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Astrometry and photometry of TNOs and asteroids using Gaia DR2

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Abstract

We will present the astrometry and photometry of a selected sample of main belt asteroids and TNOs using data from the Gaia DR2.

We analyzed the astrometry of selected TNOs and Main belt asteroids to know if it's possible to detect the presence of a satellite. We also analyzed the photometry of a selected list of main belt asteroids searching for variation in the absolute magnitude and confirming the determination of the rotational period if it is known. On the other hand, applying a shape model, an absolute size can be reached, assuming an albedo.

1. Introduction

Gaia DR2 released the data of more than 14 000 minor bodies. On these data the astrometry and photometry of only a few TNOs are presented, the rest is the astrometry and photometry of main belt asteroids, Jupiter Trojans, a small number of NEOs and Hildas. In this work we selected two particular cases from this sample, to test the potentiality of the DR2 data.

Haumea is one of the largest TNOs and it is known to have two satellites. The largest one can be detected using astrometry from ground-based telescopes following the movement of the system photocenter [1]. Rings are also detected around this TNO [2].

(596) Scheila is a main belt asteroid that presented activity in 2010 [3]. The impact of a small body could be the cause of this activity [4].

In this work, we will present the results on the astrometry and photometry of Haumea. We also will present the results on the analysis of the photometry of Scheila and its implications.

Finally, we will present the result on the variation of absolute magnitude along time for a selected sample of main belt asteroids.

2. Analysis of the data

All the data was extracted from the Gaia Archive and processed with own software.

The search for the rotational period was done applying the PDM technique. To obtain the absolute magnitude H, the magnitudes were distance and phase angle corrected using the ephemerides from the Gaia spacecraft.

After the distance and phase correction we used the equations presented by [5] to obtain the calculated absolute magnitude for a given triaxial ellipsoid with fixed albedo.

3. Main results

When analyzing the astrometry data for Haumea we realize that the data did not reach enough precision to determine the movement of the photocenter. DR2 astrometry precision for a single observation for this TNO reached 50 milli-arcsecond (mas), not enough for the detection.

Results on absolute magnitude were obtained for the entire sample. In figure 1 it is shown an example for asteroid (596) Scheila.

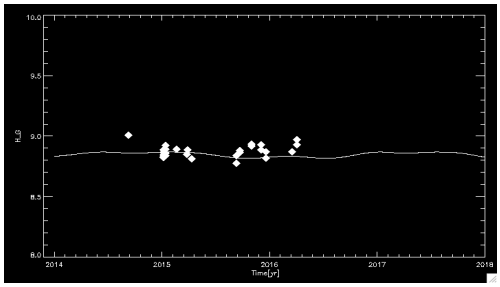

Figure 1: Absolute magnitude versus time in years for (596) Scheila. The points are the data from DR2 and the line is the generated model.

4. Summary and Conclusions

After the analysis of the astrometry of Haumea we can say that the individual measurements made with GAIA DR2 until now has not enough precision to detect the largest satellite of Haumea. We need to wait the following releases the increase the precision on the astrometry.

The rotational period based on the photometry, meanwhile, is correctly found on the data of Haumea.

On the main belts, an absolute magnitude in the Gaia system can be determined and its variation along time. The time spam on the data is from 2014 to 2017 mainly, corresponding to this release.

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