Exploring the Shape and Size of the Trojan (4709) Ennomos from Multiple Events Stellar Occultation

Ghoulam Imad Eddine BOUDIBA

Research Support Engineer
PhD Student in Astronomy
Research Center in Astronomy, Astrophysics and Geophysics (CRAAG), Algeria
Saad Dahleb Blida University (USDB), Algeria

Presentation Outline

- General Framework of my PhD Thesis
- Subject of my Study (4709) Ennomos
- Observation Campaigns and Data
- Data Extraction
- Analysis and Results
- Work in Progress

General framework of my PhD thesis

Blida University

جامعة البليدة 1

CRAAG

Research Center in Astronomy Astrophysics and Geophysics

General framework of my PhD thesis

In collaboration with
Lucky Star team

Co-advisor
Dr Damya Souami

(4709) Ennomos

Why Trojans ?

And why Ennomos ?

(4709) Ennomos

Physical Properties of Ennomos (L_5) from Literature :

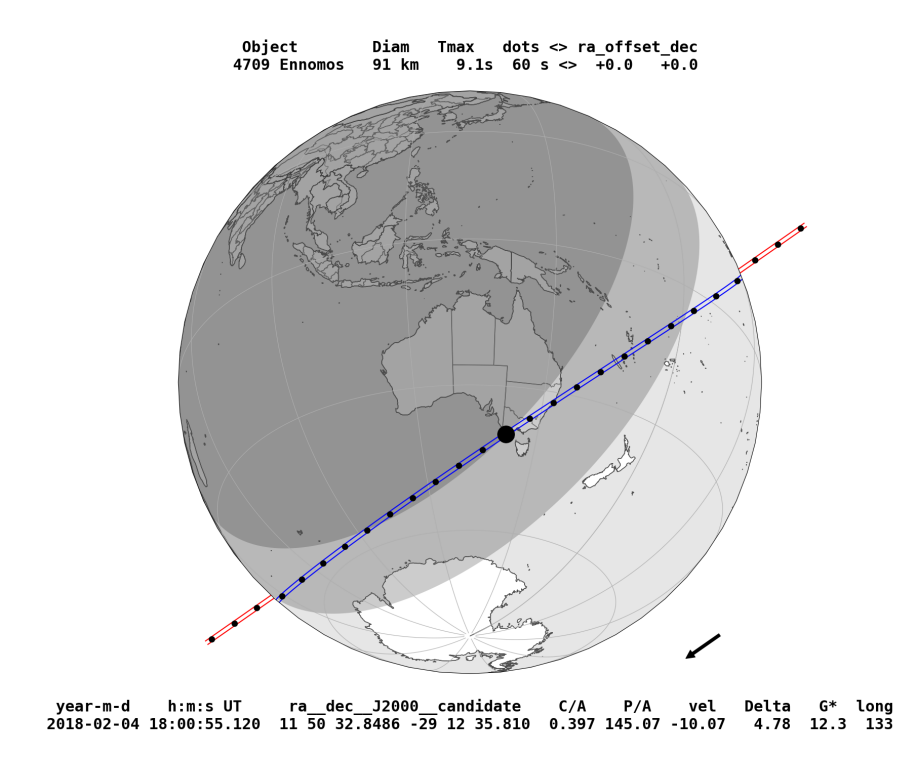
- D_v between 70.4 ± 3.4 km and 83.4 ± 4.2 km.
- 1st occultation : Aug. 11, 2011 → D_v= 102.18 ± 3.26 km.
- Geometric albedo between 0.052 and 0.180.

(4709) Ennomos

Ennomos Dynamical Family :

- One of six identified Trojan asteroid families
- 104 potential members with 13 confirmed

