Upgrade of the photometric telescope in Borowiec for occultation work

+ an update on Slow Rotators project

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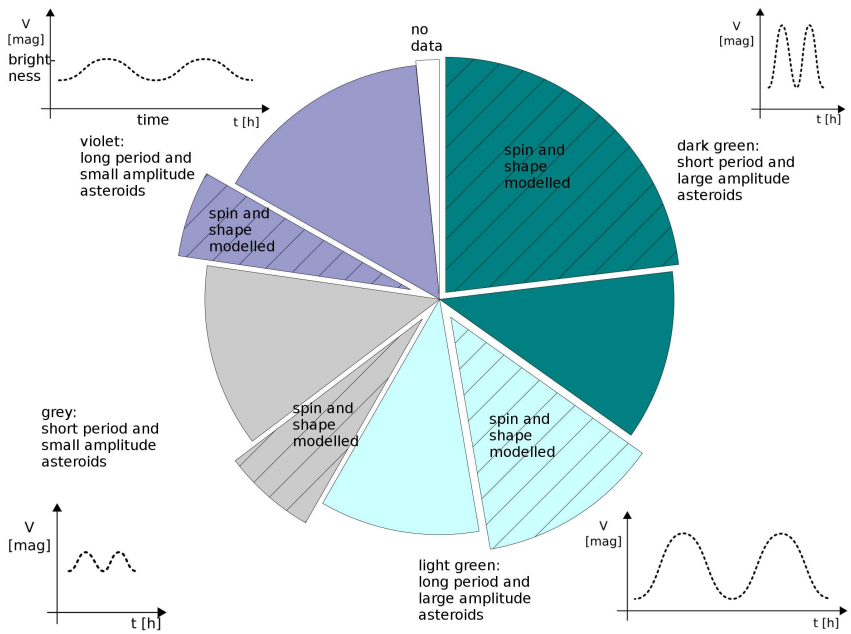
ESOP XL, 29 August 2021

Most wanted slow rotators for occultation observations

70 Panopaea	581 Tauntonia
101 Helena	657 Gunlod
215 Oenone	666 Desdemona
223 Rosa	668 Dora
269 Justitia	672 Astarte
279 Thule	688 Melanie
286 Iclea	738 Alagasta
305 Gordonia	777 Gutemberga
309 Fraternitas	806 Gyldenia
326 Tamara	814 Tauris
366 Vincentina	833 Monica
373 Melusina	838 Seraphina
395 Delia	845 Naema
397 Vienna	859 Bouzareah
412 Elisabetha	**880 Herba**
429 Lotis	903 Nealley
439 Ohio	**907 Rhoda**
464 Megaira	921 Jovita
524 Fidelio	931 Whittemora
527 Euryanthe	938 Chlosinde
541 Deborah	992 Swasey
551 Ortrud	999 Zachia
566 Stereoskopia	1062 Ljuba



IOTA/ES sub-page for „Neglected asteroids”

https://www.iota-es.de/neglected_asteroids.html

International Occultation Timing Association
European Section

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Call for Observations

Neglected Asteroids

Astronomical Observatory Institute of Poznan, Poland is coordinating a world-wide observing campaign of somewhat neglected asteroids. These are small bodies of the main belt with slow rotation and small lightcurve amplitudes, avoided by most of previous studies [1]. The aim is to improve biased statistics of spin and shape modelled asteroids. Recent results from TESS spacecraft have shown that slow rotators are actually dominating in the population of main belt asteroids [4], while asteroids with available spin and shape model have predominantly short rotation periods.

We focus on multi-apparition photometric observations, lightcurve inversion modelling, and scaling those models with thermal infrared data [2, 3]. However, many of these asteroids have poor or problematic thermal datasets, and cannot be precisely scaled this way. This is where good, multi-chord occultation can greatly help. Occultations can also pinpoint the correct spin and shape solution from two mirror ones produced by lightcurve inversion (see e.g. Svea model fitting in paper [2]). For some of our targets, marked in bold in the list, Gaia mission will provide mass, so precise density could be derived for studies on internal composition.

Please join the project and observe stellar occultations by the these asteroids, whenever possible.

List of proposed asteroids

70	Panopaea	581	Tauntonia
101	Helena	657	Gunlod
215	Oenone	666	Desdemona
223	Rosa	668	Dora
269	Justitia	672	Astarte
279	Thule	688	Melanie
286	Iclea	738	Alagasta
305	Gordonia	777	Gutemberga
309	Fraternitas	806	Gyldenia
326	Tamara	814	Tauris
366	Vincentina	838	Seraphina
373	Melusina	845	Naema
395	Delia	859	Bouzareah
397	Vienna	**880**	**Herba**
412	Elisabetha	903	Nealley
429	Lotis	**907**	**Rhoda**
439	Ohio	921	Jovita
464	Megaira	931	Whittemora
524	Fidelio	938	Chlosinde
527	Euryanthe	992	Swasey
541	Deborah	999	Zachia
551	**Ortrud**	1062	Ljuba
566	**Stereoskopia**		

In case of any questions, please contact Dr. Anna Marciniak at: am@amu.edu.pl

IOTA/ES predictions for „Neglected asteroids”

https://www.iota-es.de/pred4neglected.html

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Call for Observations

Predictions for "Neglected Asteroids"

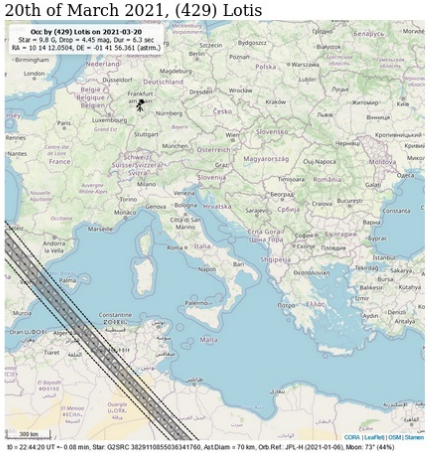
Astronomical Observatory Institute of Poznan, Poland is coordinating a world-wide observing campaign of somewhat neglected asteroids. These are small bodies of the main belt with slow rotation and small lightcurve amplitudes, avoided by most of previous studies [1]. The aim is to improve biased statistics of spin and shape modeled asteroids. Recent results from TESS spacecraft have shown that slow rotators are actually dominating in the population of main belt asteroids [2], while asteroids with available spin and shape model have predominantly short rotation periods.

On this site occultation predictions for central Europe are presented in the next one or two months. All events are calculated using Gaia DR2 catalog and the best asteroid prediction available at the time of generated the prediction. The data base for the asteroid's orbit you see in the lower left corner of the graphic.

[1] Marciniak et al. 2015, "Against the bias in spins and shapes of asteroids", Planet Space Sci. 118, 256; arXiv:1711.02429
[2] Pál et al. 2020 ''Solar System objects observed with TESS -- First data release: bright main-belt and Trojan asteroids from the Southern Survey'' ApJS 247, 26; arXiv:2001.05922

More information about the "Neglected Asteroids Project" you can find here.

