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Title: *"Short arc orbit determination and imminent impactors in the Gaia era"*

Abstract. The need of an automated system for the prediction of short-term impacts became evident after two important events: the Chelyabinsk meteor and the impact of the asteroid 2014AA on the Earth, only 21 hours after its discovery. In this field, short-arc orbit determination techniques are crucial. Even if the observations are too few to obtain an orbit, the attributable can be computed. It contains information about the sky position and motion, but it leaves unknown the topocentric distance and the radial velocity. The systematic ranging explores a raster in the topocentric range and range-rate space, and allows us to identify the regions filled with impact solutions. If a reliable nominal solutions does not exist, we make use of a two-step systematic ranging to scan the Admissible Region (AR), selecting the density and the kind of sampling (uniform in the range or in its logarithm) on the basis of the number of connected components of the AR and of the extension of the first component (if it is the only one). On the other hand, if a reliable nominal orbit exists, the use of the grid is no longer necessary: we compute a spider web sampling in a neighborhood of the nominal solution, following the level curves of the target function.

In both cases, we then compute a sampling of the Manifold of Variations, a 2-dimensional manifold parametrized on a subset of the AR, using an iterative procedure, namely the doubly constrained differential corrections. Moreover, we start from the hypothesis of a Guassian density on the residuals space, and we pull it back to the sampling space. We do not consider any other a priori assumption, such as a population model. In this way, we are able to compute the impact probability for possibly impacting objects, and to assign to each one of them a score, representing the probability for it to be a Near-Earth, a Main Belt or a distant object.

We set up an automated system for the scanning of the NEOCP and the computation of the risk assessment of recently detected objects. Such a fast-response system (i.e. within few minutes from the release of new observations) is important not to loose interesting objects before their uncertainty grows too much, and hence it will help in the follow-up activities.

Joint work with F. Spoto, A. Milani, G. Tommei, P. Tanga, F. Mignard.