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Stellar occultation by the trans-Neptunian object 2002 KX_{14}

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Abstract

On the night of April 25, 2012 we observed a stellar occultation by the trans-Neptunian object (119951) 2002 KX_{14}. Astrometric predictions had shown that the shadow path would pass upon Earth's north hemisphere and was potentially favorable for the south of Europe and even the Canary islands. Several professional and amateur telescopes/observers attempted to observe the event. We had a successful observation from the 4.2-m William Herschel telescope at the Roque de los Muchachos observatory, La Palma, Spain, where the visiting instrument Ultracam was used.

The occultation light-curve has a depth of 1.98 mag and lasted 21.2 s, this implies a minimum diameter of (414 ± 4) km. There is no evidence of atmosphere from the light-curve.

1. Introduction

Trans-Neptunian objects (TNOs) are objects orbiting in the outer realms of the Solar System. With a few exceptional cases these are faint objects whose surface characteristics we are unveiling, especially through spectra and colors, obtaining information of their composition. Other characteristics are more difficult to obtain observationally.

The technique of stellar occultations by moving objects, especially for minor bodies, can help providing information that would otherwise be unreachable using ground-based telescopes, such as accurate measures of diameters and atmosphere detections (e.g., [1, 2, 3] and references therein).

1.1. 2002 KX_{14}

The TNO 2002 KX_{14} has a low inclination - low eccentricity orbit with a semi-major axis of $\sim$ 39 AU. It has a red spectrum in the visible while neutral in the near-infrared with no absorption features detected within the signal-to-noise ratio of the observational data [4, 5] indicating a lack of detectable ices and a surface probably covered in organics and/or silicates.

2. Observations

Using nominal JPL ephemeris for 2002 KX_{14} we were able to predict the occultation of the star NOMAD 0677-0461184, $R_{mag} = 18.3$, by the TNO several months in advance. We improved the initial prediction by astrometric follow-up closer to the time of the event.

We obtained one successful light-curve of the event using Ultracam, a visiting instrument at the William Herschel telescope at the time. Ultracam is able to obtain data with a high time-resolution, 0.272 s and essentially no dead-time, resulting in an optimal instrument for us. The data were reduced using standard photometric techniques. A close-up of the light-curve during the occultation is is shown in Fig. 1.

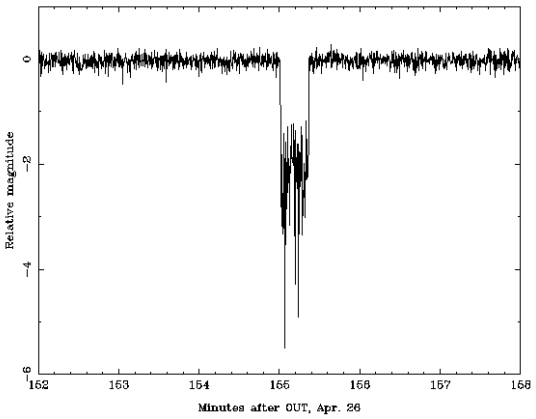

Figure 1: Light-curve of the occulted star NOMAD 0677-0461184 by 2002 KX_{14}.

3. Results and Summary

The data are still under scrutiny. Preliminary results from our successful light-curve indicate a duration of (21.2 ± 0.1) s of the event, indicating a minimum diameter of (414 ± 4) km, in agreement with the upper limit set by Spitzer data of < 561.6 km [6] and even a better agreement with the estimate of (455 ± 27) km based on Herschel plus Spitzer data [7]. Unfortunately, we could get only one light-curve showing the event which, by itself, does not allow us to put more constraints on the diameter. The sharp ingress and egress of the light-curve precludes the existence of a substantial atmosphere on the object.

We are currently improving the astrometic prediction, post-event, to set stronger constraints on the measured chord aiming at locating it with respect to the center of 2002 KX_{14} in a similar way as in [8].

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References

[1] Sicardy, B, Ortiz, J.L., Assafin, M., et al.: A Pluto-like radius and a high albedo for the dwarf planet Eris from an occultation, Nature, Vol 478, pp. 493-496, 2011.

[2] Elliot, J.L, Dunham, E.W., Bosh, A.S., et al.; Pluto's atmosphere, Icarus, Vol 77, pp. 148-170, 1989.

[3] Stern, S.A., and Trafton, L.M: On the atmospheres of Objects from the Kuiper Belt, The Solar System Beyond Neptune, University of Arizona Press, 2008.

[4] Alvarez-Candal, A., Fornasier, S., Barucci, M.A., et al.: Visible spectroscopy of the new ESO large program on trans-Neptunian objects and Centaurs: Part 1, A&A, Vol 487, pp. 741-748, 2008.

[5] Guilbert, A., Alvarez-Candal, A., Merlin, F., et al.: ESO-Large Program on TNOs: Near-infrared spectroscopy with SINFONI, Icarus, Vol 201, pp. 272-283, 2009.

[6] Stansberry, J., Grundy, W., Brown. M., et al.: Physical Properties of Kuiper Belt and Centaur Objects: Constraints from the Spitzer Space Telescope, The Solar System Beyond Neptune, University of Arizona Press, 2008.

[7] Vilenius, E., Kiss, C., Mommert, M., et al.: "TNOs are Cool": A survey of the trans-Neptunian region VI. Herschel/PACS observations and thermal modeling of 19 classical Kuiper belt objects, A&A, Vol 541, p. A94, 2012.

[8] Olkin, C.B., Elliot, J.L., Bus., S.J., et al.: Astrometry of Single-Chord Occultations: Application to the 1993 Triton Event, PASP, Vol 108, pp. 202-210, 1996.