20th of March 2021, (429) Lotis

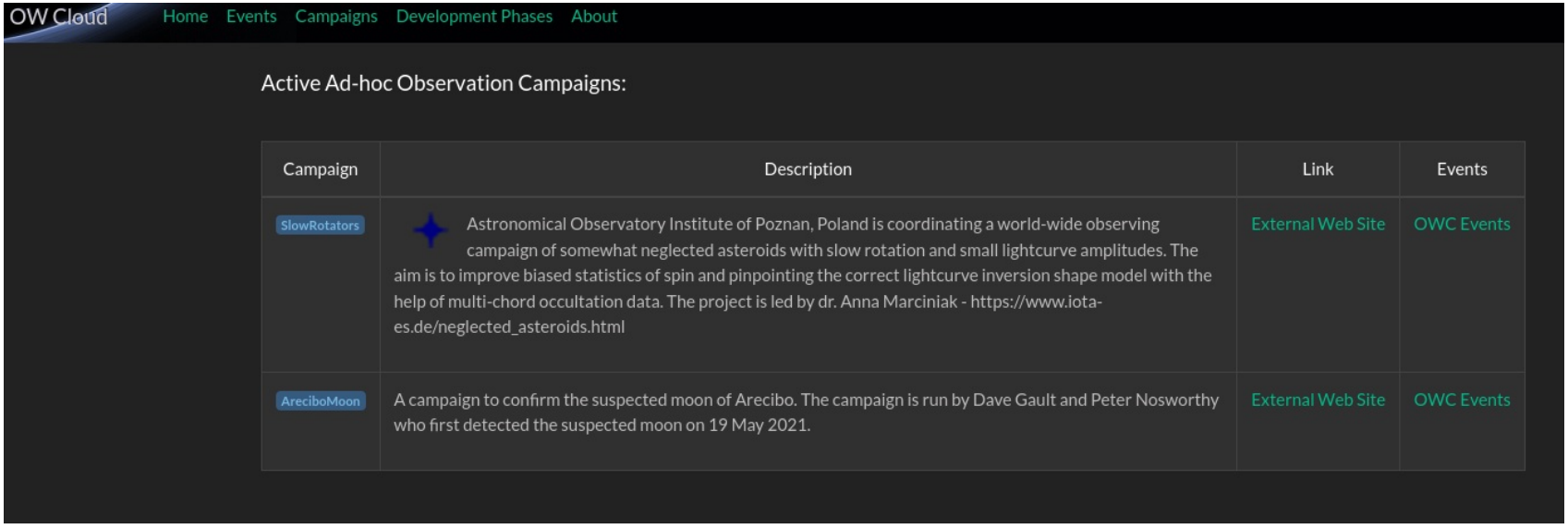


21st of March 2021, (527) Euryanthe

www.iota-es.de/index.html

Occult Watcher Cloud tag for Slow Rotators

https://cloud.occultwatcher.net/campaigns

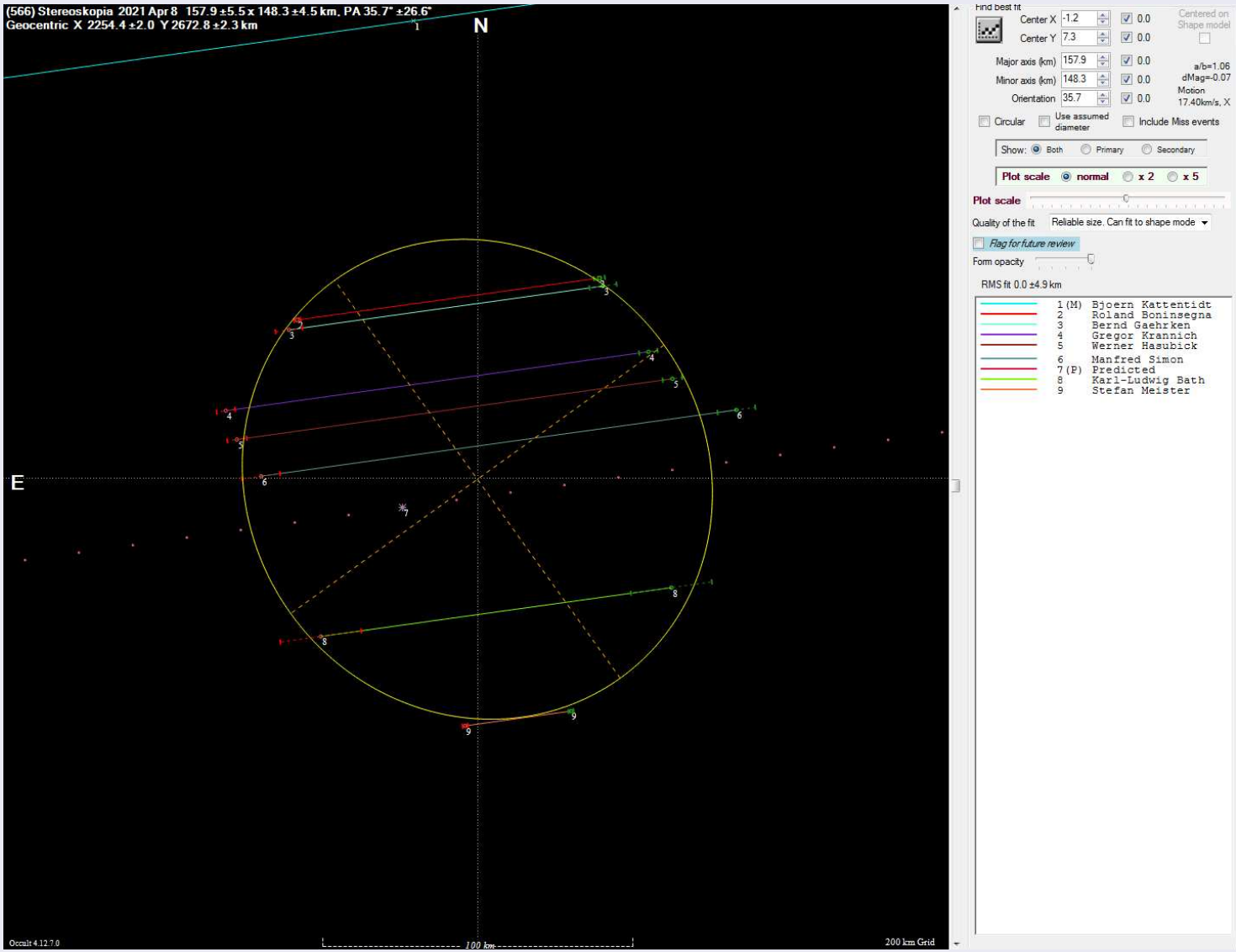


Occultations by Slow Rotators observed by European observers since October 2020

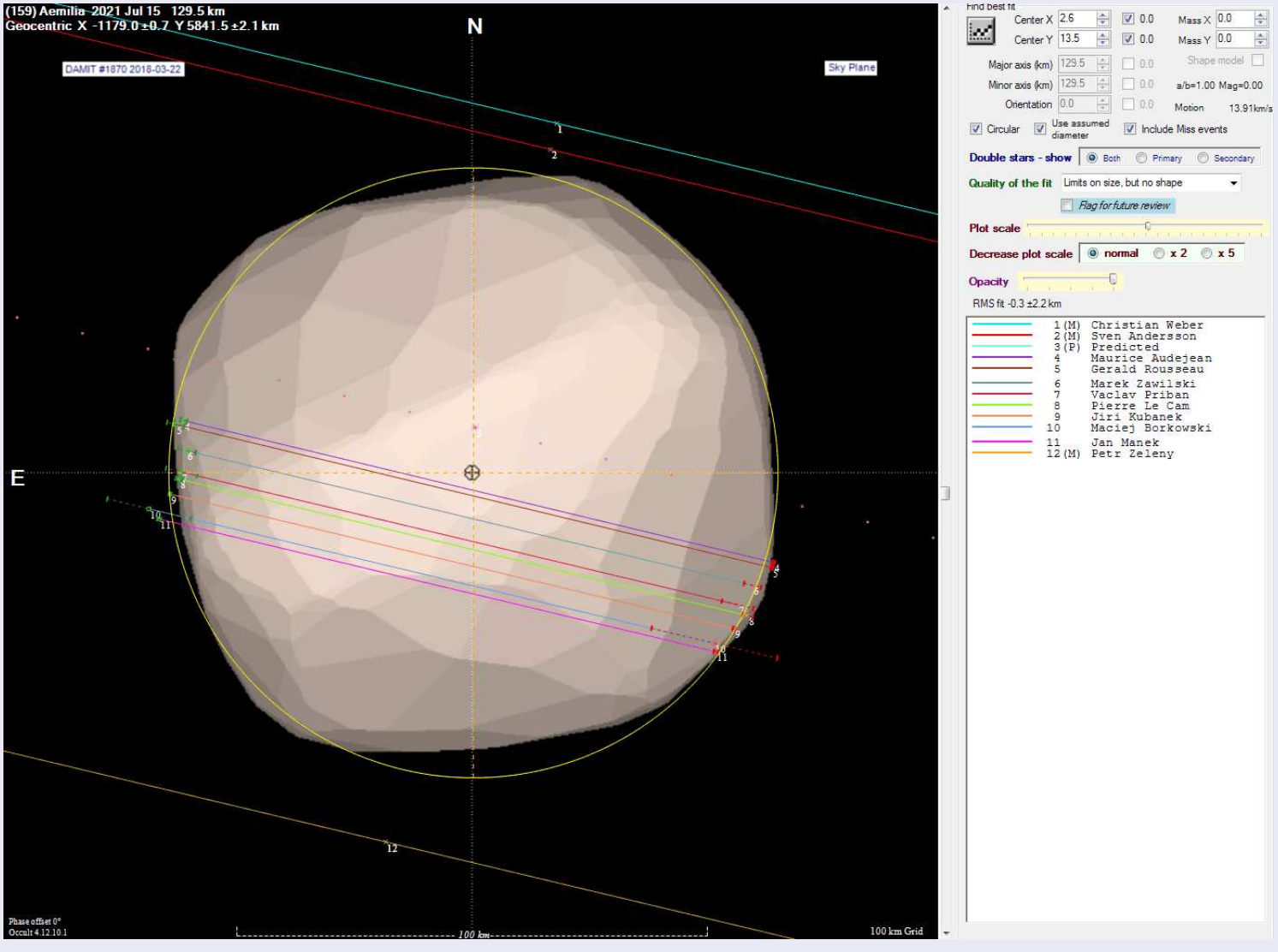
Month	Predicted events	Observed events	Highlights
October 2020	12	4	657 Gunlod, negative for all 5 sites in 1-2σ zone Another Gunlod event: **14 announced stations**, 2 neg.
November 2020	4	1	**First positive!** Target: 439 Ohio
December 2020	3	2	single negatives
January 2021	13	5	618 Elfriede: 2 positives, 1 negative 395 Delia: 1 positive 12 announced stations for 859 Bouzareah, 1 negative
February 2021	9	4	618 Elfriede: 1 positive 780 Armenia: 13 announced stations, 2 positives 1062 Ljuba: 13 announced stations, 2 pos., 4 neg.
March 2021	9	2	single negatives
April 2021	5	1	556 Stereoskopia: 16 ann. stations, **7 positives**, 1 neg.
May 2021	1	1	1 negative for 1062 Ljuba
June 2021	0	0	
July 2021	4	2	159 Aemilia: **29 announced stations**, **8 positives**, 3 neg.
August 2021	1	2	880 Herba: 2 positives

Summary: 23 events observed, 2 with multiple positive chords.

