PDC2023
Vienna, Austria

Near-Earth Object (NEO) Discovery

The two timing campaigns of the International Asteroid Warning Network

Davide Farnocchia[1], Vishnu Reddy[2], James M. Bauer[3], Elizabeth M. Warner[3], Marco Micheli[4], Matthew J. Payne[5], Tony Farnham[3], Michael S. Kelley[6]

[1] *Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, USA, Davide.Farnocchia@jpl.nasa.gov*
[2] *Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721, USA*
[3] *University of Maryland, College Park, MD 20742, USA*
[4] *ESA NEO Coordination Centre, I-00044 Frascati (RM), Italy*
[5] *Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138, USA*
[6] *Planetary Defense Coordination Office, Planetary Science Division, NASA Headquarters, Washington, DC 20546, USA*

Keywords: *Near-Earth objects; Optical telescopes; Astrometry*

ABSTRACT

Asteroid discovery, tracking, orbit determination, impact predictions crucially depend on astrometric observations from ground-based and space-based sensors. Over the last few years, significant engineering and star catalog (e.g., Gaia) improvements have enabled greater accuracy for asteroid astrometry. As a result, the accuracy of the reported time of observation becomes increasingly important, especially for asteroids observed when passing close to the Earth and moving rapidly across the sky in the sky. Therefore, as part of the International Asteroid Warning Network's (IAWN) observational exercises, we conducted two campaigns with the goal of characterizing errors in the observation times reported to the Minor Planet Center. We targeted near-Earth asteroids 2019 XS and 2005 LW3 during their close approaches to Earth on 2021 November 9 and 2022 November 23, respectively, when their high plane-of-sky rate of motion of a couple arcsec/s provided the needed resolution to detect timing errors. The campaigns saw broad participation by the observing community with global geographical coverage. Most observations were reported using the new Astrometric Data Exchange Standard (ADES) format, which allows the reporting of estimated uncertainties together with measured positions. We analyzed the observation residuals against the best-fit orbits. In particular, we estimated timing errors from the along-track residuals and also compared the observer-provided position uncertainty with the cross-track residuals, which are independent of timing errors. We compiled individual reports for each observer to help identify and remove the root cause of any possible timing error and improve the uncertainty quantification process. We suggested possible sources of timing errors, actions to improve the timing accuracy, and derived a simple procedure to determine reliable, conservative positional uncertainties. Comparing the results of the two campaigns allows us to assess the timing accuracy progress made by the observing community.

Acknowledgements: Part of this research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration (80NM0018D0004), and at the University of Maryland under a cooperative agreement with NASA (80NSSC22M0024).
****

Comments:

NEO Characterization could work too, Oral presentation