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THE NEAR-EARTH OBJECT CAMERA: OVERVIEW

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ABSTRACT

The most critical questions about NEOs are when is the next impact likely to occur and how bad will it be? To answer the former, we must discover NEOs in large numbers and measure their orbits with sufficient precision to understand their impact probability on timescales of the order of a century or two. The answer to the latter question depends largely on kinetic energy, which scales as mass x velocity^2, or as diameter^3 x density x velocity^2. At present, most survey telescopes focus on discovery of NEOs and refinement of their orbits in an effort to address the first question, but in terms of the second question, they are generally unable to provide information beyond velocity and absolute visible magnitude. NEOs have a wide range of albedos, and thus converting absolute magnitude to diameter leads to considerable uncertainty regarding impact energy for most objects. Characterization efforts are currently restricted to a much smaller number of objects (~10% of known

NEOs have been spectrally characterized; Binzel et al. 2019). In most cases, NEOs are brightest at the epoch of discovery, often complicating future efforts at characterization.

The Near-Earth Object Camera (NEOCam) is a space mission designed to address both of these critical questions by finding, tracking, and characterizing the majority of NEOs large enough to cause severe regional damage, and large numbers of smaller objects. By operating at the wavelengths at which NEOs are brightest, and by executing a survey cadence designed for self-follow up of NEOs, NEOCam is optimized for the discovery and study of potentially hazardous objects. Because NEOs emit most of their energy in thermal infrared wavelengths, the NEOCam design employs two mid-infrared channels (4-5.2 and 6-10 microns) with a 50-cm telescope to maximize sensitivity and to provide robust measurements of physical properties such as effective spherical diameter.

NEOCam complements existing and future ground-based surveys operating at visible wavelengths. By operating at mid-infrared wavelengths, NEOCam is sensitive to both high and low albedo objects, the latter of which are more difficult for visible surveys to detect. While diameters can be derived using only thermal infrared measurements, the combination of visible and thermal measurements allows for determination of albedo, which correlates loosely with composition and in turn density. Moreover, ground- and space-based surveys observe complementary regions of the volume of space around Earth’s orbit, resulting in the best possible chance of meeting the Congressional goal of achieving 90% survey completeness for NEOs larger than 140 m within approximately a decade of survey operations (Stokes et al. 2017).

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