556 Stereoskopia event, 8 April 2021

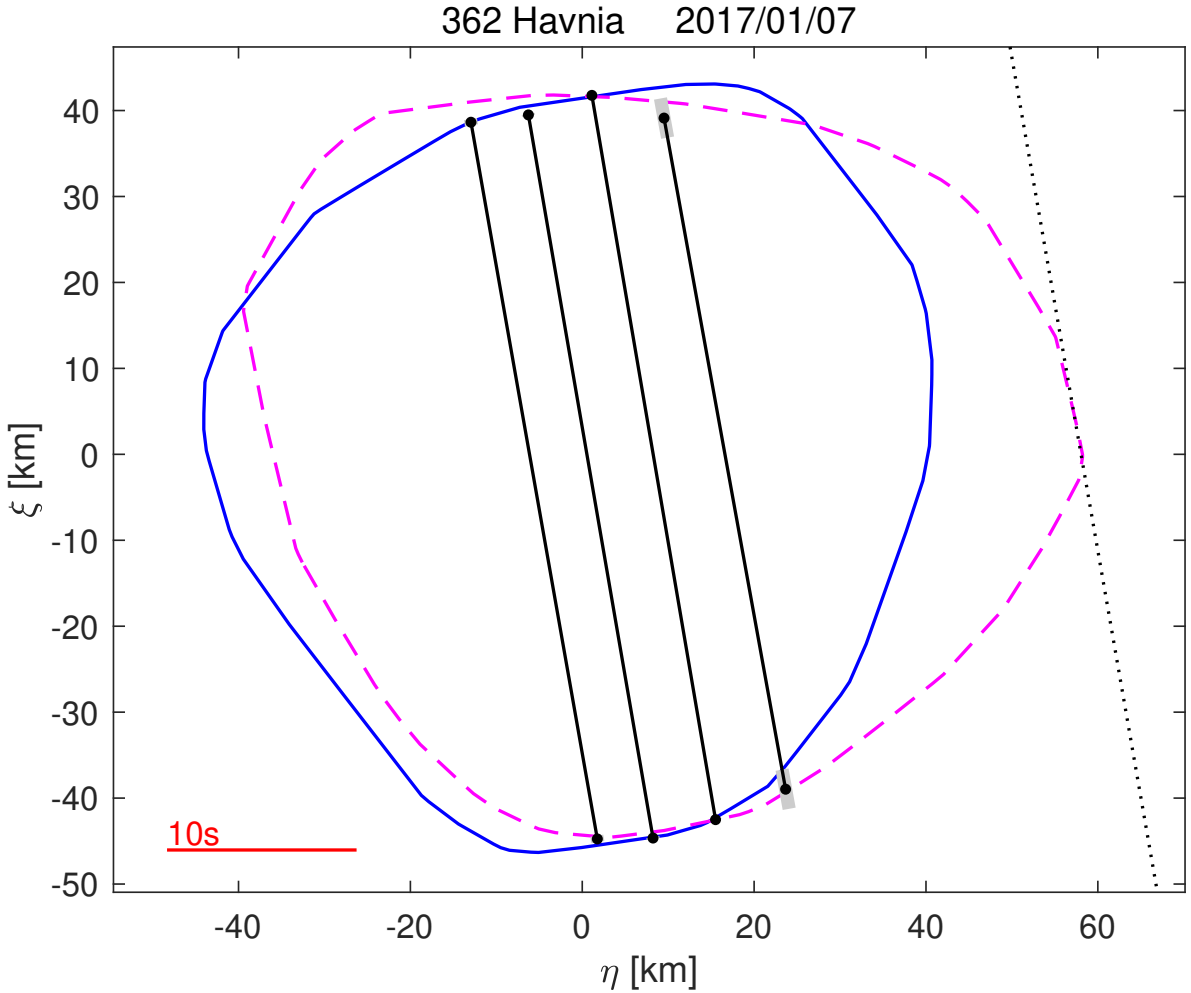


159 Aemilia event, 15 July 2021



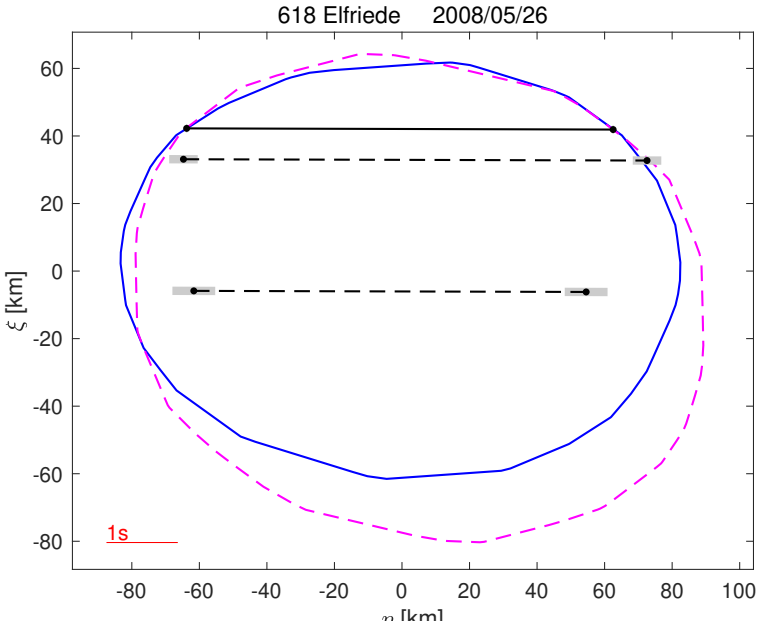
http://euraster.net, Marciniak et al. (2018)

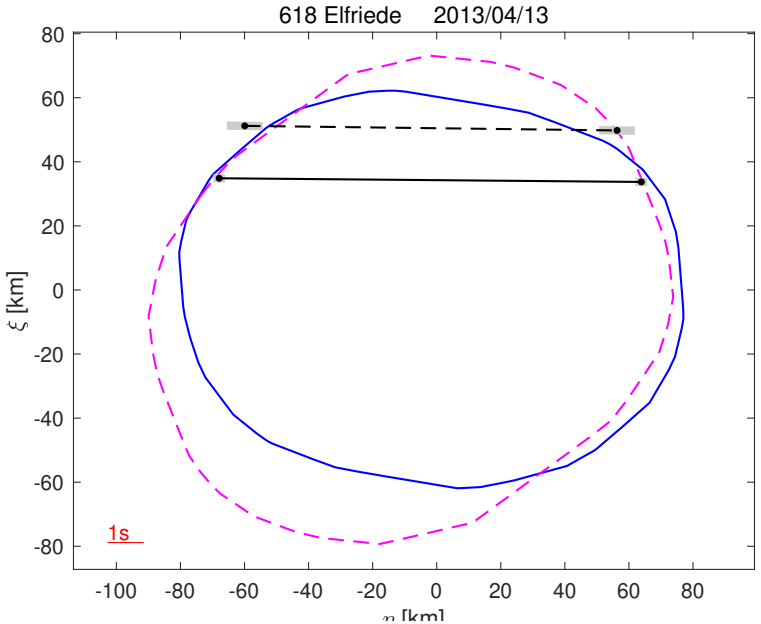
362 Havnia event, 17 January 2017

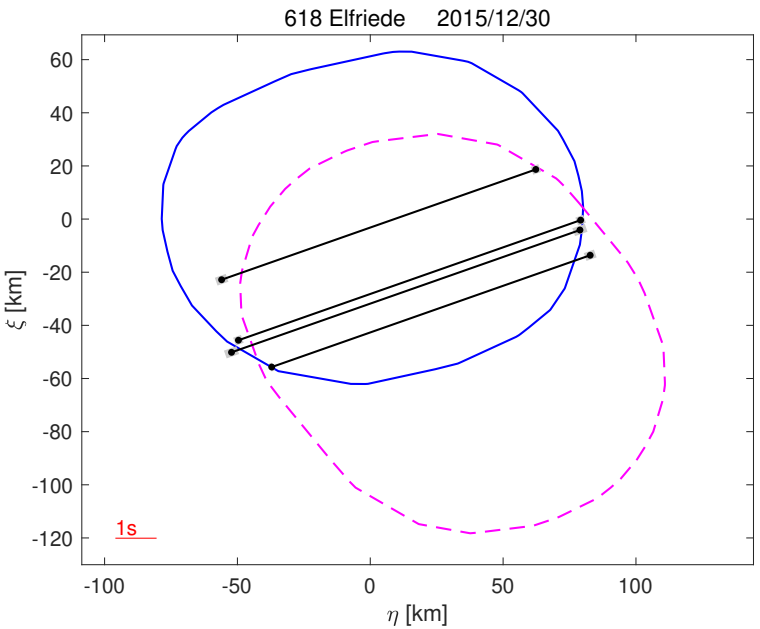


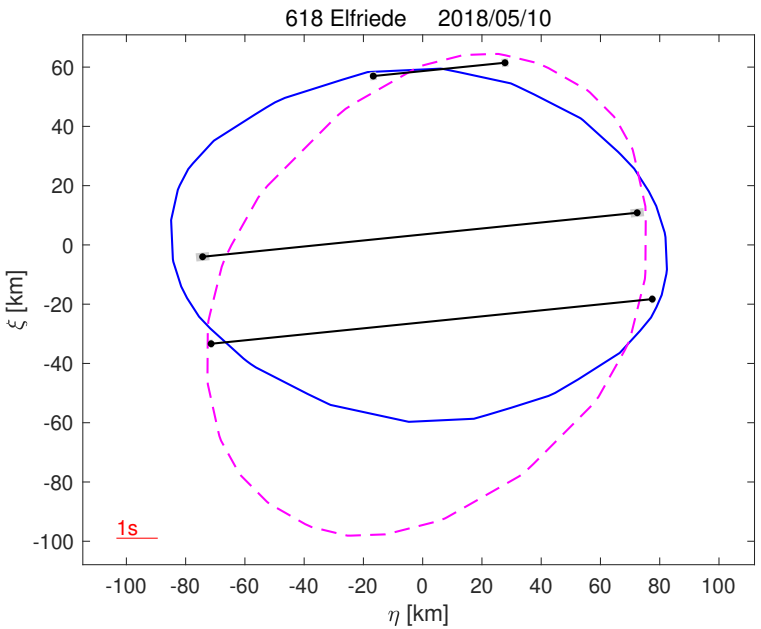
Marciniak et al., Astronomy Astrophys., in print

