

NAROO Program – Preccovery observations of Potentially Hazardous Asteroids

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Abstract. Potentially Hazardous Asteroids (PHAs) are small bodies making very close encounters with the Earth. PHAs are a real danger and depending on their size, an impact may have catastrophic consequences. The knowledge of their dynamics is essential for the purpose of an international program of planetary defense. Thus, accurate astrometric measurements acquired over a large time span are important to provide reliable orbits and impact probability, which often need to take into account accelerations such as Yarkovsky effect. Photographic plates made during the 19th and 20th century consist of a substantial source of old observations of Solar System objects. From existing databases, we have identified preccovery observations of PHAs: i.e. fortuitous observations made before its discovery. We used the NAROO machine [1] to digitize the plates and realized the astrometric reduction with Gaia eDR3 reference star catalog. Metadata have been verified and corrected through the measurement of the position of Main Belt Asteroids in the field of view. We added the results to observation dataset of PHAs to define new orbital solutions and detect Yarkovsky effect with the NIMA software [2]. It shows an improvement of the accuracy of their new ephemeris depending on the asteroid. Our analysis demonstrates the interest of using preccovery observations from photographic plates. It allows us to better assess the risk and impact probability of PHAs in the context of Planetary Defense or Space Situational Awareness.

Keywords: Potentially Hazardous Asteroids, Photographic Plates, Astrometry, Orbital Solutions, Ephemerides.

References

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2. Desmars, J. 2015, A&A, 575, A53