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The November 14th, 2014 Stellar Occultation by the TNO 2007UK126

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Abstract

We report the observation of a multi-chord stellar occultation by the transneptunian object (TNO) 2007 UK126. The event was observed by the RECON network and other collaborators on November 14, 2014 UT from seven sites in the United States. With a diameter of about 600 km and orbiting at about 43.5 AU, this recently discovered object is listed as highly likely a dwarf planet. Some of its physical parameters could be derived from this occultation.

1. Introduction

Stellar occultation is one of the best methods used to acquire precise information on the Trans-Neptunian Objects (TNOs) and Centaurs. Km-sizes [1,9] and nano-bar atmosphere [10,2,11] can be obtained with this method. Shape, albedo[2], density, surface properties [7] presence of rings [1] or other structures such as jets, and other physical parameters can be also derived [9].

Those physical parameters of the TNOs provide important information on their formation and evolution. Orbiting at more than 30 Astronomical Units (AU) from the Sun, those objects are less affected by interplanetary radiation and have low rate of mutual collision. For this reason, they can be considered as remnants, relatively unaltered, of the solar system formation [5].

Besides that, information about the TNOs are of great relevance when one tries to establish a more general formation scenario for planetary systems, also needed for the most recent extra-solar systems discovered. The problem is that TNOs have a diameter smaller than 2,300 km (Eris, one of the biggest has 2326 km [10]) and when seen from Earth they appear smaller than 50 mili-arcseconds in the sky and not very bright, so that it is extremely hard to resolve such objects with the actual imaging systems.

One of the biggest known TNO is called 2007 UK126 [8]. With a diameter of about 600 km and orbiting at about 43.5 AU, this recently discovered object is listed as highly likely a dwarf planet [3] and it occulted [5] a star in November 14, 2014. Its shadow crossed USA where the RECON [4] network and other collaborators obtained 7 occultation chords from which we could obtain some of its physical parameters.

Observations were made in 4 different locations from the RECON: Gardnerville, Tonopah, Yerington, and Carson City (2 chords); and also two more chords were obtained in San Pedro Martir (negative) and by the IOTA team. Figure 1 shows the prediction map for the event.

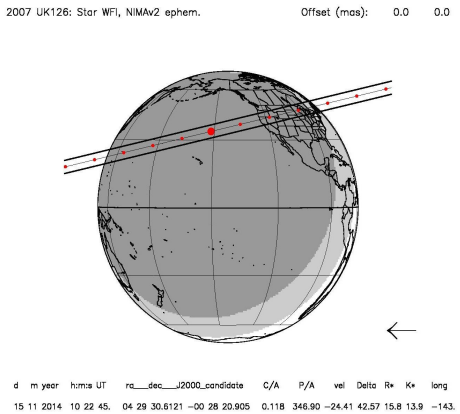

Figure 1: Prediction map for the occultation of a MagR= 15.8 star by the TNO 2007 UK126. The

bigger red dot represents the closest approach (10:22:45 UT) and other dots are one minute spaced (crescent to the left). Map generated using the NIMA ephemerides [6].

2. Results

The positive detections yields seven occultation chords. The ongoing reduction will allow to determine size and shape of the object. Also, one negative detection is important to determine limits on its values. Considering only the longest observed chord, we can calculate the lower limit to the semi-major axis of 2007 UK126 as R= 337±21 km.

From the determined size and shape we will derive its density, considering that is in hydrostatic equilibrium, and put a lower limit on the presence of atmosphere. By using current estimations for its magnitude, we can also infer a geometric albedo for the body.

3. Summary and Conclusions

From the stellar occultation data of November 14, 2014, (ongoing) it will possible to obtain some important physical characteristics for the TNO 2007 UK126 such as size, shape, density and albedo.

Furthermore, the observation demonstrates that occultations of faint stars (here ~15.8) can be detected through modest instruments and depends on a international collaboration. This is made possible as sensitive cameras and better astrometric predictions are available and continues a new era of discoveries because faint stars are far more numerous than bright ones. This allows us to determine the size of remote (e.g. trans-neptunian) objects at kilometric accuracy with associated accurate values for their albedo and density.

Acknowledgements

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