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Target-of-Opportunity Characterization of Sub-200 meter Near-Earth Asteroids

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ABSTRACT

Assessing the threat from the near-Earth asteroid (NEA) population requires an understanding of the population itself, as well as the dynamics and mechanisms of collisional evolution of small body systems. Knowledge of the latter can be gained by studies of both Main Belt and near-Earth asteroids and the larger members of these populations have been examined for decades. However, the role smaller objects play in the asteroid threat has been demonstrated by the Carancas cratering impact in 2007, the airburst of 2008 TC_3 in the Sudan, and of course, the Tunguska airburst in Siberia in 1908, all of which fortunately hit in less populated regions. Although these sub-200 meter objects do not fit into the 'planet killer' category, they do have the potential to cause significant local damage. If there is any lingering doubt regarding the danger posed by smaller objects, the airburst event on February 15, 2013 in Chelyabinsk, Russia should have put that to rest. Furthermore, the fact that, aside from Tunguska, all of these incidents occurred in the last decade demonstrates that the frequency of these events make them very real threats.

Robust characterization of sub-200 meter objects is usually limited to when these asteroids make close approaches to the Earth. Characterization studies that determine physical properties such as spin rates and orientations, shapes, material type and internal structure/strength are important for properly addressing and mitigating any potential risk from these objects. The observing window for these studies is usually weeks, days, or, for the smallest members of this population, just a single day or two bracketing their closest approach to Earth. For many, the only optimal occasions for study that present themselves for the foreseeable future occur as soon after discovery as possible. Therefore, these are truly targets-of-opportunity.

As part of an effort to obtain astrometric data on newly discovered near-Earth asteroids using the Magdalena Ridge Observatory's (MRO) 2.4-meter telescope, a

program has also been implemented to obtain physical characterization information on the smallest objects in the asteroid population. Here, we quantify the observing window that exists for various objects in this size regime using this facility. We then present example spectral and lightcurve data of objects obtained near their discovery timeframe demonstrating how target-of-opportunity strategies are critical to obtaining characterization data on sub-200 meter asteroids.