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Advancements in NEO Discovery

Near-Earth Objects in the Isolated Tracklet File

Robert Weryk^{a,1,*}, Richard Wainscoat^{a,2}, Gareth Williams^{b,3}

^a*University of Hawaii, 2680 Woodlawn Drive, Honolulu HI 96822, USA*

^b*Harvard Smithsonian Center for Astrophysics, 60 Garden St MS-18, Cambridge MA 02138, USA*

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Survey telescopes, such as Pan-STARRS1 and the Catalina Sky Survey, are dependent on the follow-up capabilities of the community. However, not every detected asteroid is immediately re-observed or identified, causing many to be relegated to the Isolated Tracklet File (ITF) – a rich, always growing repository of 15+ million unlinked detections maintained by the Minor Planet Center (MPC).

While many of these asteroids may have in-fact been observed sufficiently over longer timescales, the linking of their astrometry (resulting in an official designation) can pose a challenge. We have developed a search method capable of linking astrometry over many lunations and associating it with already existing designations. Our method compares tracklets having similar motion but which may be offset a large distance from their predicted positions. Optimisations are made to reduce comparisons of tracklets which are clearly not related, and suspected linkages are further tested by searching for additional astrometry over multiple oppositions.

While we have previously reported linkages for ~180 000 main-belt and Hungaria objects [1, 2], our focus here is to determine whether unknown Near Earth Objects (NEOs) are present in the ITF in large number. These may be due to either a lack of follow-up of known candidates, or their having low “digest” score – a estimate that a given object is an NEO based on whether it shows unusual motion. This score (0 to 100) determines if a candidate asteroid is posted to the NEO Confirmation page, and must be at least 65. Pre-discovery observations of NEOs are often found to have lower score, suggesting a population of “hidden” NEOs should exist. We stress that while our search process is mostly automated, finding NEOs in the ITF is more difficult than identifying the more mundane asteroids, and therefore requires manual confirmation. As well, we suspect there may be many “sporadic” tracklets, where an asteroid may have been observed only once per opposition, making linkage identifications more difficult.

Our goal is to reduce the size of the ITF in order to improve the efficiency of survey operations, as known asteroids may then be batch submitted without review, and can be identified before being posted to the NEO Confirmation Page, saving valuable follow-up time better spent on the true new NEO candidates. This is especially important given that Pan-STARRS2 is now online, which is producing many more NEO candidates in need of their own follow-up confirmation.

*Corresponding author

Email addresses: weryk@hawaii.edu (Robert Weryk), rjw@hawaii.edu (Richard Wainscoat), gwilliams@cfa.harvard.edu (Gareth Williams)

¹Planetary Defense Researcher, Institute for Astronomy

²Faculty, Institute for Astronomy

³Associate Director, Minor Planet Center

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