to detect NEOs are then compared and contrasted. Assuming each spacecraft is completed as planned, and operates without unanticipated failures, the primary difference between the two proposed missions relates to their telescopes' orbital locations. Survey completion simulations by the second team suggest that the Venus-trailing orbit will enable faster discovery of NEOs, especially those with slow velocity relative to Earth. The first team's simulations show that both surveys would perform approximately equally.

Although both telescopes would use next-generation HgCdTe detectors, one would use a detector designed for low-background, low-noise applications that is currently operating on board the Hubble telescope, NEOWISE, and most ground-based astronomical telescopes. The other would use a design that has been used for several high-background, high-noise space- and ground-based applications, and is routinely used for 10 micrometer readouts. The first team has developed and tested its first

batch of detectors, and the second has completed a prototype which needs further development.

Due to their respective orbits, the second team's detector would require a cryocooler in addition to passive cooling, whereas the first team's would likely be able to rely completely on passive cooling. Both detectors' cooling techniques have identified advantages and disadvantages, which can be overcome with appropriate design. The location of second also requires significant onboard processing that has not been tested on NASA's space missions.

As currently estimated, the second option is about 40% less expensive than the first one, and expects to raise funds from private donors. The first would seek funding from the NASA Discovery program. Given the science-oriented goals of the highly competitive NASA Discovery program that runs only once every 5 years, it may not get selected. Likewise, the foundation proposing the second option may not be able to raise the funds it needs from private donors.

In the judgment of the research team, the first alternative offers lower technical risk at higher cost, and the second offers lower cost for potentially faster detection and a more innovative—though riskier—architecture, and neither seems well-positioned to be launched as planned given current funding status.