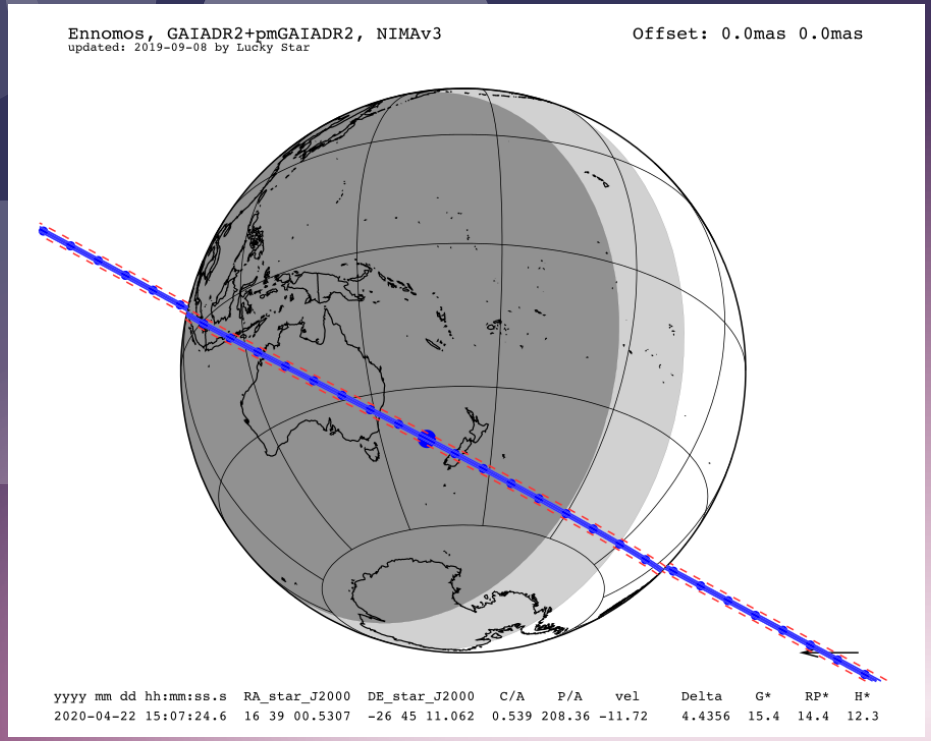
Observation Campaigns and Data



- Australia on Feb. 4, 2018 ~ 18:00 UT.
- Mag star 13.1
- Exp drop 3.4 mag
- Max duration 8.9s

- Recorded by D. Gault and D. Herald

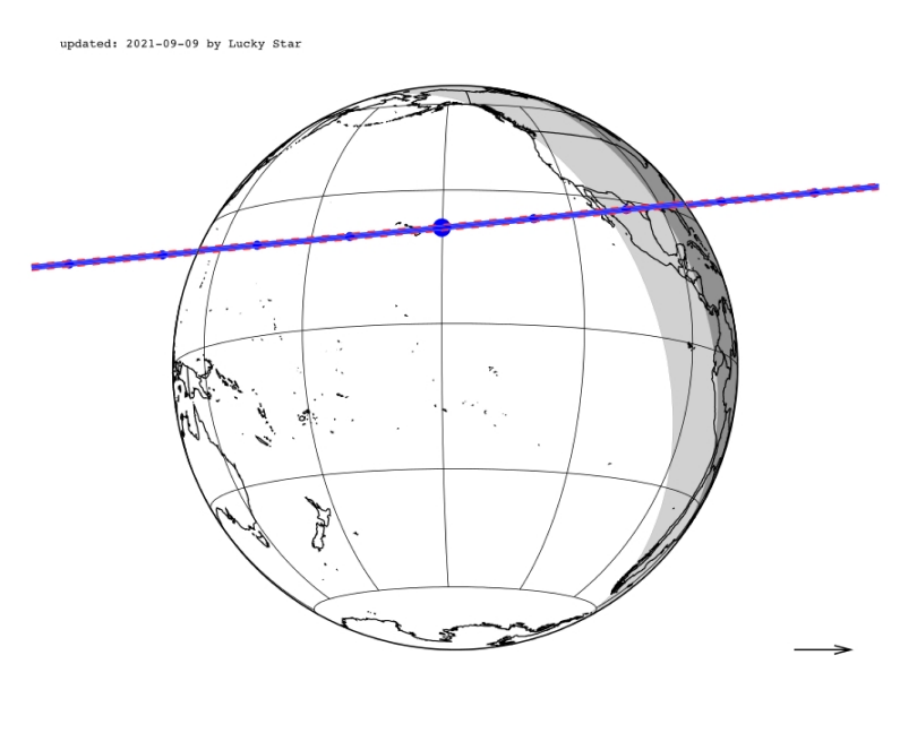
Observation Campaigns and Data



- Australia on Apr. 22, 2020 ~ 15:07 UT.
- Mag star 15.7
- Exp drop 0.7 mag
- Max duration 7.7s