618 Elfriede events + CITPM model

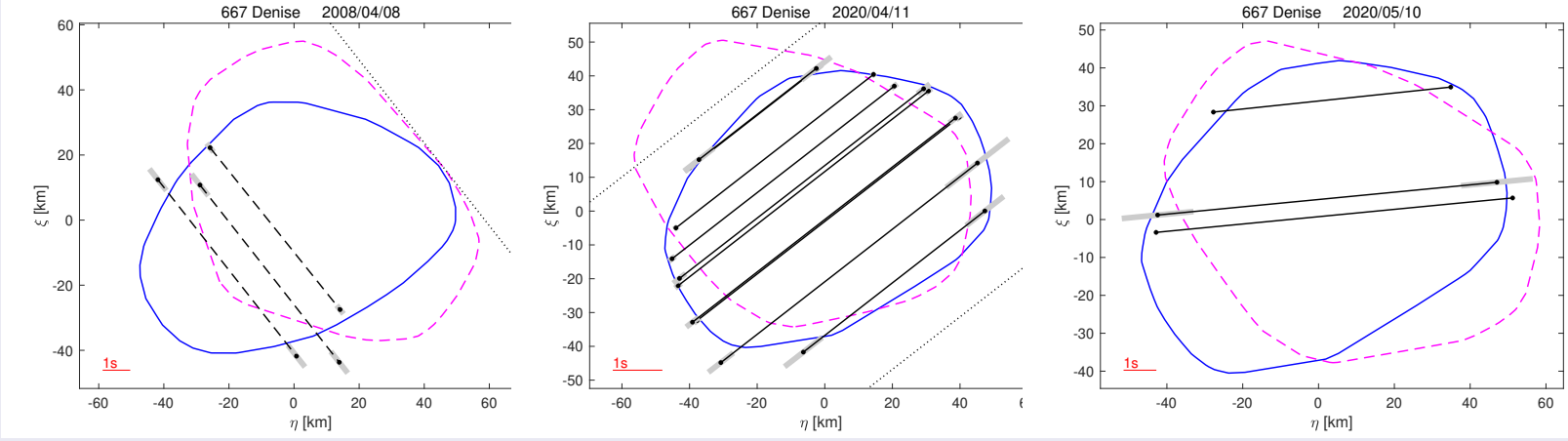








667 Denise events + CITPM model



Marciniak et al., Astronomy Astrophys., in print

Sizes of Havnia, Elfriede and Denise from occultation scaling

Target	Pole 1	Pole 2
362 Havnia	84 ± 1 km	88 ± 1 km
618 Elfriede	145 ± 7 km	155 ± 2 km
667 Denise	83 ± 2 km	rejected

Table: Diameters of equivalent volume spheres for CITPM shape models fitted to stellar occultations.

Marciniak et al., Astronomy Astrophys., in print

Observers of Havnia, Elfriede and Denise events

(362) Havnia, 2017-01-07

P. Maley	Gila Bend, AZ
C. Wiesenborn	Boulder City, NV
W. Thomas	Florence, AZ
T. George	Scottsdale, AZ

(618) Elfriede, 2008-05-26

D. Breadsell	Toowoomba, Qld, AU
J. Bradshaw	Samford, Qld, AU
P. Anderson	Range Observatory, Qld, AU

(618) Elfriede, 2013-04-13

D. Herald	Murrumbateman, NSW
J. Drummond	Patutahi, Gisborne, NZ

(618) Elfriede, 2015-12-30

J. Rovira	ES
R. Naves	ES
C. Perello, A. Selva	ES
C. Schnabel	ES

(618) Elfriede, 2018-05-10

J. Broughton	Woodburn, NSW, AU
J. Broughton	Grafton, NSW, AU
J. Broughton	Mullaway, NSW, AU

(667) Denise, 2008-04-08

R. Nugent	Pontotoc, TX
G. Nason	Tobermory, ONT, CA
M. McCants	Kingsland, TX
P. Maley, D. Weber	Horseshoe Bay, TX

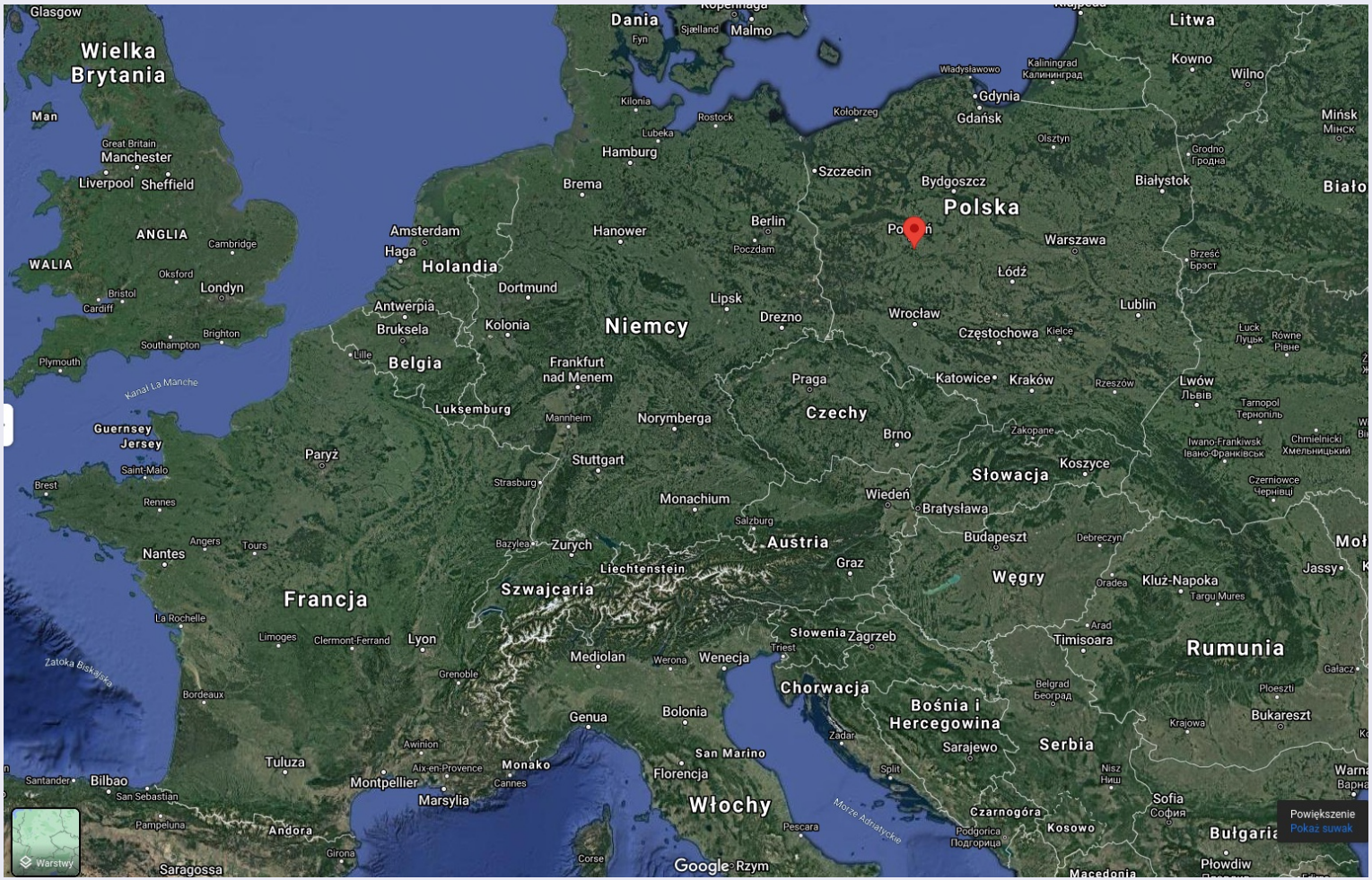
(667) Denise, 2020-04-11

S. Meister	CH
A. Schweizer	CH
C. Ellington	DE
S. Sposetti	CH
A. Manna	CH
A. Ossola	CH
O. Schreurs	BE
M. Bigi	IT
P. Baruffetti	IT
F. Van Den Abbeel	BE
J. Bourgeois	BE
R. Boninsegna	BE

