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POTENTIALLY HAZARDOUS ASTEROIDS AND TUNGUSKA-SIZED OBJECTS IN THE TAURID RESONANT SWARM

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The Taurid Complex is a large interplanetary system that contains comet 2P/Encke, several meteoroid streams, and possibly a number of near-Earth asteroids [1]. The size and nature of the system have led to the speculation that it was formed through a large-scale cometary breakup [2]. Numerical investigations and meteor observations have suggested that planetary dynamics can create a resonant region with a large number of objects concentrated in a small segment of the orbit, known as the Taurid swarm, which approaches the Earth in certain years and provides favorable conditions to study the Taurid Complex [3,4,5].

Here we report a dedicated telescopic search for potentially hazardous asteroids and other macroscopic objects in the Taurid swarm using the 1.2-m Palomar Schmidt telescope as part of the Zwicky Transient Facility survey [6]. Observations were made on October 29 and 31, 2022, when the Earth passed close to the center of the Taurid swarm. We imaged an on-sky area of 1550 square degrees covering 99% of 100-m-class swarm objects. Two sets of moving object detection software were used to search for swarm objects, one specialized in detecting fast-moving, trailed objects and the other focused on point-source objects [7,8], with no swarm objects found. We determine from our non-detection that there are no more than 9-14 H<24 (equivalent to a diameter of D≳100 m) objects in the swarm, suggesting that the Encke-Taurid progenitor was ~10 km in size. A progenitor of such a size is compatible with the prediction of state-of-the-art Solar System dynamical models, which expect ~0.1 D>10 km objects on Encke-like orbits at any given time. We will also discuss the implications of our results for the existence of smaller, Tunguska-sized objects in the swarm, also discussed by Boslough et al. at this conference [9].

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