- Recorded by D. Gault and P. Nosworthy

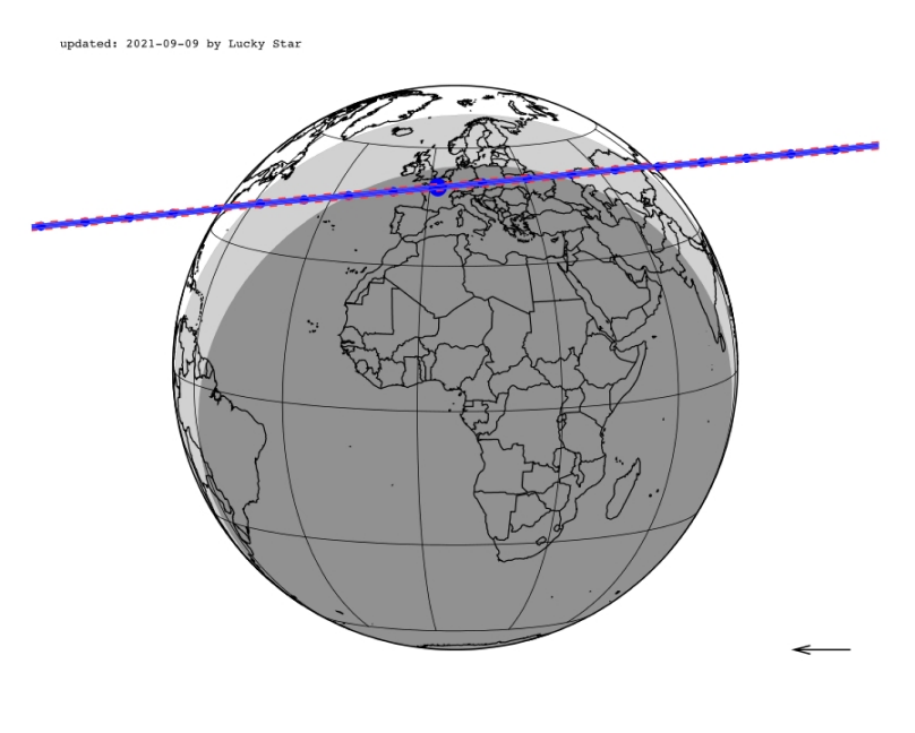
Observation Campaigns and Data



- USA on Nov. 20, 2021 at 00:25 UT.
- Mag star 9.9
- Exp drop 6.7 mag
- Max duration 2.6s

- Lucky Star campaign Recorded by P. Stuart and R. Venable

Observation Campaigns and Data



- Europe on Aug. 3, 2022 at 23:06 UT.
- Mag star 15.7
- Exp drop 0.8 mag
- Max duration 5.4s

- Lucky Star campaign Recorded by R. Boninsegna, J. Manek and J. Polak

Observation Campaigns and Data

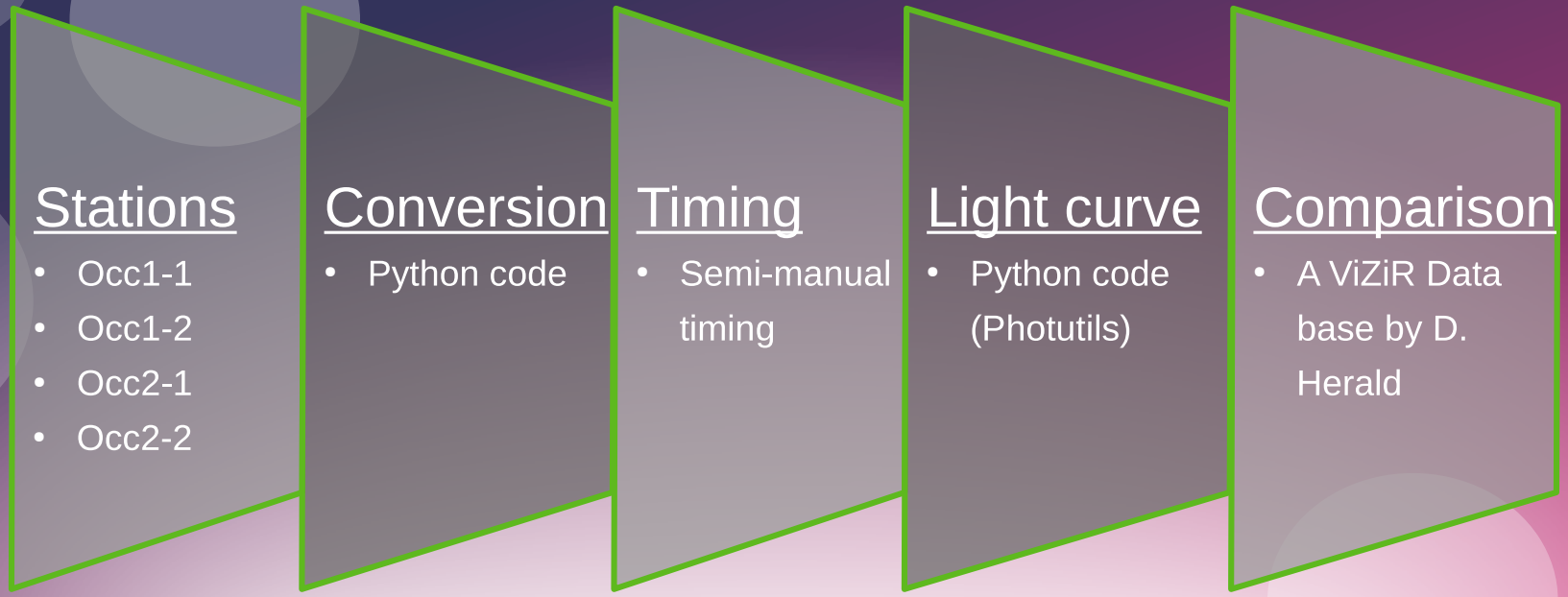
Occultation	Date	Observer	Station	Camera	Expos/Cyclic time (s)
Occ1	Feb. 04, 2018	DG	Occ1-1	Watec 910BD	0.04
		DH	Occ1-2	Watec 910BD	0.04
Occ2	Apr. 22, 2020	DG	Occ2-1	Watec 910BD	1.28
		PN	Occ2-2	Watec 910BD	1.28
Occ3	Nov. 24, 2021	PS	Occ3-1	Watec 910BD	0.033
		RV	Occ3-2	Watec 910HX	0.033
Occ4	Aug. 03, 2022	RB	Occ4-1	Watec 910HX	0.32
		JM	Occ4-2	QHY 174M	0.5
		JP	Occ4-3	QHY 174M	0.5

