

XI TALLER DE CIENCIAS PLANETARIAS

Results of Estelar Occultations by the Trojan (5638) Deikoon

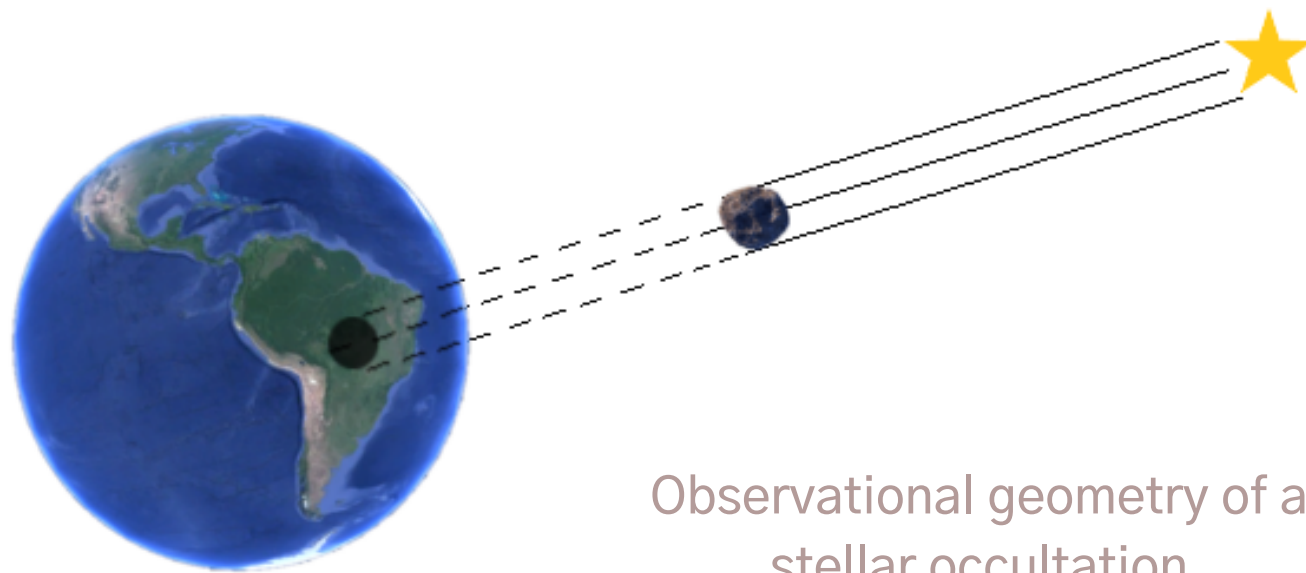
V. F. PEIXOTO, J. I. B. CAMARGO, B. E. MORGADO,
M. BANDA-HUARCA, A. PIERES, F.S. FERREIRA, F. BRAGA-RIBAS,
DES COLLABORATION, LUCKYSTAR TEAM, SORA DEVELOPERS, OBSERVERS



