

Collision probability for Earth-crossing asteroids

Karri Muinonen¹, Jenni Virtanen¹, Edward Bowell²

¹*Observatory, University of Helsinki,
Kopernikussentie 1 (P.O. Box 14), FIN-00014 U. Helsinki, Finland. E-mail: Karri.Muinonen@Helsinki.Fi*

²*Lowell Observatory,
1400 West Mars Hill Road, Flagstaff, Arizona 86001, U.S.A. E-mail: ebowell@lowell.edu*

We introduce techniques to compute the collision probability for Earth-crossing asteroids in the case of short observational arcs and/or small numbers of astrometric observations. The techniques are based on initial statistical ranging of complicated Bayesian a posteriori probability densities of orbital elements. Before collision analysis, with the help of the ranging technique, we assess the systematic errors in the astrometric observations: computing a large number of Monte Carlo sample orbits allows a self-consistent estimation of both systematic and random observational errors. The techniques are applied to the lost asteroid 1998 OX₄ with non-vanishing collision probability in 2038, 2044, and 2046. In particular, we study the effects of systematic errors on the orbit determination, ephemeris prediction, and collision probability computation. Finally, we review recent overall progress in the computation of collision probabilities.