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Using Gaia DR2 asteroid data: recommendations and example applications

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Abstract

We present the main properties of the Solar System data published in the Data Release 2 of the Gaia missions. Recommendations for their use are exposed, and applications to Yarkovsky determination illustrated.

1. Introduction

The Gaia mission by ESA regularly observes Solar System objects during its survey of the sky. The Data Relase 2 (Gaia DR2) includes for the first time epoch astrometry and photometry of asteroids. The time range covered by Gaia DR2 corresponds to nearly 22 months of operations.

2. Object selection and processing

Asteroids published in Gaia DR2 come from a pre-selected list of asteroids, covering different populations and maximizing the number of transits on the Gaia focal plane.

The data have been processed at the CNES facilities of Toulouse (France), one of the data processing centers of the Data Processing and Analysis Consortium (DPAC) of Gaia.

Processing has involved the rejection of clearly anomalous astrometric positions and fluxes, and a validation phase. This last task has involved a careful orbital fitting on Gaia data only, and an analysis of the residuals.

DR2 contains astrometry and photometry for 14.099 asteroids, consisting of nearly 2 million epoch data.

3. Astrometric accuracy

For objects brighter than V~18 the single-epoch astrometry is in general better than 1 mas, except at the bright end where size effects can play a role.

At the faint end (V~20.7) the accuracy decreases to a few mas. Photometry is in general accurate at a few mmag.

4. Orbit improvement

We used the data to attempt a bulk orbit improvement for all objects in DR2 showing that:

- An appropriate weighting, that takes into account the peculiar error model of Gaia data is required.

- The improvement in orbit quality is severely limited by the systematic errors present in the bulk of the other sources of astrometric data.

5. Conclusions and perspectives

In our talk we will discuss the approach to an appropriate debiasing of the non-Gaia astrometry, and on the possibility to improve the measurements of the Yarkovsky acceleration. New detections of Yarkovsky should also become possible.

References

[1] The Gaia collaboration, Spoto, F., Tanga, P. et al, A&A 2018.