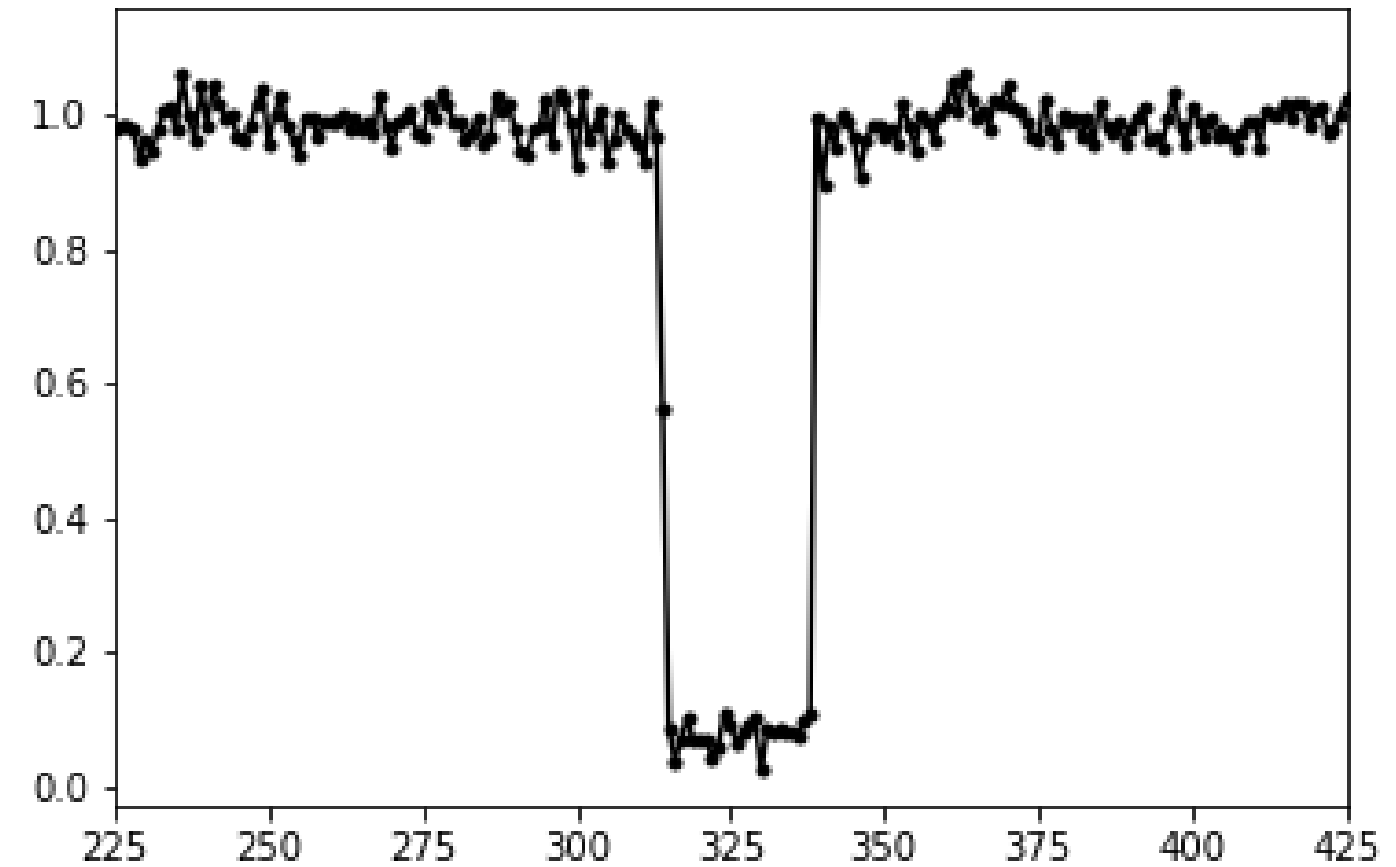
Introduction

STELLAR OCCULTATION

is a technique in which the light of a star is blocked by a small body for a given observer. From the data of this technique, it is possible to estimate the size and the shape of the occulting object.



Observational geometry of a stellar occultation



Example of a light curve from a stellar occultation

(5638) DEIKOON

is a Jovian Trojan located at the L5 Lagrangian point. It was discovered by Carolyn and Eugene Shoemaker on October 10th, 1988 (MPC 18047).

