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The stellar occultation by the Transneptunian Object 2002TC302 on January 28th 2018. Preliminary results.

J. L. Ortiz (1), P. Santos-Sanz (1), B. Sicardy (2), G. Benedetti-Rossi (3), F. Braga-Ribas (3,4), N. Morales (1), R. Duffard (1), V. Nascimbeni (5,6), D. Nardiello (5,6), A. Carbognani (7), L. Buzzi (8), A. Alleti (8), P. Bacci (9), M. Maestripieri (9), L. Mazzei (9), H. Mikuž (10,11), J. Skvarč (10), F. Ciabattari (12), F. Lavalade (13), G. Scarfi (14), J-M Mari (15), M. Conjat (16), S. Sposetti (17), M. Bachini (18), G. Succi (18), M. Fabrizio (18), M. Alighieri (18), E. Dal Canto (18), M. Masucci (18), J. Desmars (19), J. Lecacheux (2), R. Vieira-Martins (3,19,20), J.I.B. Camargo (3,20), M. Assafin (21), F. Colas (19), E. Fernández-Valenzuela (22,1), W. Beisker (23), R. Behrend (24), T. G. Mueller (25), E. Meza (2), A. R. Gomes-Junior (20), F. Roques (2), F. Vachier (19), S. Mottola (26), S. Hellmich (26), A. Campo Bagatin (27), S. Cikota (28), A. Cikota (29), J. M. Christille (7), A. Pál (30), C. Kiss (30), T. Pribulla (31), R. Komžík (31), K. Hornoch (32), P. Pravec (32), J. M. Madiedo (33), V. Charmandaris (34, 35), J. Alikakos (34), R. Szakáts (30), A. Takácsné Farkas (30), E. Varga-Verebélyi (30), G. Marton (30), A. Marciniak (36), P. Bartczak (36), M. Butkiewicz-Bąk (36), G. Dudziński (36), V. Alí-Lagoa (25), K. Gazeas (36), N. Paschalis (38), V. Tsamis (39), A Sanchez-Lavega (40), S. Pérez-Hoyos (40), R. Hueso (40), J. C. Guirado (41), V. Peris (41), R. Iglesias-Marzoa (42,43), and the 2002TC302 collaboration

(1) Instituto de Astrofísica de Andalucía (CSIC), Granada, Spain, (2) LESIA/Observatoire de Paris, Université Pierre et Marie Curie, Université Paris-Diderot, Meudon, France, (3) Observatório Nacional/MCTI, Rio de Janeiro, Brazil, (4) Federal University of Technology-Paraná (UTFPR / DAFIS), Curitiba, Brazil, (5) Dipartimento di Fisica e Astronomia, 'G. Galilei', Università degli Studi di Padova, Padova, Italy, (6) INAF-Osservatorio Astronomico di Padova, Padova, Italy, (7) Astronomical Observatory of the Autonomous Region of the Aosta Valley, (8) Schiaparelli Astronomical Observatory, Varese, Italy, (9) Astronomical Observatory San Marcello Pistoiese CARA Project, Italy, (10) Črni Vrh Observatory, Črni Vrh nad Idrijo, Slovenia, (11) Faculty of Mathematics and Physics, University of Ljubljana, Slovenia, (12) Osservatorio Astronomico di Monte Agliale, Lucca, Italy, (13) 83560 Vinon sur Verdon – France, (14) Observatorio Astronomico Iota-Scorpii, La Spezia, Italy, (15) 06410 Biot, France (16) Observatoire de la Côte d'Azur, France, (17) 6525 Gnosca, Switzerland, (18) Osservatorio Astronomico di Tavolaia, Pisa, Italy, (19) IMCCE/Observatorie de Paris, Paris, France, (20) Laboratório Interinstitucional de e-Astronomia - LIneA, Rio de Janeiro, Brazil, (21) Observatório do Valongo/UFRJ, Rio de Janeiro, Brazil, (22) Florida Space Institute, Florida, USA, (23) International Occultation Timing Association - European Section (IOTA-ES), Germany, (24) Observatoire de Genève, Sauverny, Switzerland, (25) Max–Planck–Institut für extraterrestrische Physik (MPE), Garching, Germany, (26) German Aerospace Center (DLR), Institute of Planetary Research, Berlin, Germany, (27) Universidad de Alicante, Alicante, Spain, (28) Department of Applied Physics, Faculty of Electrical Engineering and Computing, University of Zagreb, Zagreb, Croatia, (29) European Southern Observatory, München, Germany, (30) Konkoly Observatory of the Hungarian Academy of Sciences, Budapest, Hungary, (31) Astronomical Institute, Slovak Academy of Sciences, Tatranská Lomnica, Slovakia, (32) Astronomical Institute, Academy of Sciences of the Czech Republic, Ondřejov, Czech Republic, (33) Facultad de Ciencias Experimentales, Universidad de Huelva, Huelva, Spain, (34) Institute for Astronomy, Astrophysics, Space Applications & Remote Sensing, National Observatory of Athens, Athens, Greece (35) University of Crete, Department of Physics, Heraklion, Greece, (36) Astronomical Observatory Institute, Faculty of Physics, A. Mickiewicz University, Poznań, Poland, (37) National and Kapodistrian University of Athens, Greece, (38) Nunki Observatory, (39) Elllinogermaniki Agogi Observatory, Greece (40) Departamento de Física Aplicada I, Escuela de Ingeniería de Bilbao, Universidad del País Vasco UPV /EHU, Bilbao, Spain, (41) Observatorio Astronómico, Universidad de València, Valencia, Spain, (42) Centro de Estudios de Física del Cosmos de Aragón, Teruel, Spain, (43) Dpto de Astrofísica, Universidad de La Laguna, Tenerife, Spain, and the 2002TC302 collaboration