Data Extraction

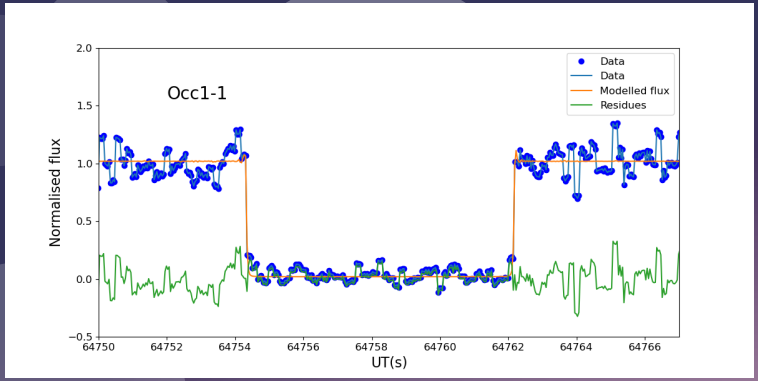
Data Extraction

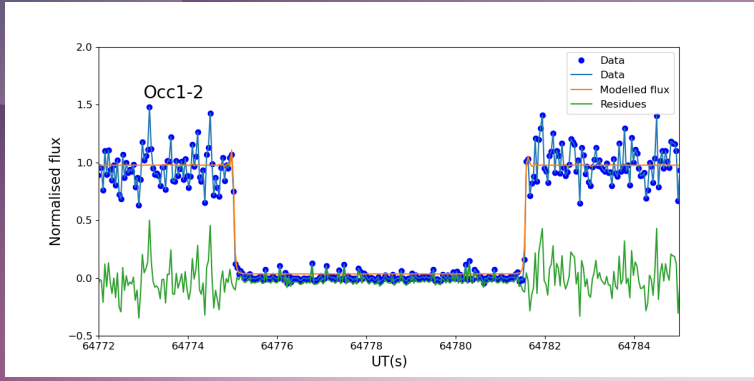
Data Extraction

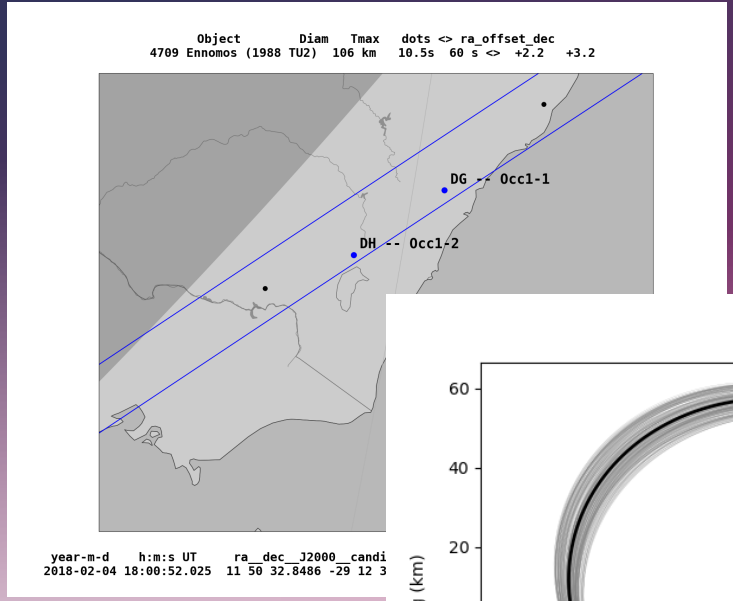
Data Extraction

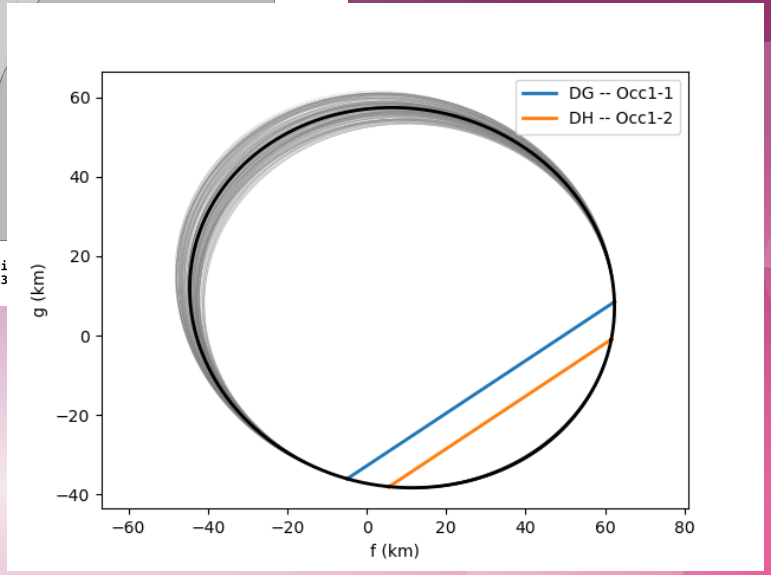


Analysis and Results





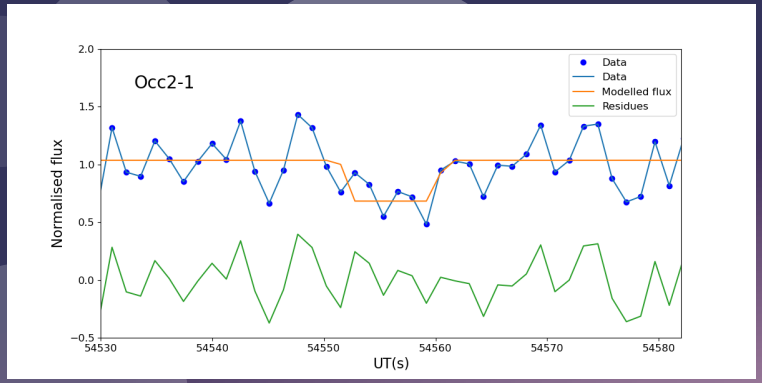




Occ1

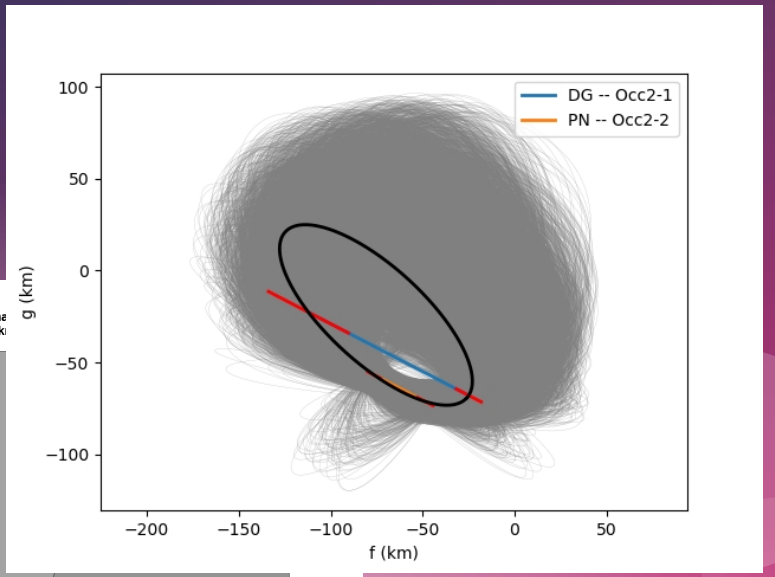
Feb. 04, 2018

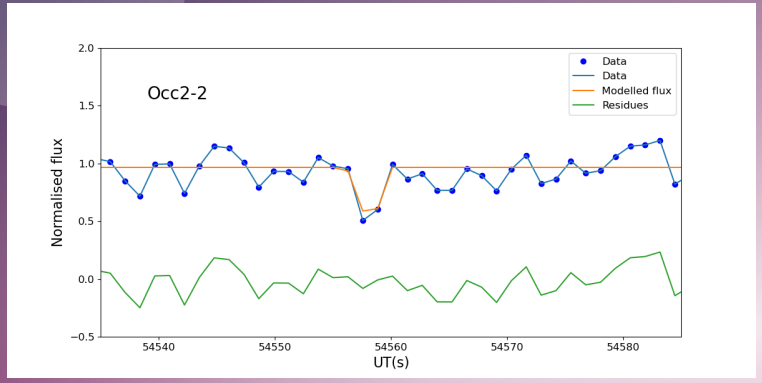
Analysis and Results

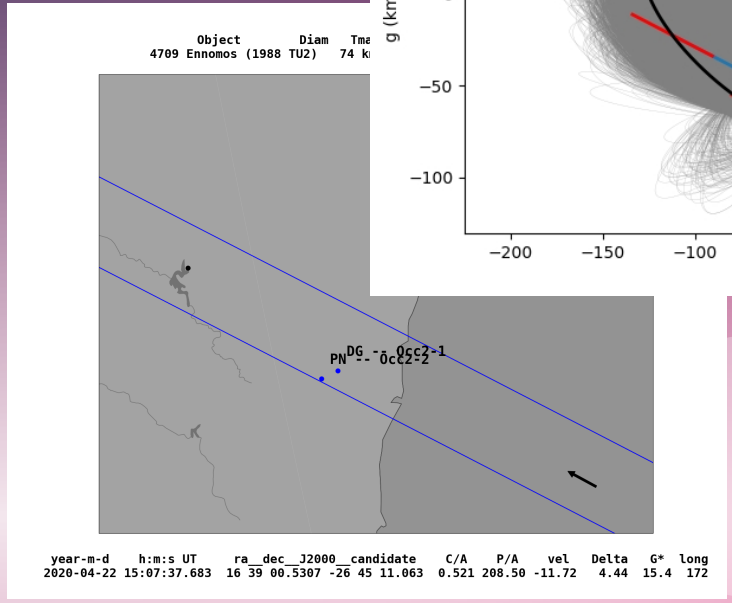


Occ2

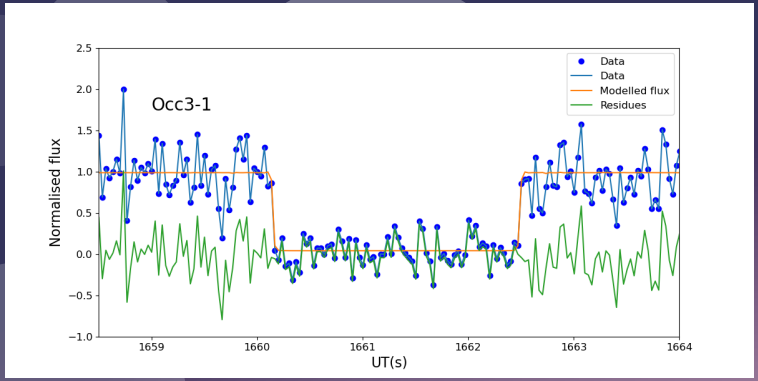