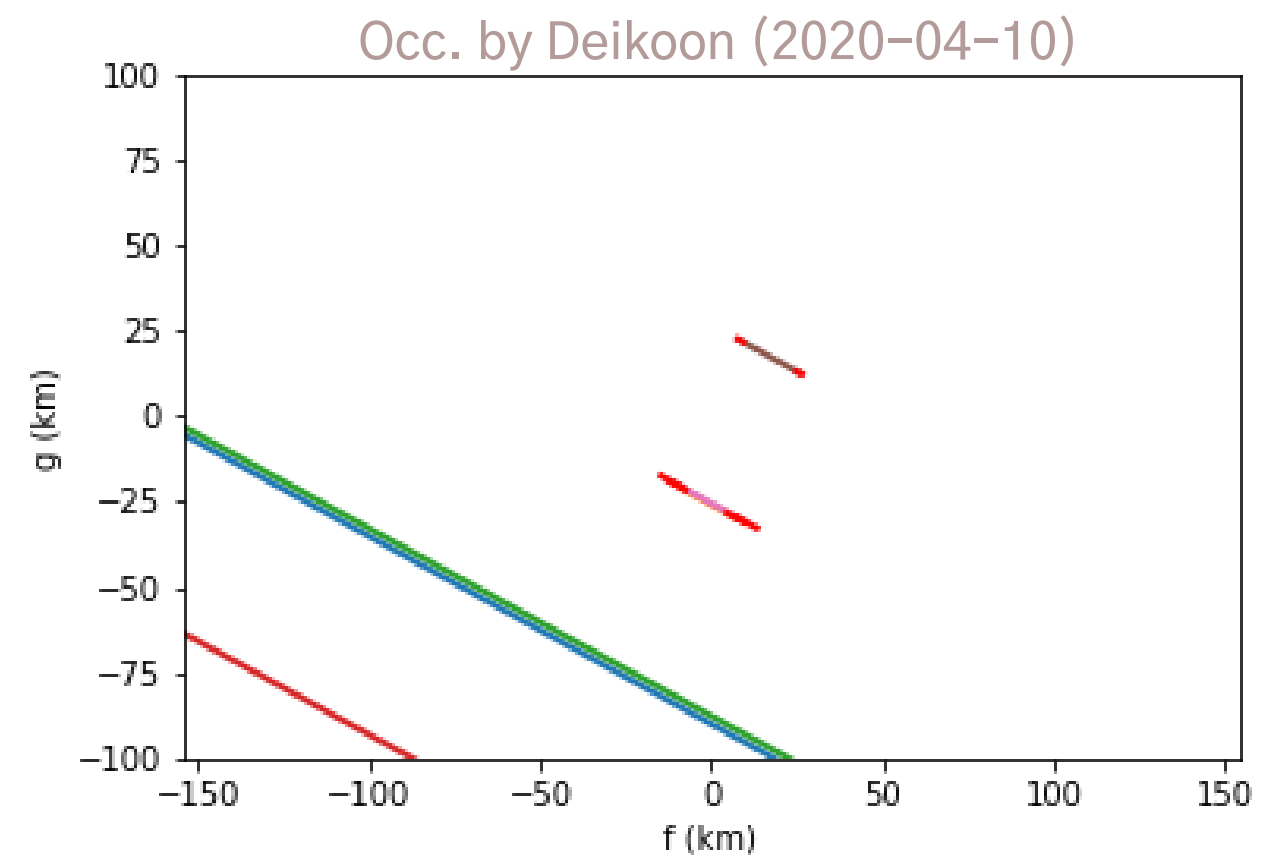
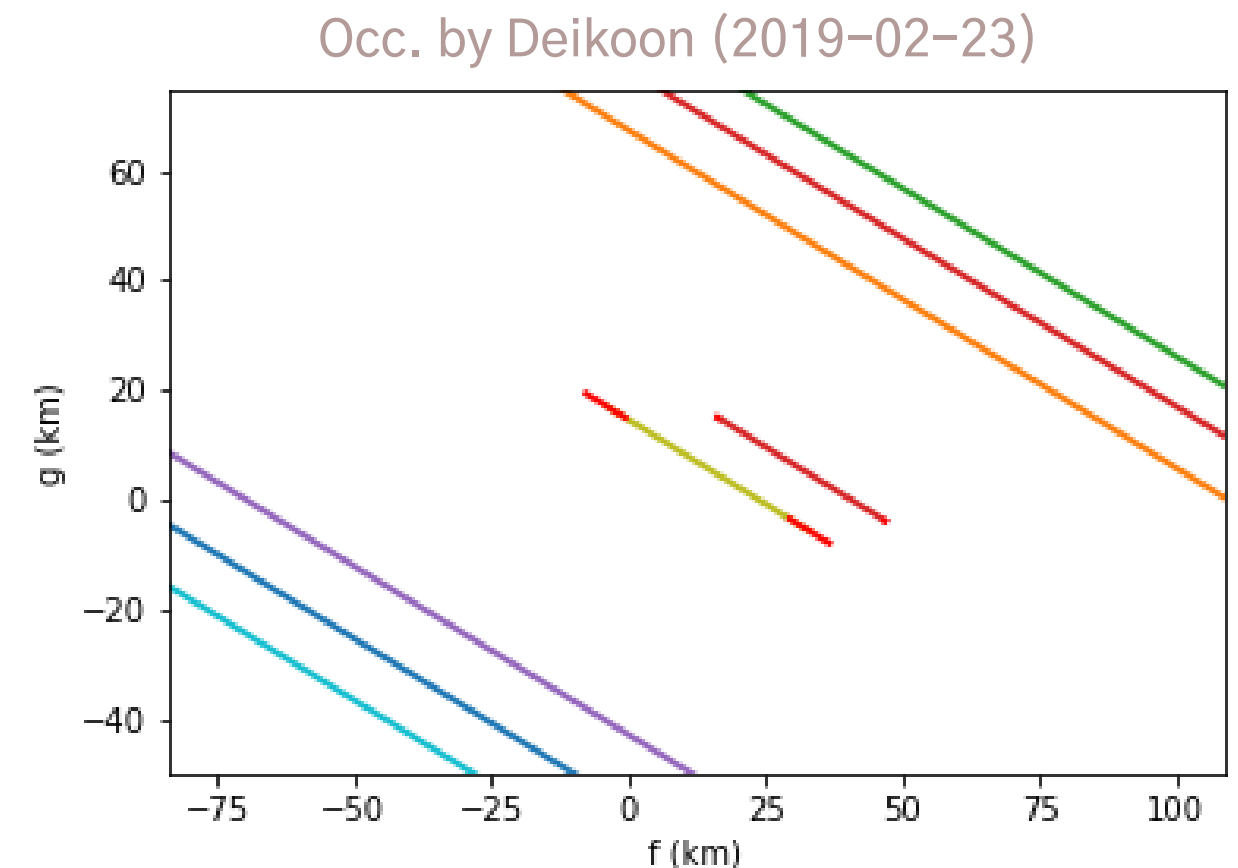


