Orbit Determination and Projection of Potentially Hazardous Asteroid 12538 (1998 OH)

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The orbit determination and projection of potentially hazardous asteroids (PHAs) are crucial, as these bodies present a danger to Earth and spacecraft. The goal of this study was to determine the six classical orbital elements of PHA 12538 (1998 OH) and develop a novel program specified to project a given PHA's trajectory over millions of years. I obtained raw images concerning 1998 OH from the Etscorn Observatory in New Mexico on June 19, June 23, and July 10 of 2019. Through the Python programming language, I reduced the images and performed the Method of Gauss on the data to calculate the orbital elements of 1998 OH; uncertainty were propagated through the Monte Carlo method. My calculated orbital elements were consistent with the elements published by the Jet Propulsion Laboratory (JPL), and will serve to further constrain the literature values. In my asteroid trajectory program, I used Wisdom-Holman integration and the regularized mixed variable symplectic (RMVS) method to create 65 test particles simulating the orbit of 1998 OH over 12 million years. Due to the test particles' interactions with various planetary bodies, the majority of the particles (47.7%) collided with the sun. As PHAs present a threat to Earth and spacecraft, it is vital to frequently update our understanding of these objects. There is a lack of publicly available resources to study the current and future states of asteroids; the programs I developed are user-friendly and generalized to study any known near-Earth asteroid.

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