Studying binary asteroids through stellar occultations – GAIAMOONS

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According to **[Pravec P. et al.],** 15% of the population of the main belt asteroids are binary asteroids. These systems are essential to assess our knowledge about the origin and dynamical evolution of our solar system **[Nesvorny et al. 2021]**. However, due to our current observational techniques, we estimate that the actual known samples identify only 2% of this population. Moreover, traditional observational techniques like direct imaging (revealing large object with small satellite) or optical and radar photometry (revealing close and icy objects) limit the variety of the current available sample, leading to a biased database. To enhance the current sample and fill this gap, GAIAMOONS has been launched in 2022, -> by identifying binary candidates using Gaia astrometric data and validating asteroid companions through stellar occultation observations. In fact, thanks to dynamic information about the asteroid pair, provided by the occultation observations, it is possible to trace the mass of the primary precisely as well as its shape and volume to a kilometric precision **[Braga-Ribas et al.]** and thus derive its density. This way, physical conditions of the primary can be precisely determined.
Gaia's astrometric measurements is in fact that of the photocenter moving around the system's center of mass **[Tanga et al. 2023]**. Through data analysis, a list of 358 binary candidates has been established **[*Liberato et al. 2024*]** and observational campaigns are underway to confirm the binary nature of these systems using the stellar occultation observation method **[Lallemand et al. 2024]**.
This presentation will focus on the observational part of the GAIAMOONS program results obtained so far on GAIAMOONS targets (in particular (35420) 1998AG6, (5044) Shestaka (**Fig. 1**) and (1127) Mimi), including updated astrometry, derived shapes, probable moon discoveries and criticism of available 3D models for some objects.

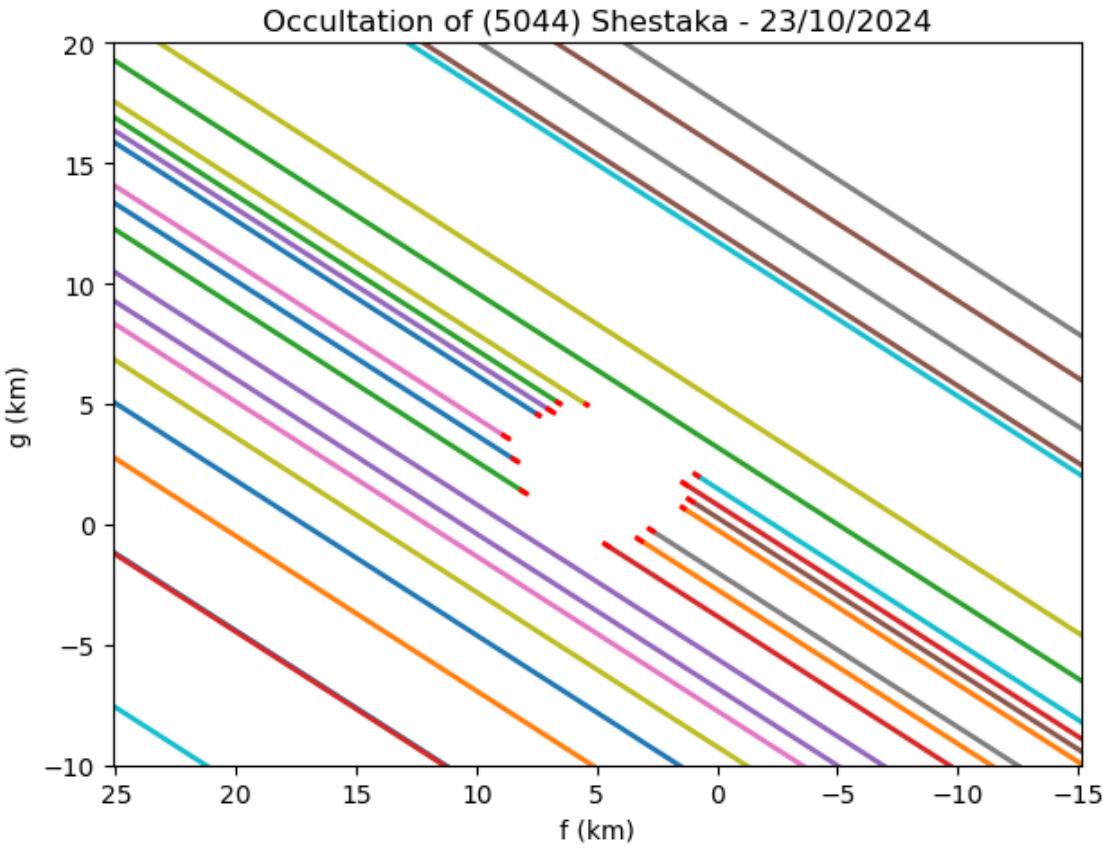

Figure 1. Projection of the shape of asteroid (5044) Shestaka at the time of occultation on 23 Oct. 2024. The x-axis has been inverted to mimic the point of view of the projection in the sky as seen from the ground.

Références

[1] Pravec P. et al., 2007 **Icarus**
[2] Nesvorny et al., 2021 **The Planetary Science Journal**
[3] Braga-Ribas et al. 2013, **The Astrophysical Journal**
[4] Tanga et al., 2023 **Astronomy and Astrophysics**
[5] Liberato et al., 2024 **Astronomy and Astrophysics**
[6] Lallemand et al. 2024, **SF2A Proceedings 2024**

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