THE DATA

In this work, we present the results from two stellar occultations by (5638) Deikoon: a double-chord detection in February 2019 and another in April 2020. The both were observed by citizen scientist in Europe.

The data obtained in these two occultations were analysed with **SORA** – Stellar Occultations Reduction and Analysis, Gomes–Júnior et al. (2022), MNRAS.

The photometric analysis of the astronomic images was made using **PRAIA** – Platform for the Reduction of Astronomical Images Automatically, Assafin et al. (2011), Gaia FUN–SSO workshop proceedings.



Methods

ALBEDO

We can combine stellar occultation data and photometric data from large surveys to calculate the albedo.

In this work, we used the data from **DES**.

In this way, using occultations and the DES data, we calculate the Deikoon albedo in these two bands:

$$10^{0.4(H_{\text{sun}} - H)} \times \left(\frac{149597870.7 \text{ km}}{R_{\text{eq}}} \right)^2 = \text{Albedo}$$

DES (with arrow pointing to the exponent term)

Stellar Occultation (with arrow pointing to the radius term)

The Dark Energy Survey (DES)

It is a survey that made observations from 2013 to 2019, in the grizY bands, in order to study the nature of dark energy and its evolution. From its data, we could calculate the absolute magnitudes of Deikoon in bands g and i.

Together, these properties (**size** and **albedo**) can reveal more details about the surface properties of the studied object.



