ESA NEOCC effort to eliminate high Palermo Scale virtual impactors

M. Micheli[1,2], D. Koschny[1], O. Hainaut[3], and F. Bernardi[4]

[1]ESA NEO Coordination Centre
[2]Serco S.p.A.
[3]European Southern Observatory
[4]SpaceDyS S.r.l.

At the moment of this writing about 4 % of the known near-Earth objects are known to have at least one future close approach scenario with a non-negligible collision probability within the next century, as routinely computed by the NEODyS and Sentry systems. The most straightforward way to improve the knowledge of the future dynamics of an NEO in order to exclude (or possibly confirm) some of these possible future impact is to obtain additional astrometric observations of the object as soon as it becomes observable again. In particular, since a large fraction (>98 %) of the known objects currently recognized as possible future impactors have been observed during a single opposition, this usually corresponds to obtaining a new set of observations during a second opposition, a so called "recovery". However, in some cases the future observability windows for the target after the discovery apparition may be very limited, either because the object is intrinsically small (and therefore requires a very close and consequently rare approach to become observable) or because its orbital dynamic prevents the observability from the ground for a long timespan (as in the case of quasi-resonant objects with a long synodic period). When this happens, the only short-term way to clarify an impact scenario is to look toward the past, and investigate the possibility that unrecognized detections of the object are already present in the databases of old astronomical images, which are often archived by professional telescopes and made available to the community a few months to years after they are exposed.

We will here present an effort lead by the newly formed ESA NEO Coordination Centre (NEOCC) in Frascati to pursue both these avenues with the intent of improving the orbital knowledge of the highest-rated possible impactors, as defined by the Palermo Technical Impact Hazard Scale (PS in the following).

As an example of our ongoing observational activities, we will first present our recovery observations of a few very faint high-PS objects, and the follow-up observations of recently discovered objects during the outgoing phase of their apparition, down to magnitude 25 or so. Most of these observations were obtained within an accepted DDT proposal of an ESA/ESO team, which gives us access on short notice to the observational capabilities of the 8.2 meter Very Large Telescope at Cerro Paranal, Chile. The instrument has been used to successfully detect targets fainter than $V = 25$, and provide high-accuracy astrometry which in most cases has been sufficient to remove the impact solutions from the allowed future dynamics of the object. As a main focus of our activities at the ESA NEOCC we are also actively soliciting observations of NEOs by other worldwide observers which are known to have access to the most appropriate facilities for each target (in terms of telescope aperture, camera FoV and/or geographic location). We will also quickly summarize the results of some of these activities.

In the second part of this contribution, we will present the result of a focused precovery effort by our team, which led to the identification, measurement and submission of previously unrecognized archival detections of possible impactors, most of which scored particularly high in the PS ranking, but would nevertheless have been unobservable for the imminent future. We will discuss a couple of interesting cases which could be entirely excluded as a risk thanks to the addition of faint detections we located in data from the Canada-France-Hawaii Telescope (CFHT), and an interesting case of a "chain of precoveries" where a first short-arc precovery allowed for the identification of additional observations obtained more than a decade earlier, which in turn lead to the elimination of the impact risk from that object. We will also discuss how a real time access to the data of current surveys like Pan-STARRS can allow almost immediate precovery observations of recently discovered possible impactors, allowing to clarify the impact probability within days from the discovery, and thus saving most of the observational effort often necessary to provide adequate follow-up to recent discoveries.

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