(667) Denise, 2020-05-10

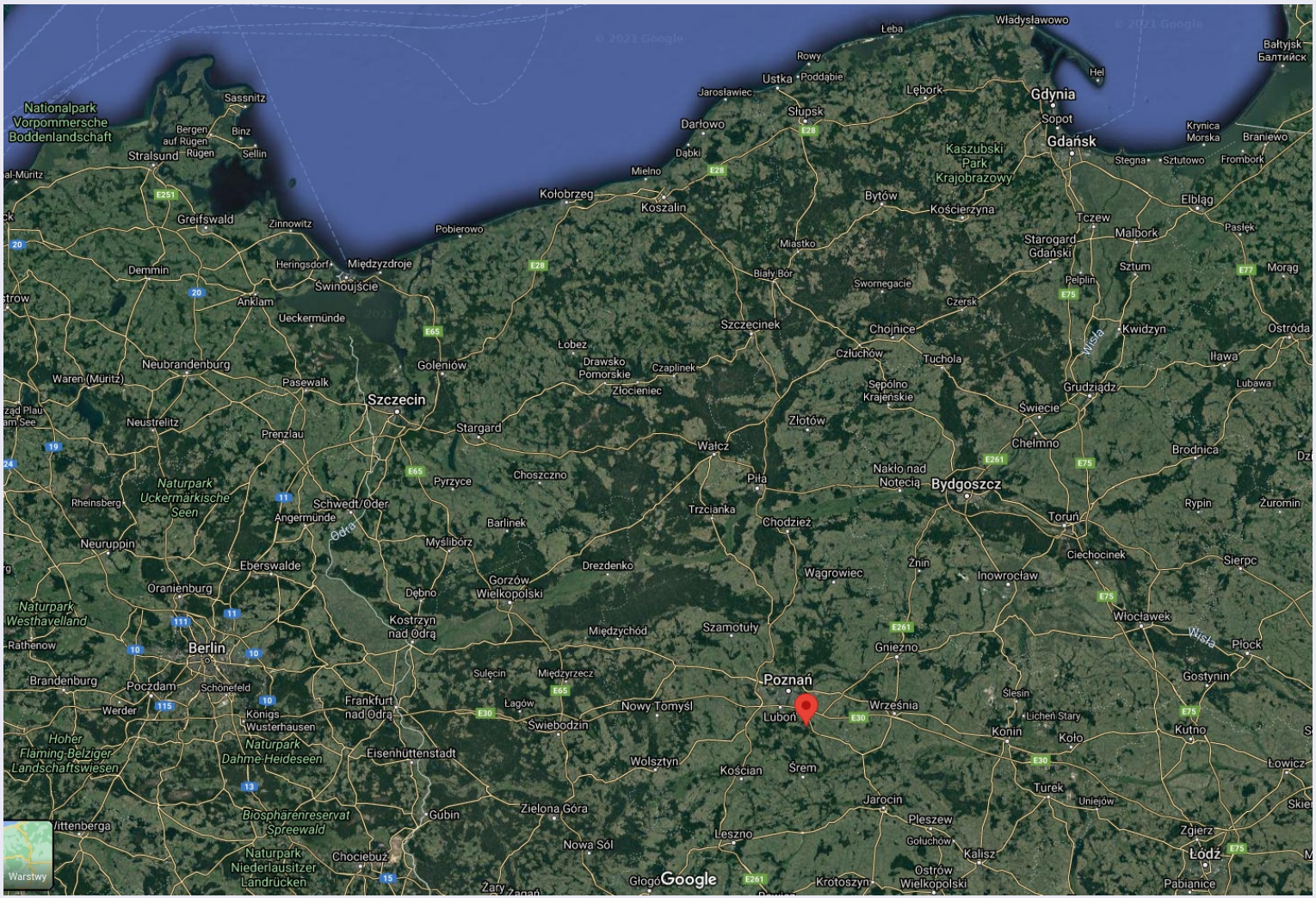
K. Hanna	MT
K. Green	CT
R. Kamin	PA
S. Conard	MD
K. Getrost	OH
A. Scheck	MD
A. Caroglanian	MD
J. Massura	IN
J. Harris	VA
C. Anderson, K. Thomason	ID
M. Wasiuta, B. Billard	VA
B. Billard	VA

Poznan, Poland



Google Maps

Poznan and Borowiec



Google Maps

Borowiec observing station (Astrogeodynamical Observatory, Polish Academy of Sciences)

http://www.astro.amu.edu.pl/en/about-us/telescopes/

Borowiec photometric telescope

40-cm Newtonian, operating since 1998. Main research topic: asteroid lightcurves.

Old camera at 40-cm photometric telescope in Borowiec

http://www.company7.com/sbig/products/st7.html

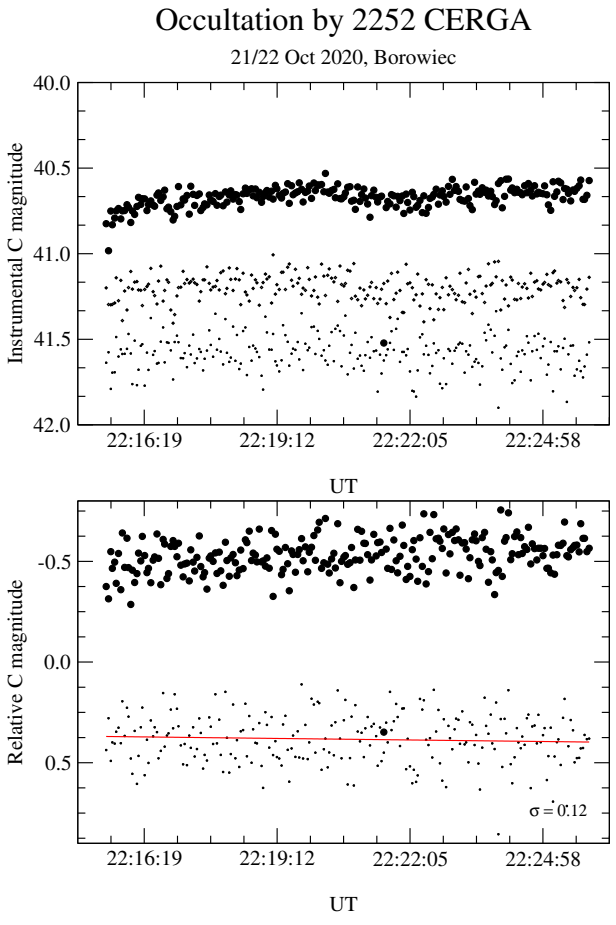
Sensor : SBIG ST7 CCD camera with KODAK KAF400 sensor
Time source : ntp server vega.cbk.poznan.pl (NTP++), accurate to 0.02s
Mode of recording: Resolution: Medium, Vertical binning: 2, Image size: Quarter
Readout time : At least 1.1 seconds

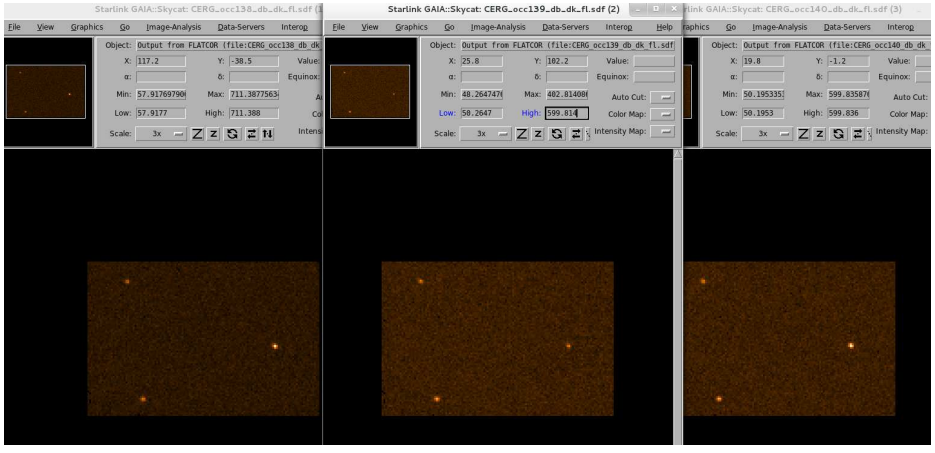
Occultations observed from Borowiec since October 2020

Month	Predicted events	Observed events	Highlights
October 2020	14	2	657 Gunlod, negative 2252 CERGA uncertain (single frame positive)
November 2020	5	1	18521 Chaos, negative **(16.8 mag star)**
December 2020	8	3	41 Daphne, **positive**
January 2021	14	2	2 negatives
February 2021	9	2	2 negatives
March 2021	5	2	499 Venusia, **positive**

Summary: 12 events observed until the camera exchange, 2 positives.

