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An efficient algorithm for prioritizing NEA physical observations

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Abstract

The present NEA discovery rate has overcome 1500 objects per year thus calling for extensive observation campaigns devoted to physical characterization. A tool is presented which, through a prioritization algorithm, aims to optimize the planning and the execution of NEA physical observations.

1. Introduction

The problem of efficiently planning and executing NEO follow-up observations has been originally addressed by the Spaceguard Central Node to ensure that the highest possible percentage of these objects, and in particular the newly discovered ones, is recovered at other apparitions. Therefore a prioritization algorithm, which ranks the observable objects according to an urgency criterion, was developed [1]; since more than 10 years it produces a list of targets needing astrometric observations ranked in term of urgency. These lists are publicly available at the Spaceguard Central Node and at the ESA NEO Coordination Centre web sites. In the present work a similar approach has been followed for addressing the prioritization of NEA physical observations.

2. Prioritization algorithm

The prioritization algorithm has been substantially revised in order to account for the technical requirements of the NEOShield-2 project [2] (recently approved by the European Commission in the framework of the Horizon 2020 programme), i.e. increase the number of NEAs for which physical characterization is available by focusing on objects in the 50-300 m size range and which are potentially accessible for a space mission.

Various parameters have been taken into account: the sky uncertainty, the visibility period, the phase range, an estimate of the object apparent motion and of its accessibility (provided by a best-case transfer strategy). Two ranking criteria are introduced, "urgency" and "importance", which correspond to different observing scenarios. The former is a function of the number of visibility days and of the magnitude trend and applies especially for newly discovered objects at risk of being again observable only after a long time span, thus calling for rapid response times. The latter is a function of the object size and accessibility, providing the rationale for planning large observing programs.

3. Figures

The dimension function (DIM) used in the "importance" ranking computation is modeled as shown in Figure 1. It is closely related to the absolute magnitude of the object [3].

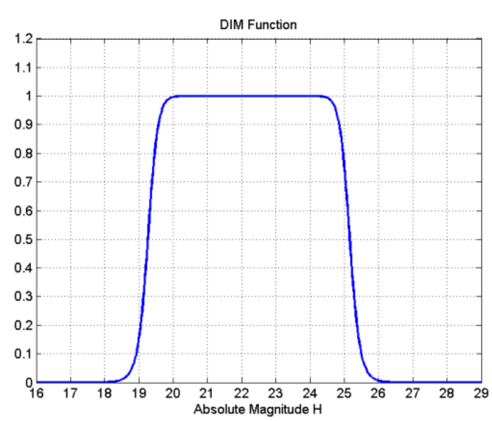

Figure 1: DIM function used in the "importance" ranking computation.

6. Summary and Conclusions

The prioritization of NEA follow-up observations has been extended to physical characterization. The resulting tool will generate a daily table of observable targets and it can be also run as a stand-alone tool in order to provide future observing opportunities at a specific date of interest. It is planned to make these data publicly available through the NEOShield-2 web site.

References

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[3] Chesley S.R., Chodas P.W., Milani A, Valsecchi G.B., and Yeomans D.K.: Quantifying the Risk Posed by Potential Earth Impacts, Icarus, Vol. 159, pp. 423-432, 2002.