Apr. 22, 2020

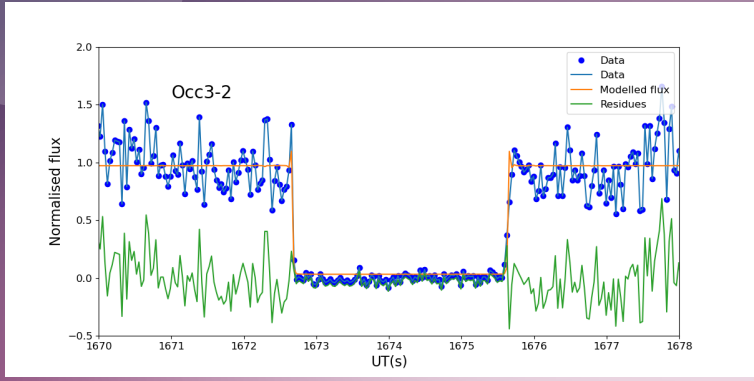


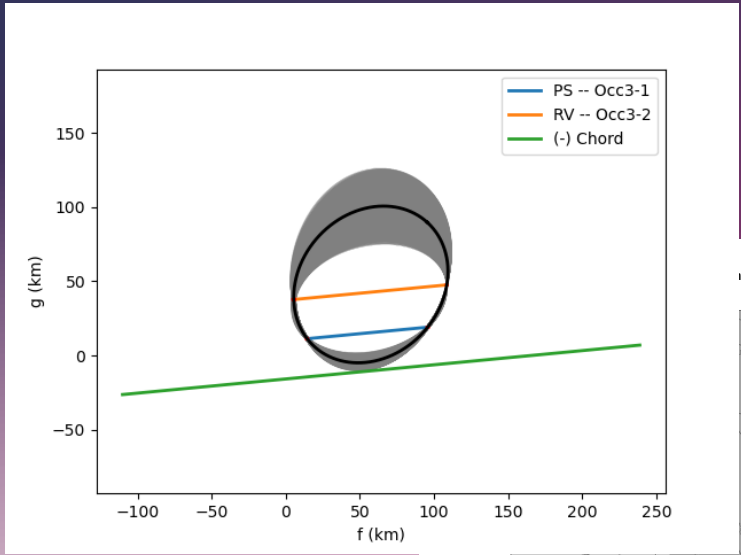




Analysis and Results

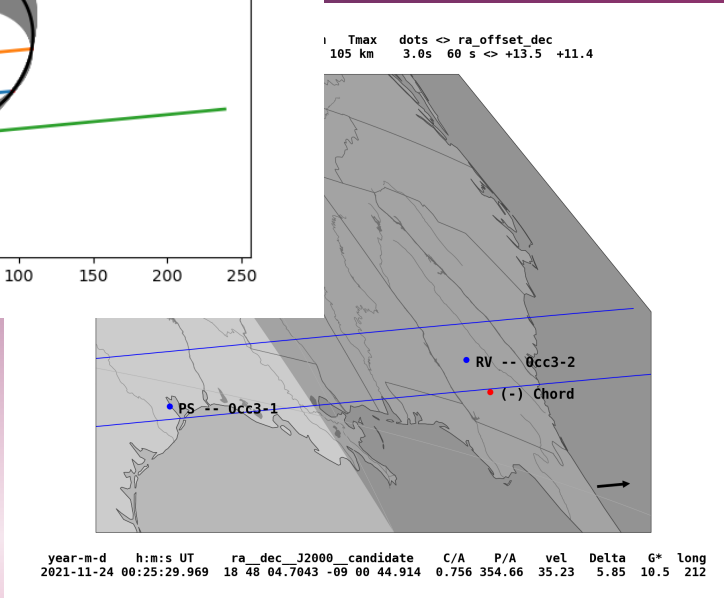






Occ3

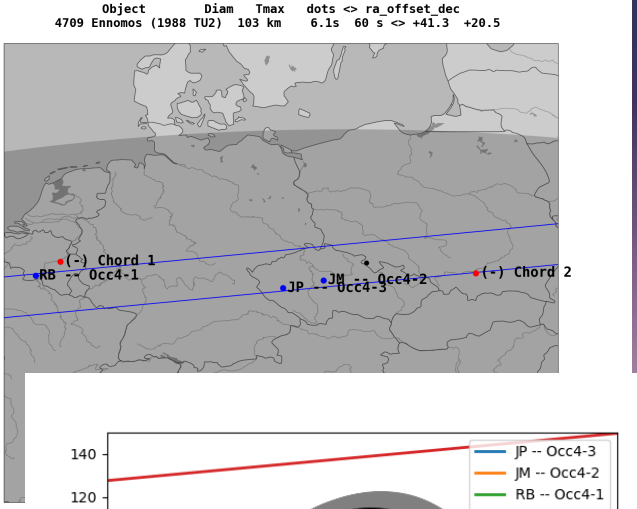
Nov. 24, 2021

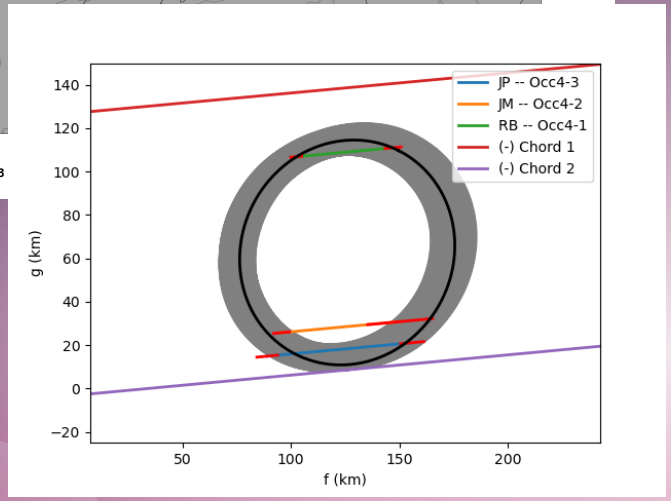


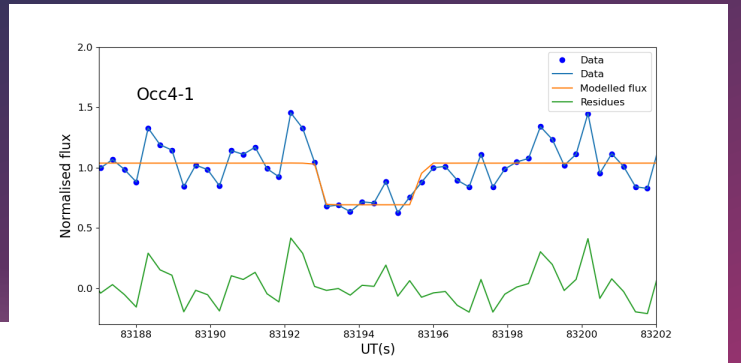
Analysis and Results

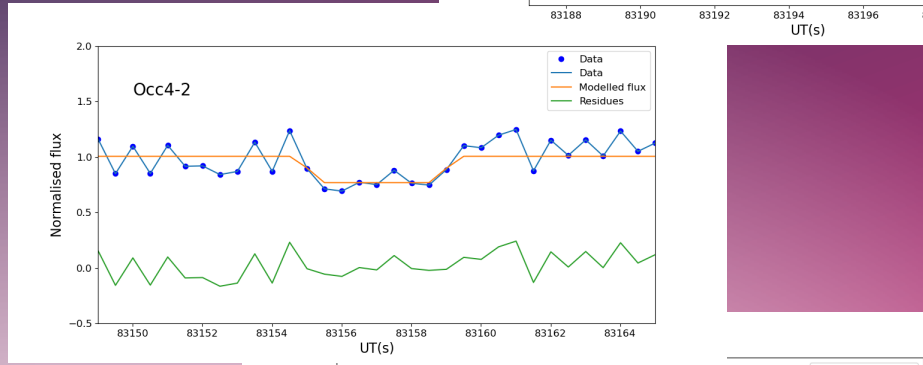
Occ4

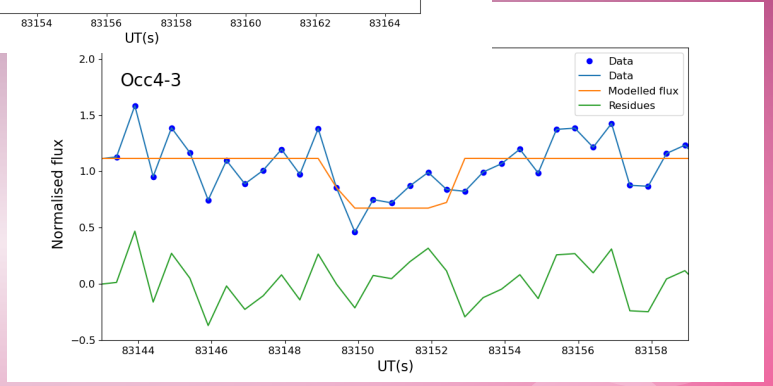
Aug. 03, 2022









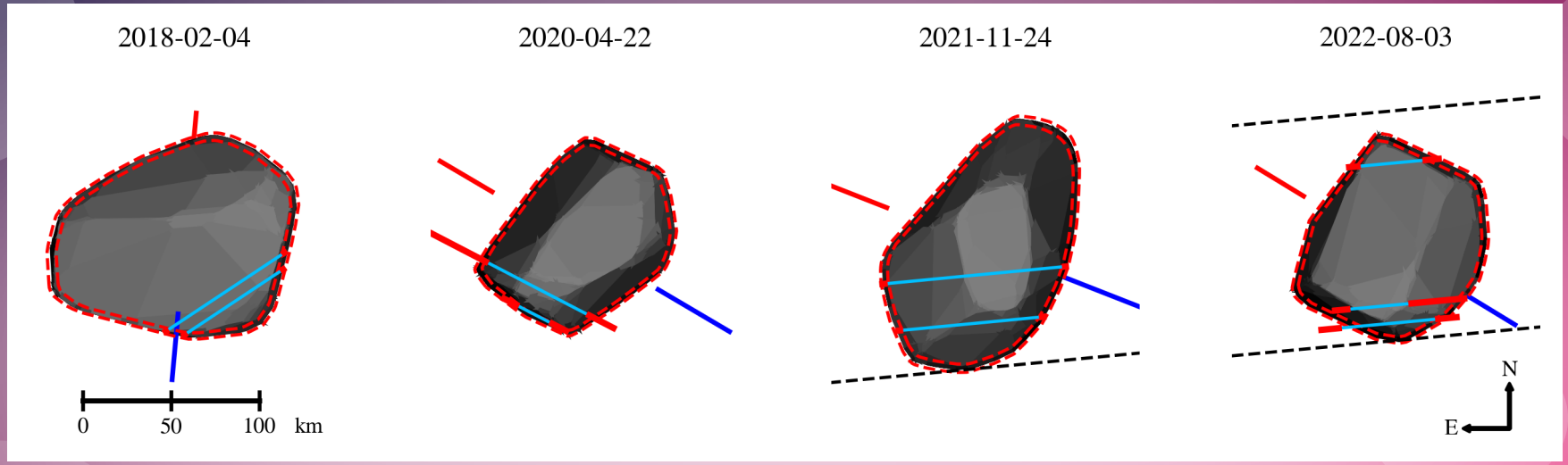