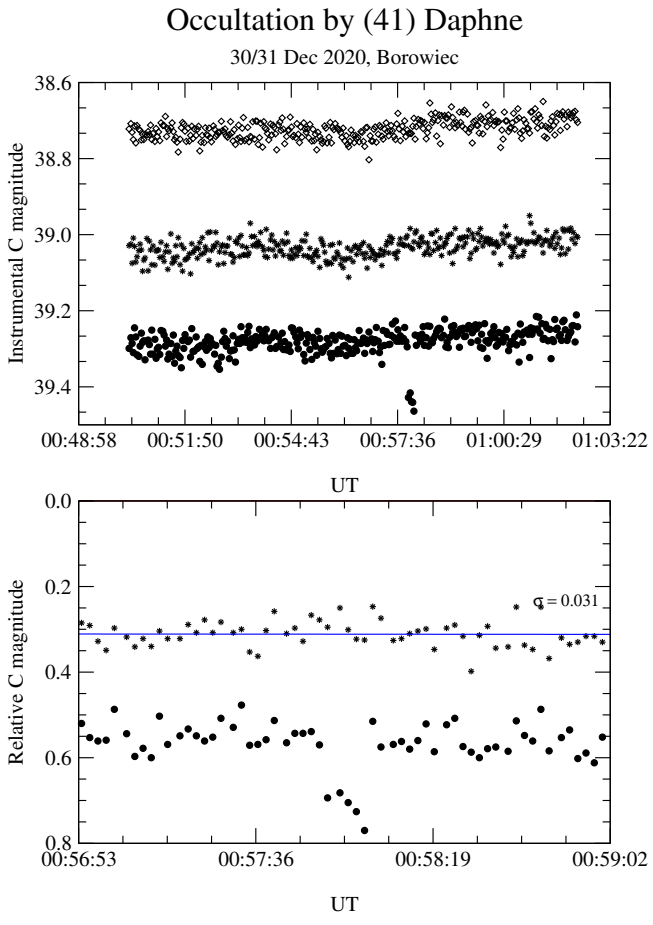
2252 CERGA event, 21 October 2020





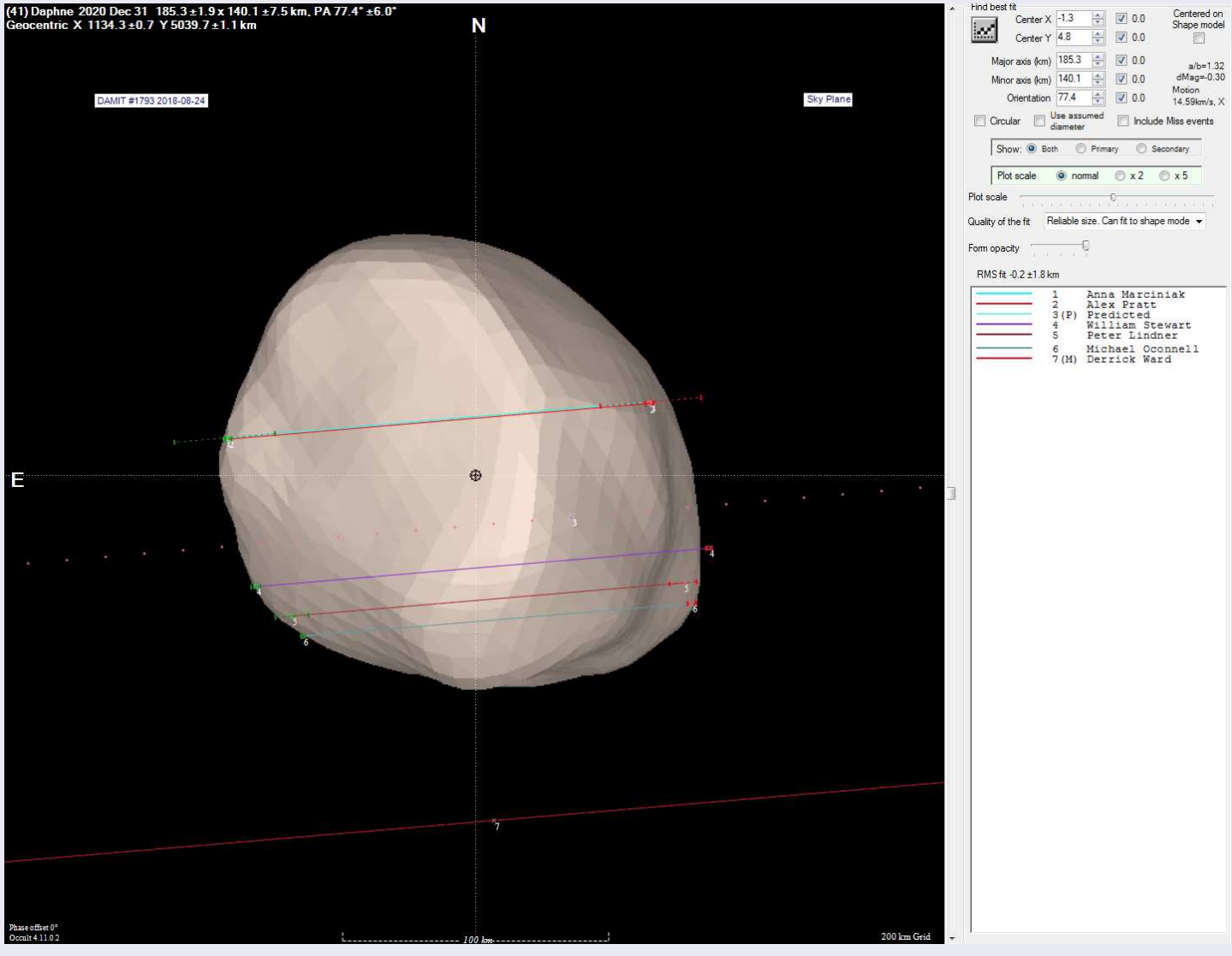
Star: 13.4 mag at 40 deg, dark skies, but 1.4s exposure, and 1.5s readout.
13% probability. Location just 3 km from the center line, but huge uncertainty (path width 24 km, sigma width 170km).

41 Daphne event, 30 December 2020



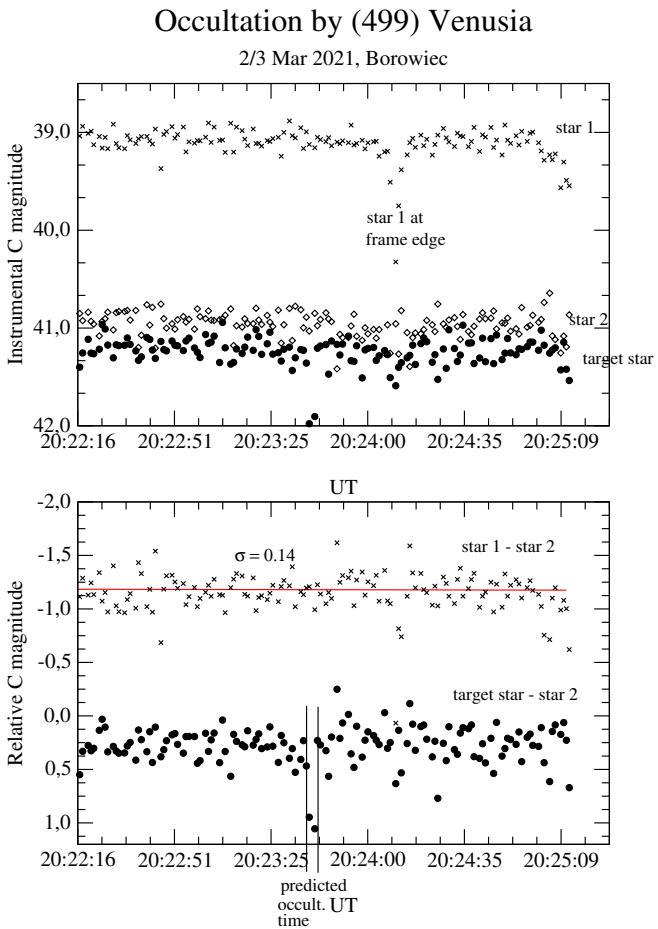
Star: 13.2 mag, but asteroid 11.9 mag (max drop 0.3 mag). Height 33 deg, Moon up.
Probability: 98%.
1.0 s exposure, readout: 1.15s, duration at least 10.8s.