(ortiz@iaa.es)

Abstract

We will report a multi-chord stellar occultation by the large Transneptunian Object 2002TC302 on 28 January 2018, detected from 12 sites in Europe. This is now the best occultation by a Trans-Neptunian Object ever observed, in terms of the number of chords and the number of near misses. The positive chords of the occultation allowed us to fit an ellipse for the limb of the body at the moment of occultation with kilometric accuracy. Tentative possible three-dimensional shapes are presented from a combination of the occultation results with rotational light curve data obtained from the Sierra Nevada 1.5m telescope and the 1.2m Calar Alto telescope in Spain along several years. Also, an interesting result is the fact that the occultation lightcurve profiles are abrupt from all the observing sites, so we can conclude that there is no global atmosphere around this TNO. It is also worth mentioning that none of the occultation lightcurves show any evidence for brief secondary events that could be linked to a ring.

1. Introduction

At the time of this writing there are 2708 known transneptunian objects (TNOs), Neptune trojans and centaurs [1]. The object provisionally designated as 2002TC302 is an interesting TNO, which is among the group of the ~100 largest TNOs known so far. Its radiometric effective diameter is 584 km according to Herschel measurements [2]. Within our program to obtain physical properties of TNOs we predicted an occultation of the star UCAC4 593-005847 (130957813463146112 in GAIADR1) and arranged observations within a very favorable expected shadow path in Europe. The occulted star was of sufficient brightness (V~15.6 mag) so that even small telescopes of less than 0.4m in diameter could make a good contribution.

2. Observations

Sequences of images were obtained with different telescopes from around 15 minutes prior and 15 minutes after the predicted occultation time. Fortunately, 12 of them recorded the disappearance as well as the reappearance of the star. On the other hand, 4 sites were close to the shadow path, but outside of it and reported close misses. This is major achievement because no stellar occultation by a TNO had ever been observed with so many chords across the main body and with constraining near misses. The telescopes that recorded positive observations were the following ones: the Crni Vrh observatory 0.6m telescope (Slovenia), the Asiago observatory 0.67m telescope, the S. Marcello Pistoiese 0.6m telescope, the Monte Agliale 0.5m telescope, the La Spezia 0.4m telescope, the Varese Schiaparelli Observatory 0.84m telescope, the Val d'Aosta observatory 0.4m telescope, the Tavolaia Observatory 0.4m telescope (in Italy), the Gnosca 0.28m telescope (Switzerland), the Observatoire Cote d'Azur 0.4m telescope, the Biot 0.2m telescope, and the Vinon sur Verdon 0.3m telescope (in France).

3. Main results

From the positive occultation observations, we derived light curves which showed deep drops of different duration around the predicted occultation time. As these curves are abrupt at disappearance and reappearance of the star, 2002TC302 must lack an atmosphere of the type seen in Pluto. On the other hand, we have found no hints for short brightness drops prior or after the main event that could be linked to the presence of a thin ring around this body. From the chords of the occultation we fitted an ellipse, which represents the instantaneous limb of the body at the moment of the occultation. The exact semimajor and semiminor axes of the ellipse and its orientation, together with a precise rotational light curve, allowed us to constrain the full 3D shape of this TNO, which will be presented in the conference. Also, constraints on the density can be obtained under the assumption of hydrostatic equilibrium, and some conclusions can be drawn by comparing with densities of bodies of similar size under similar assumptions.

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