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FORTHCOMING GAIA OBSERVATIONS OF THE EARTH DYNAMICAL ENVIRONMENT

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ABSTRACT

The Gaia mission by ESA is a global sky survey for astrometric and spectroscopic characterization of the galaxy, which will start operations by end 2013. Gaia is expected to observe all sources brighter than magnitude V~20, including Solar System objects (Hestroffer et al. 2010), with unprecedented astrometric accuracy. If the proper motion is low, a single-epoch position accuracy of about 1 mas at V=20, and 0.02 mas at V=12, can be reached with the end-of-mission calibration.
A typical Main Belt asteroid will be observed about 70 times on average during the mission. Degradations of the performance are expected for fast-moving objects, such as potentially hazardous Near-Earth Asteroids, however the quality will still be much better than the one usually reachable from the ground (Tanga and Mignard, 2012).
The number of observations will be smaller on average for NEAs, depending on the geometry, but small solar elongations down to 45° will be reached (Mignard et al. 2002).
Solar System objects will be processed by a specific pipeline capable of dealing with their peculiar properties, especially their high apparent speeds. Additionally, the pipeline will produce output quantities that are specific to this category of celestial objects. All the dedicated software is implemented in an architecture provided by the related Data Processing Centre (the CNES in Toulouse, France in this case), and

written by the planetology community of the DPAC (Data Processing and Analysis Consortium).
Two “daily processing” will operate on the shortest possible time scale, i.e. as soon as new data will become available. In practice, data sets are made available daily, so this pipeline will run once per day. It will essentially operate on the most recent observations in a ~48 hours window, meaning that a typical object will have 1 to 4 transits in the focal plane, resulting in different positions on the several CCDs. The aim of the daily processing chain is the identification of peculiar asteroids – i.e. objects that are not known, or whose orbits are poorly constrained, NEAs in particular.
Gaia will also obtain low-resolution spectra in the visible domain for each observed NEA (Delbo et al. 2012). Reflectance spectra won’t be available on an alert basis, since they require a full calibration that will be performed on longer time scales only. However, this will be a very relevant source of information on the composition of NEAs.
Photometry in the Gaia “G band” (corresponding to the integrated unfiltered visual spectrum) will be useful to assess rotation periods and shape information.
We review the properties of the mission, its performance specifically on NEAs, illustrating the properties of the data that will be available both on an alert mode, and on a longer term with better calibration.
Eventually, we mention the undergoing parallel actions for supporting the contribution of Gaia to asteroid studies, which are being organized. Also, the issue of organizing the access to the huge amount of asteroid data coming from large surveys will be addressed.

References

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