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NEAR EARTH ASTEROIDS ASTROMETRY WITH GAIA

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Potentially Hazardous Asteroids (PHAs) are Near Earth Asteroids caraterised by a Minimum Orbital Intersection Distance (MOID) with Earth less to 0,05 A.U and an absolute magnitude H<22. Those objects have sometimes a so significant close approach with Earth that they can be put on a chaotic orbit. This kind of orbit is very sensitive for exemple to the initial conditions, to the planetary theory used (for instance JPL's model versus IMCCE's model) or even to the numerical integrator used (Lie Series, Bulirsch-Stoer or Radau). New observations (optical, radar, fly-by or satellite mission) can improve those orbits and reduce the uncertainties on the Keplerian elements.

The Gaia mission is an astrometric mission that will be launched in 2012 and will observe a large number of Solar System Objects down to magnitude V≤20. The Solar System science mission is to map thousands of MBA, NEO (including comets) and also planetary satellites with the principal purpose of orbital determination (better than 5 mas astrometric precision), determination of asteroid mass, spin properties, and taxonomy. Besides Gaia will be able to discover new objects, in particular Near Earth Objects (NEOs) in the region below solar elongation of 90º, which are harder to detect with current ground-based surveys.

During the 5-year mission, Gaia will continuously scan the sky with a specific strategy: objects will be observed from two lines of sight separated with a constant basic angle. Five constants already fixed determinate the nominal scanning law of Gaia: The inertial spin rate (1°/min) that describe the rotation of the spacecraft around an axis perpendicular to those of the two fields of view, the solar-aspect angle (45°) that is the angle between the Sun and the spacecraft rotation axis, the precession-period (63.12 days) which is the precession of the spin axis around the Sun-Earth direction. Two other constants are still free parameters: the initial spin phase, and the initial precession angle that will be fixed at the start of the nominal science operations. These latter are constraint by scientific outcome (possibility of performing test of fundamental physics) together with operational requirements (downlink to Earth windows).

Several sets of observations of specific NEOs will hence be provided according to the initial precession angle. The purpose is to study the statistical impact of the initial precession angle on the error propagation and on the collision probability, especially for PHAs. We will also analyse the advantage of combining space-based to ground-based observation over long term, as well as in short term from observations in alert.