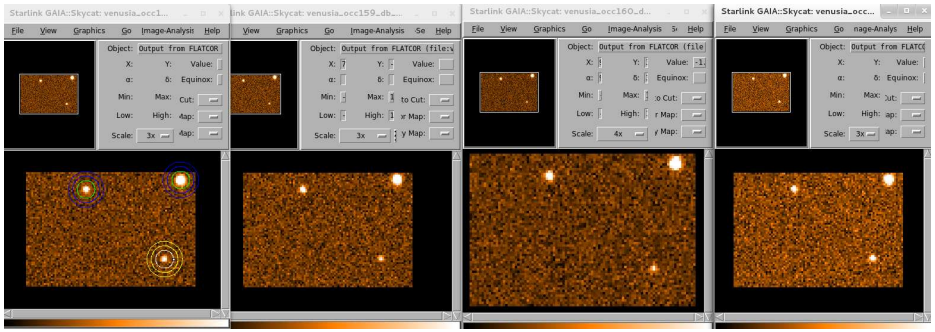
41 Daphne event, 30 December 2020



http://euraster.net, Carry et al. (2019)

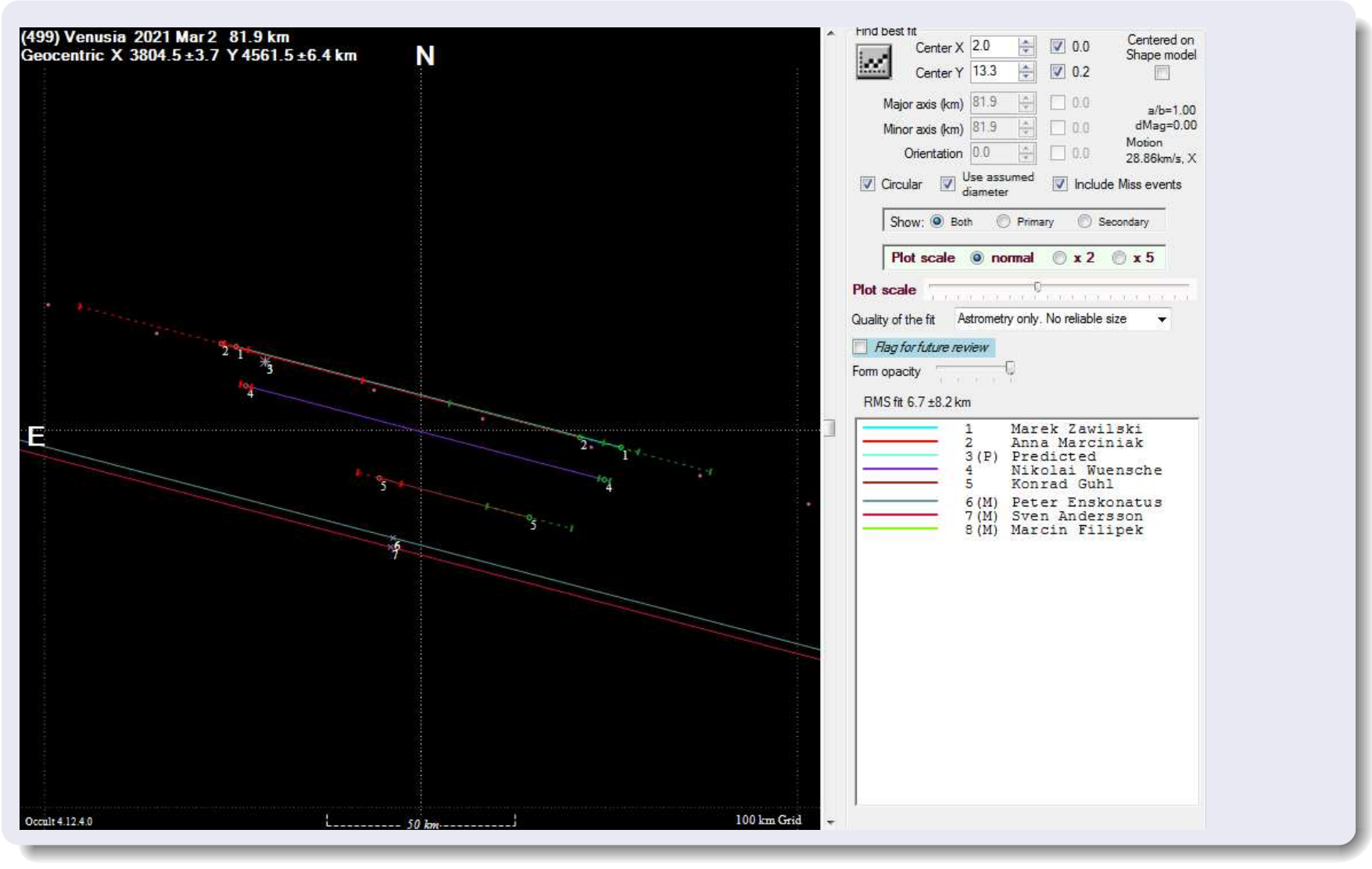
499 Venusia event, 1 March 2021





Star: 11.4 mag. Height: 21 deg, dark skies. Probability: 62%.
0.15 s exposure, readout: 1.15s, duration: 3.3s. Much lower mag drop than predicted (0.6 vs 4.1 mag), reported also by other observers.

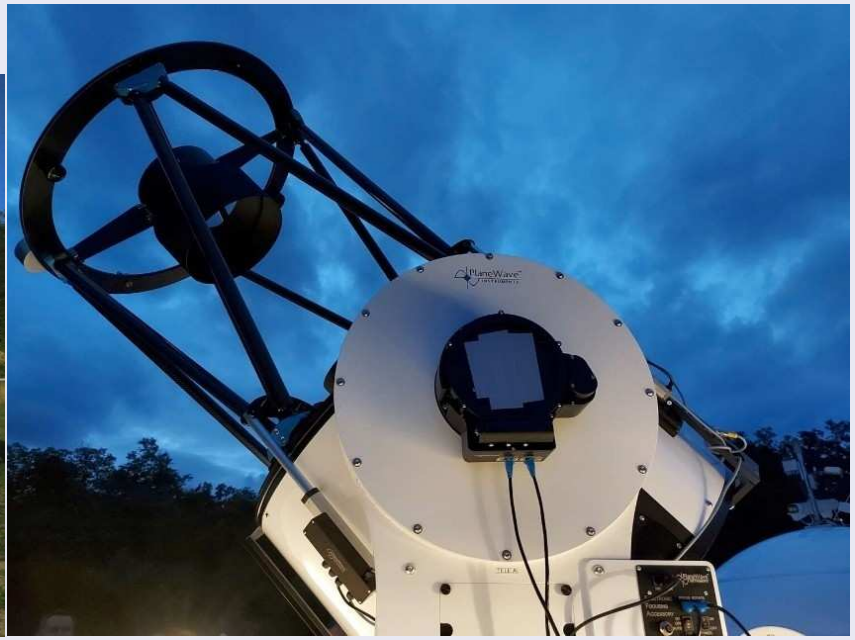
499 Venusia event, 1 March 2021



http://euraster.net

Chalin - protected Dark Skies Reserve

New node in Global Astrophysical Telescope
(Borowiec, Winer Observatory in Arizona, Chalin)
70-cm main telescope + five 30-cm auxiliary telescopes.
Main targets: variable stars and artificial satellites.