Results

EVENT IN 2019

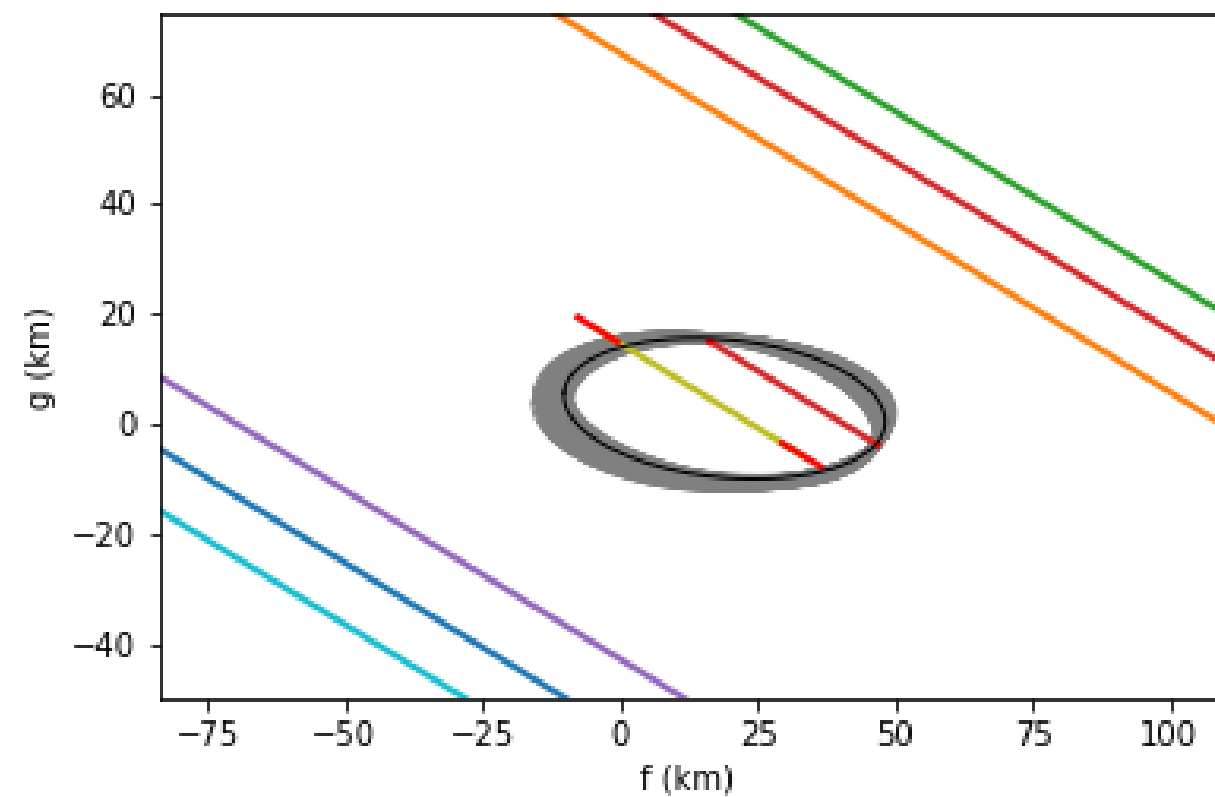
Equatorial radius: 30.292 ± 1.224 (km)

Oblateness: 0.559 ± 0.013

Astrometric position:

RA = 11 10 16.734 \pm 0.808 mas

DEC = 7 17 25.256 \pm 0.337 mas



Best ellipse fit for 2019 event, with 1σ region in gray.

