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Building the Reference Small Body Population Model

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ABSTRACT

An accurate population model of small Solar System objects is required to measure the performance of any observational survey, and it is essential to make consistent comparisons of the survey performance as engineering trades and component tests are conducted. With these goals, the Reference Small Body Population Model

(RSBPM) is currently under development by the Near-Earth Object Surveyor (NEO Surveyor) team. The RSBPM will contain up-to-date information on the orbital elements, diameter- and albedo distributions of most small Solar System objects including comet populations. Because the RSBPM is a diameter-based model, both optical and infrared surveys can be compared on a consistent basis. Development of the RSBPM will be completed before the NEO Surveyor launch, and the finished product will be peer-reviewed to ensure accuracy and made publicly available. Here we will present the expected NEO and main belt asteroid (MBA) detection rates calculated using our NEO Surveyor simulator and the preliminary NEO and MBA RSBPM models.

The RSBPM contains a diameter-debiased NEO model based on the orbital and H distributions from [1] combined with diameter and albedo information from NEOWISE [2][3][4]. It will include a carefully debiased small end of the SFD distribution expected to be non-linear in the log-diameter space. A preliminary version of the RSBPM NEO model with objects larger than 140 m [2] is being currently tested in the NEO Surveyor Simulator. Our simulations show (Fig.1) that NEO Surveyor would reach ~83% and ~92% PHA (Potentially Hazardous Asteroid) completeness after 5 and 10 years of survey respectively, assuming a ~42% PHA completeness reached by the ground-based optical surveys at the start of in-flight operations.

In addition to NEOs, which are the main focus of the NEO Surveyor, the RSBPM also includes MBAs. MBAs are of particular importance to modeling the survey performance because they outnumber the NEOs by orders of magnitude and can thus serve as a source of false linkages between real NEO detections. A preliminary version of the RSBPM MBA model contains ~13 million MBAs with H-distribution from [5], and albedo, and beaming parameter distribution fits from [6][7], which were used to calculate the diameters. The future versions of model will also include 15 of the largest MBA families.

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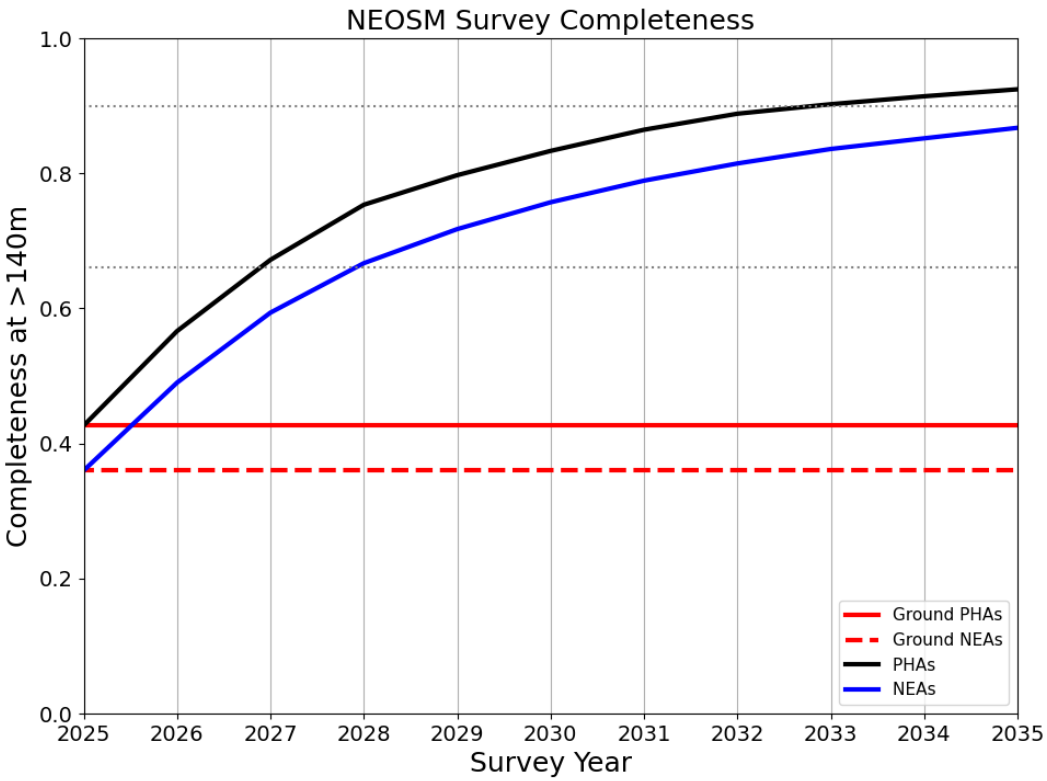

Figure 1: PHA and NEO survey completeness (i.e. the percentage of objects discovered in each population) as a function of NEO Surveyor survey time compared to completeness reached using ground assets only (excluding the LSST).

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