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First results from stellar occultations in the "GAIA era"

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Abstract

Stellar occultation is a powerful technique to study distant solar system bodies. It allows high angular resolution of the occulting body from the analysis of a light curve acquired with high temporal resolution. In the past few years, this technique is showing impressive results such as the determination of Pluto's atmosphere with uncertainties comparable to the New Horizons probe[1], the discovery of rings around the Centaur object (10199) Chariklo[2], or the detection of a chasm on a Trans-Neptunian Object (2003 AZ84)[3], among others. After the first release of the GAIA catalog (in October/2016), stellar occultations predictions became much more accurate, which allowed us to observe several other stellar occultations. In this work we will present the improvement in orbit refinement for the outer solar system objects, some of the latest results obtained from stellar occultations, and the new chalenges to face.

1. Introduction

One big advantage of the stellar occultation technique is that it can be considered magnitude independent, in the sense that it is only necessary to detect light from the occulted star and not from the occulting body during the occultation. This allows both small and big telescopes to operate together and obtain impressive results[1,2,3]. On the other hand, stellar occultations present difficulties: they are transient events and require accurate predictions and can happen anywhere in the world, needing a huge collaboration network.

With the results from the GAIA space mission, stellar and bright TNO positions will be known with unprecedented accuracy, reaching values of the order of milliarcseconds. In other words, the prediction difficulty is overcome and the stellar occultation technique will now definitely be able to provide much more information about the sizes and shapes, presence of atmosphere, and also about the immediate neighborhoods of distant solar system bodies.

Stellar occultations by Pluto, (10199) Chariklo, (136108) Haumea, among many other objects are already in the list of the observed objects in the "GAIA era".

2. Summary and Conclusions

The GAIA mission (together with other surveys, such as the LSST) should provide accurate predictions of stellar occultations by tens of thousands of distant small solar system bodies in the next years. This will set a new era where a huge amount of unprecedent information will be acquired.

The participation of professional astronomers, laboratories, and the amateur community will be crucial to observe the predicted events. An easier method to coordinate observation campaigns, and the development of softwares capable of reducing the data more efficiently is needed

Stellar occultations observation campaigns will need to be selected according to a specific scientific prupose such as the probability to detect rings or archs around a body, the presence of atmosphere or even the detection of topographic features.

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