EVENT IN 2020

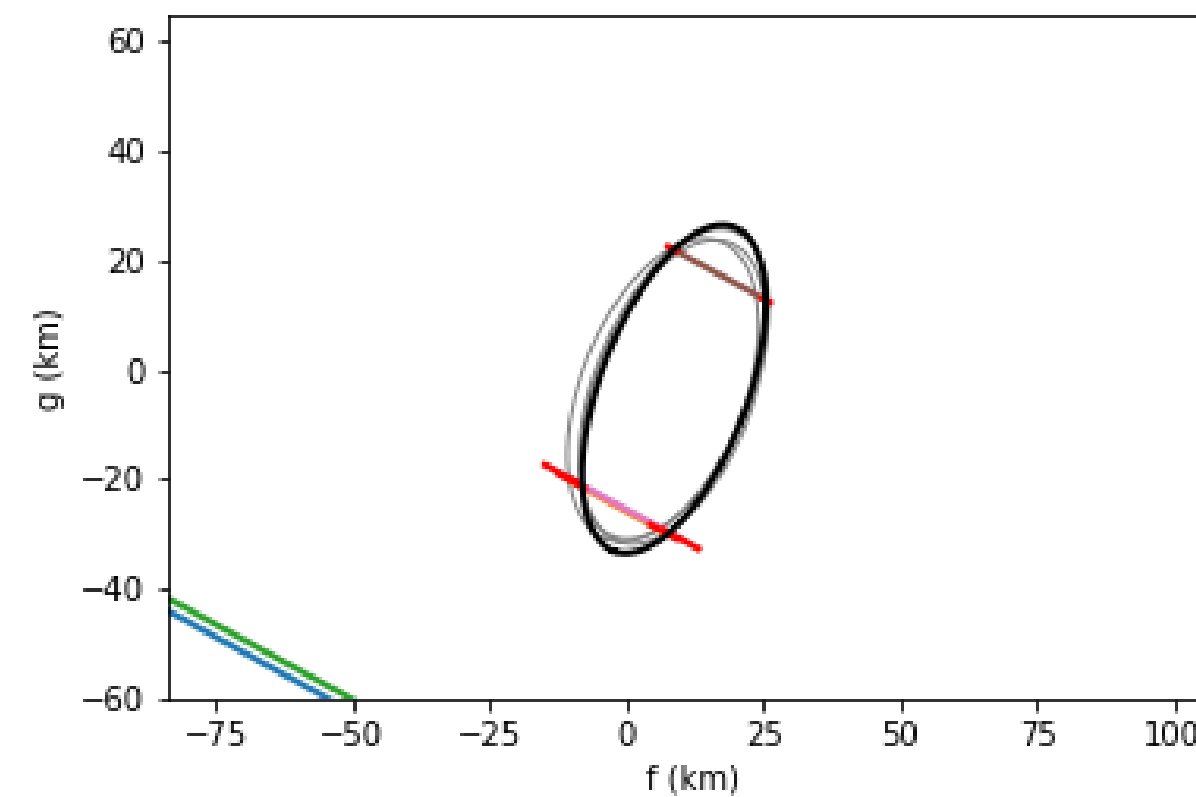
Equatorial radius: 30.307 ± 1.244 (km)

Oblateness: 0.528 ± 0.044

Astrometric position:

RA = 13 30 16.252 \pm 0.764 mas

DEC = 1 00 46.453 \pm 0.477 mas



Best ellipse fit for 2020 event, with 1σ region in gray.



Results

ALBEDO

$$10^{0.4(H_{\text{sun}} - H)} \times \left(\frac{149597870.7 \text{ km}}{R_{\text{eq}}} \right)^2 = \text{Albedo}$$

DES
Stellar Ocultation

2019 data (Occ)

Equivalent radius:
20.116 +/- 2.112 (km)

2020 data (Occ)

Equivalent radius:
20.821 +/- 2.769 (km)

g band

H = 10.985 +/- 0.013 (DES)*
Hsun = -26.507095

Albedo = 0.055 +/- 0.011

Albedo = 0.0520 +/- 0.013

i band

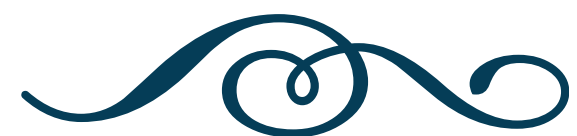
H = 10.418 +/- 0.007 (DES)*
Hsun = -27.047783