Analysis and Results

	Occ1 Feb. 04, 2018	Occ2 Apr. 22, 2020	Occ3 Nov. 24, 2021	Occ4 Aug. 03; 2022
R_{eq} (km)	53.90±1.18	68.88±19.86	59.89±7.15	52.97±2.13
R_v (km)	51.73±1,21	52.43±29.22	54.94±8.60	51.52±2.45
Albedo	6.3 %	7.8 %	5.9 %	6.2 %

Work in Progress

	Occ1 Feb. 04, 2018	Occ2 Apr. 22, 2020	Occ3 Nov. 24, 2021	Occ4 Aug. 03; 2022
R_{eq} (km)	53.90±1.18	68.88±19.86	59.89±7.15	52.97±2.13
R_v (km)	51.73±1,21	52.43±29.22	54.94±8.60	51.52±2.45
Albedo	6.3 %	7.8 %	5.9 %	6.2 %



References

1. Marzari, F., Scholl, H., Murray, C., & Lagerkvist, C. (2002). Origin and evolution of Trojan asteroids. Asteroids III, 1, 725-738.
2. McNeill, A., Erasmus, N., Trilling, D. E., Emery, J. P., Tonry, J. L., Denneau, L., ... & Weiland, H. J. (2021). Comparison of the Physical Properties of the L4 and L5 Trojan Asteroids from ATLAS Data. The Planetary Science Journal, 2(1), 6.
3. Durech, J., Hanuš, J., & Vanˇco, R. 2019, A&A, 631, A2
4. Herald, D., Gault, D., Anderson, R., Dunham, D., Frappa, E., Hayamizu, T., ... & Timerson, B. (2020). Precise astrometry and diameters of asteroids from occultations–a data set of observations and their interpretation. Monthly Notices of the Royal Astronomical Society, 499(3), 4570-4590.
5. Nesvorný, D., Vokrouhlický, D., & Morbidelli, A. (2013). Capture of Trojans by jumping Jupiter. The Astrophysical Journal, 768(1), 45.
6. Tedesco, E. F., Noah, P. V., Noah, M., & Price, S. D. 2002, AJ, 123, 1056
7. Wong, I. & Brown, M. E. 2023, AJ, 165, 15

Thank you for your attention !