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[x] Near-Earth Object (NEO) Discovery

Near Earth Objects in the recent Isolated Tracklet File

Robert Weryk[(1)]**, Peter Veres**[(2)]**, and Richard Wainscoat**[(3)]
[(1)]*Physics and Astronomy, The University of Western Ontario*
1151 Richmond Street, London ON N6A 3K7, Canada
[(2)]*Minor Planet Center, Harvard-Smithsonian Center for Astrophysics*
60 Garden Street, Cambridge MA 02138, USA
[(3)]*Institute for Astronomy, University of Hawaii*
2680 Woodlawn Drive, Honolulu HI 96822, USA

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ABSTRACT

Numerous observational surveys are tasked with finding new Near Earth Objects (NEOs). Candidate detections are formed into “tracklets” and ranked based on a “digest” score, a quantitative estimate of how interesting an object is, and this score must be >65 to be considered for posting on the Confirmation Page (NEOCP) at the Minor Planet Center (MPC). Objects on the NEOCP which do not receive sufficient follow-up, or those that did not score high enough to post and could not be linked to an already known object, are relegated to the the Isolated Tracklet File (ITF), a rich repository of orphan astrometry. As of December 2022, the ITF contains 3.0 M (million) unique object names with 11.3 M detections, mostly from Pan-STARRS (6.5 M) and the Catalina Sky Survey (2.3 M).

Linking ITF objects allows for their identification/attribution in future data to be handled automatically without review, but even now with 1.26 M total known objects, linking what remains in the ITF is still a challenge. While some objects may eventually reach higher score and post to the NEOCP after being observed by a survey telescope, linking them sooner allows valuable follow-up effort to be better spent elsewhere.

We have previously reported[1] on our efforts to develop an automated pipeline to search the recent ITF for lower scoring NEOs, as this can still allow for follow-up if additional confirmation is required. Improvements since that earlier work includes tuning our processing and splitting it two components: objects with higher (10+) and lower (0-9) scores. This allows lower latency reporting of objects which may soon post to the NEOCP, and expands the total tracklet count that we consider to allow arc extensions for main belt objects. Improvements at the MPC to the ID-pipeline (which processes linkage submissions) has made the entire process easy, although while our linking is automatic, the reporting of NEO candidates to the ID-pipeline and their subsequent designation is currently performed manually to allow for additional unreported data to be found in archival image searches.

We successfully linked observations of Apophis during its Planetary Defense Campaign[2] flyby, and have found more than 50 new NEOs from our efforts to date. Notable objects linked include 2019 GO146, a 1.4 km NEO, and 2021 AF8, a PHA. An important question to ask for any linking algorithm is what types of orbits is our search sensitive to, especially for hypothetical impactor objects such as 2023 PDC and those from past PDC exercises? We investigate this and present a summary of new NEOs found so far.

[1] Weryk, Wainscoat, Veres. 2021 PDC.
[2] Reddy et al., 2022, PSJ, 3, 123.

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Comments:

Prefer an oral talk.