Albedo = 0.057 +/- 0.011

Albedo = 0.0532 +/- 0.014

*These results are still being validated by DES Collaboration

vivianepeixoto989@gmail.com

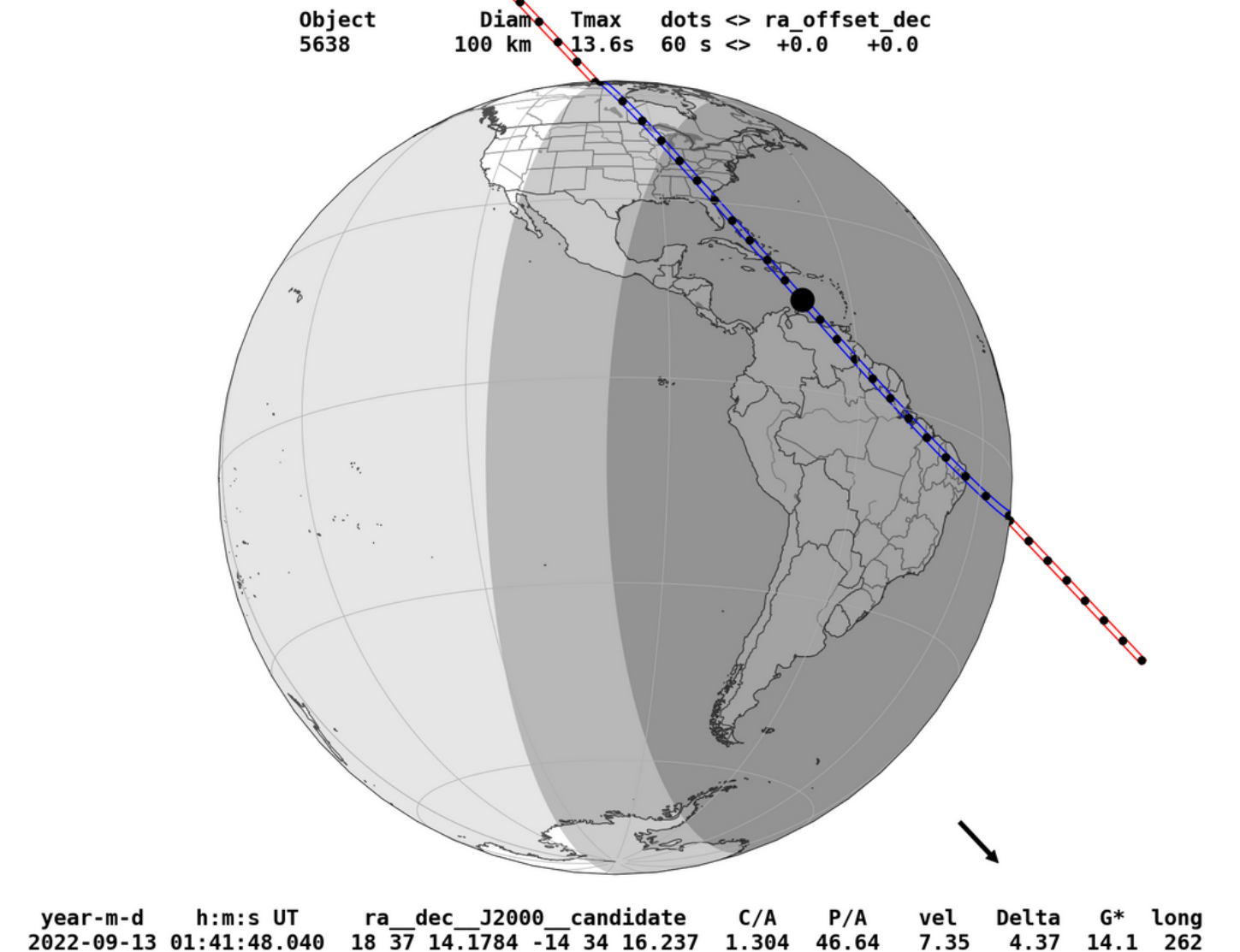


MORE OCCULTATION DATA

In the next steps, we intend to observe other stellar occultations by (5638) Deikoon. For that, we have been making predictions for upcoming events.

ROTATIONAL LIGHT CURVE

In addition, we also intend to obtain the rotational light curve of (5638) Deikoon, using telescopes of the Observatório Pico dos Dias (OPD, Brazil). It can help us to understand the shape and the aspect angle of the object.



A Stellar Occultation by Deikoon expected to happen in September 2022

In addition, we are comparing our results to those obtained in other works in order to understand and complement the values we found.



References

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