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Miosotys, a new instrument to search for trans-Neptunian stellar occultations

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Abstract

Miosotys is a new instrument mounted on the 193-cm of Observatoire de Haute-Provence, France. The aim is the detection of serendipitous trans-Neptunian occultations, revealing 0.1 to 1km-sized objects during unpredicted events. This would allow us to (a) reconstruct the Edgeworth-Kuiper (and possibly Oort cloud) structure from statistical studies of those occultations and (b) give the size distribution of those small bodies, an important parameter for constraining formation scenarii.

1. Introduction

Serendipitous occultations have no other competing methods, as the magnitudes of the corresponding objects, V~35 or fainter, are unreachable through classical ground-based imaging [1]. Such occultations reveal the vertical and radial distribution of the EKBOs as far as 50 AU and beyond. Also, they provide information on the size distribution down to hectometer-sized objects. This is a key parameter for better understanding formation processes in this remote region of the solar system. In particular, the primordial structure of the proto-planetary disk just outside the giant planet region has been deeply modified by planetary migrations, resonance trapping and collisions [2], [3]. A better knowledge of the Kuiper Belt will allow comparisons with circumstellar material around other stars, and provides some clues on the comet belt observed around the β-Pictoris system, and rings or disk-like features akin to Kuiper belts around other young stars.

Stellar occultations have the oustanding capacity of providing km-scale resolution on the studied objects, which is out of reach of any other ground-based instruments. This is because this method is diffracted-limited at the Fresnel scale level, $L_F \sim \sqrt{\lambda D/2}$, where λ is the observation wavelength and D the distance of the EKBO, so that L_F~1 km for D= 30-100 AU in visible bands. Note that usually, the stellar diameter projected at the EKBO distance is also of the order 1-km or less.

2. The instrument

MIOSOTYS (Multi-object Instrument for Occultations in the SOlar system and TransitorY Systems) is a multi-fiber positioner coupled with a fast photometry camera (Fig 1). It has been newly implemented at the cassegrain focus of the 193 cm telescope at the Observatoire de Haute-Provence, France. It is an arm positioner using 29 arms in a 26 arc-minute field. Each arm is equipped with an individual viewing system for accurate setting and carries one individual fiber that intercept 13" arcsec on the sky. All the 29 fibers are aligned on a frame-transfer EMCCD for fast photometry acquisition.

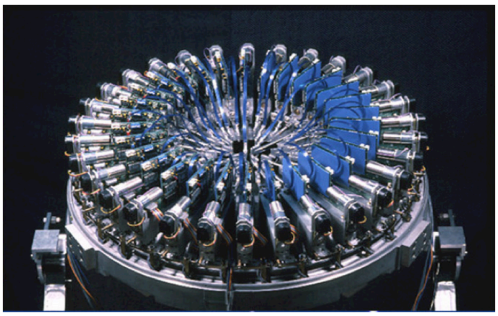

Figure 1 : The MIOSOTYS instrument with its arms system

The association of fast photometry with a multi-fiber instrument and a 2 meters telescope provides a unique possibility to perform fast precise photometry on several targets in a large field. This would allow us to (a) reconstruct the Edgeworth-Kuiper Belt (and possibly Oort cloud) structure from statistical studies

of those occultations and (b) give the size distribution of those small bodies, an important parameter for constraining formation scenarii.

Testing and calibration phase has been done with success and MIOSOTYS is now ready for science operations.

We have developed a software dedicated to the search of targets for the field of view of MIOSOTYS (Fig. 2) . The target fields are chosen so that we could feed the fibers with enough bright and small (to enable diffraction) stars. We have also developed a complete and automated data reduction pipeline (Fig. 3) to analyse the typically 2 teraoctets of data during an observing run. Based on the current knowledge and statistics of the Kuiper Belp, we expect a detection rate of 1 event every 11 nights.

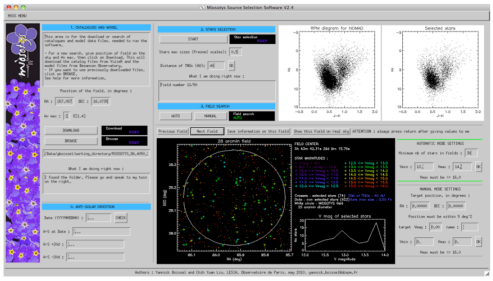

Figure : Miosotys Sources selection software.

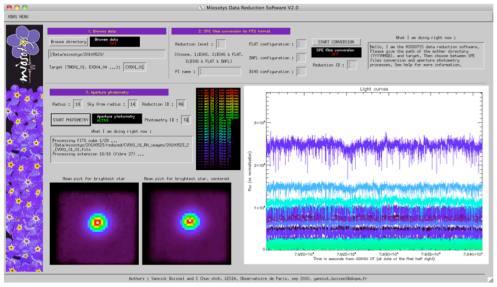

Figure 2 : quick view tool of MIOSOTYS

We will present the on-going observations campaign, objectives and observing strategy. We will discuss more specifically the method used to analyse the data, the VI (Variability Index) method [4] and the software developed to search for optimized target-stars for MIOSOTYS field of view.

Acknowledgements

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References

[1] Roques *et al., in* The Solar System beyond Neptune (eds Barucci, Boehnhardt, Cruikshank, Morbidelli), UoA Press, 2008

[2] Morbidelli, Levison & Gomes, *in* The Solar System beyond Neptune (eds Barucci, Boehnhardt, Cruikshank, Morbidelli), UoA Press, 2008.

[3] Farinella, Davis & Stern, *in* Protostars and Planets IV (eds Mannings, Boss, Russell) UoA Press, 2000.

[4] Roques et al. 2006, AJ, 132, 819-822