PHYSICAL PROPERTIES OF TNOS AND CENTAURS FROM STELLAR OCCULTATIONS AND THERMAL OBSERVATIONS

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Introduction: Physical characterization of TNOs and Centaurs is improving in the very last times with the detection of stellar occultations by these minor bodies[1] and by more sensitive observations of their thermal emissions[2,3]. Each of these techniques can take advantage of the other to improve the physical knowledge of these icy bodies.

Stellar occultations: Stellar occultations by minor bodies is a very elegant and direct technique to obtain sizes (with a few kilometres precision), shapes and albedos of these objects from the precise timing of a star disappearing and reappearing behind the object's limb[4]. In the last decade has been possible to predict and to observe stellar occultations by these objects, mostly thanks to the improvement on the star positions accuracy from the available stellar catalogues and also thanks to the best knowledge of their orbital elements. Around a dozen of TNOs/Centaurs have been characterized by this technique up to date, including some of the largest TNOs (e.g. Eris[5], Makemake[6], Quaoar[7], 2007 UK_{126}[8], 2003 VS_2[9], 2003 AZ_{84}[10], etc), and the (unexpected) ringed Centaur Chariklo[11]. It is expected a relevant increment in the number of stellar occultations by TNOs and Centaurs detected, thanks to the use of the GAIA star catalogue to predict occultations. This refinement will allow the detection of stellar occultations by smaller TNOs and Centaurs. The GAIA DR1 catalogue is now available and improvements in predictions are starting to be obvious, future realeases will improve the situation even more.

Thermal observations: Radiometric technique provides diameters and albedos of TNOs and Centaurs from measures of their thermal emission. A thermal or thermophysical model applied to the thermal data, together with the knowledge of the absolute magnitude, allows to obtain diameters and albedos, but with larger uncertainties (~10% in diameters and ~20% in albedos) than those obtained from stellar occultations. The maximum of the thermal emission for the TNOs and Centaurs is in the 70-160 μm range, these wavelengths are only reachable from space-based telescopes like Spitzer or Herschel. Spitzer has detected the thermal emission of a few dozens of TNOs and Centaurs[2] and Herschel Space observatory, within its key programme 'TNOs are Cool', has increased the number to ~140 objects [3,12,13 and references therein]. For all these objects equivalent diameters and albedos have been derived.

Merging techniques: Stellar occultations by TNOs/Centaurs provide very accurate diameters and albedos while the radiometric technique is less precise but allows accessing to a large number of objects. Both techniques are complementary and it is possible to put both together in order to better characterize these bodies[14]. It is also possible to improve the physical knowledge adding results derived from other techniques like light curves, photometry, spectra, etc, obtaining a very complete physical portrait for selected objects. This is the main objective of the European Union's funded project known as 'Small Bodies Near and Far' (SBNAF). A sample of small bodies, including TNOs and Centaurs, are being characterized within this project with a multi-technique approach.

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