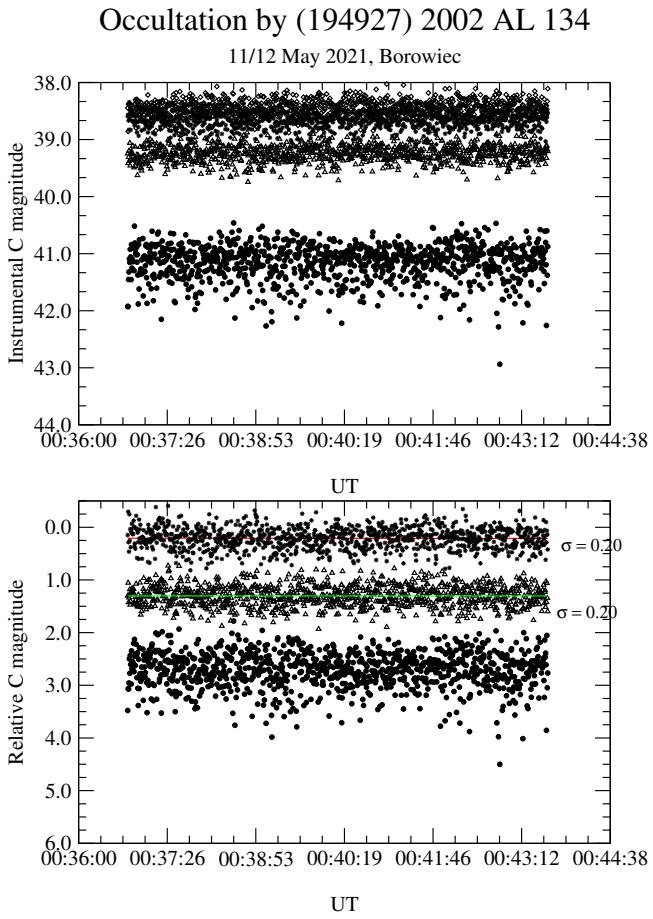


Andor Zyla 5.5 sCMOS camera

https://andor.oxinst.com/products/scmos-camera-series/zyla-5-5-scmos

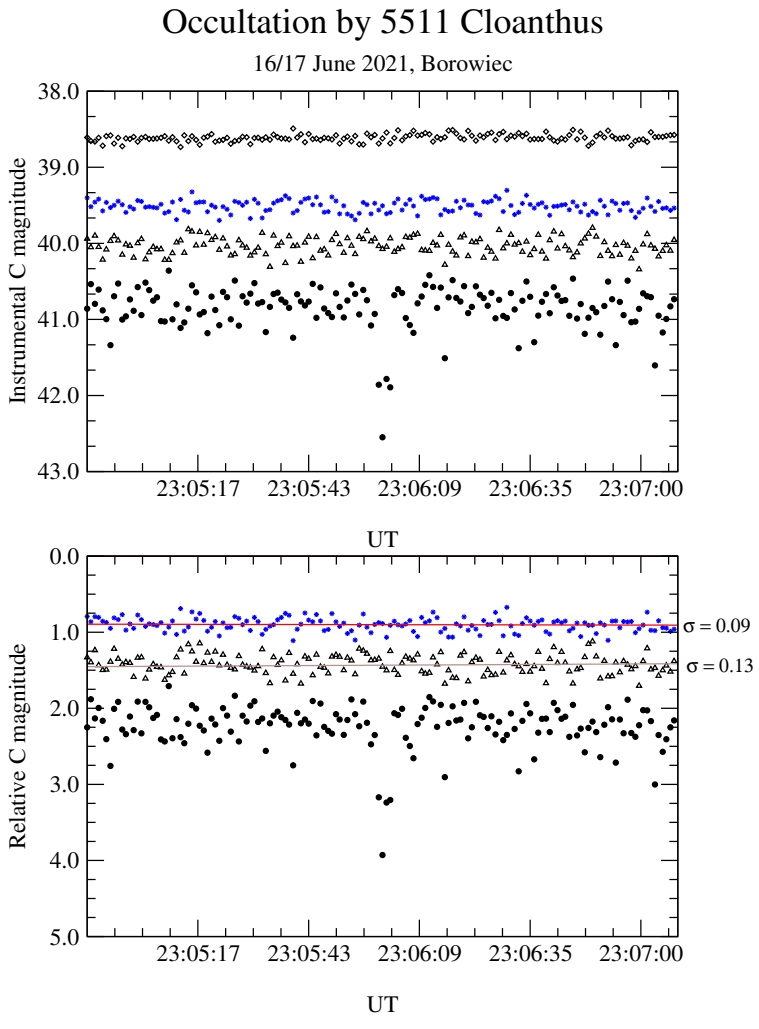
5 Megapixel, 6.5μm pixel - 22mm diagonal
0.9 e^- read noise
60% QE
100 fps Camera Link; 40 fps from USB 3.0

First event observed with Zyla camera



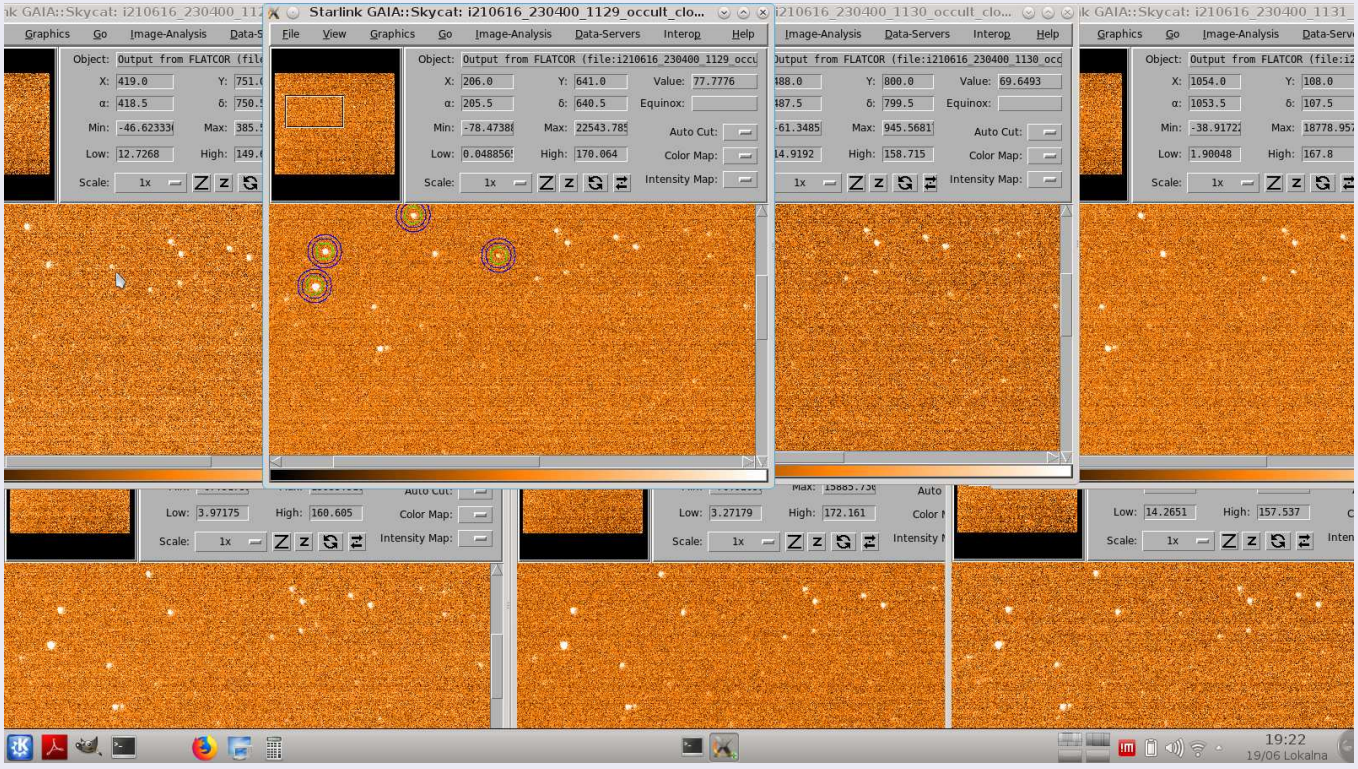
Star: 13.4 mag, max drop 8.0 mag. Height 14 deg, Moon up. Probability: 3.4%.
0.4 s exposure, **readout: 0.03s**, negative event.

First positive event observed with Zyla



First positive event observed with Zyla

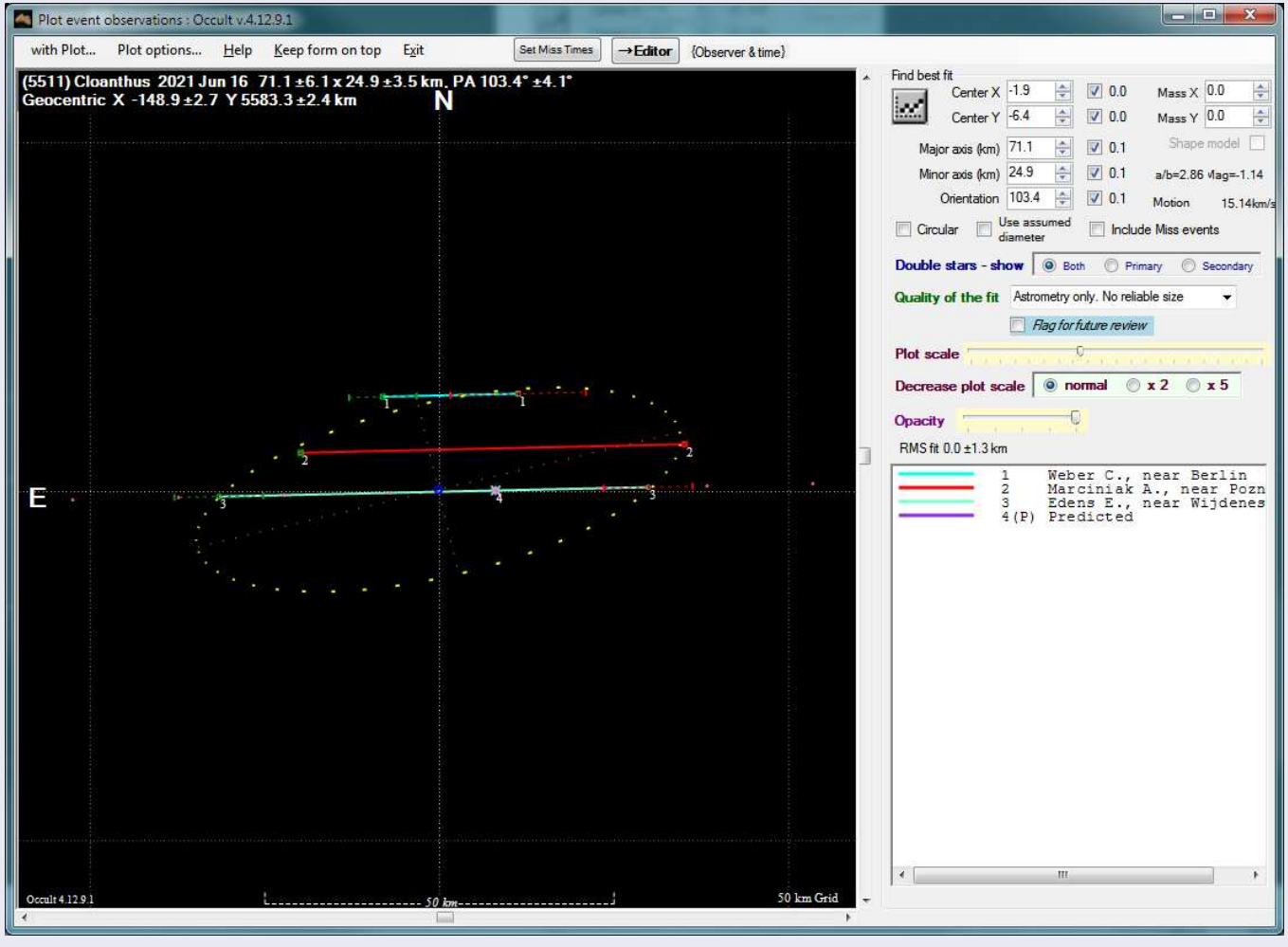
5511 Cloanthus, 16 June 2021



Star: 14.3 mag, max drop 2.7 mag. Height 29 deg, Dark skies. Probability: 90%.
0.9 s exposure, readout: 0.01s. Duration: 3.63 +/- 0.03 s.

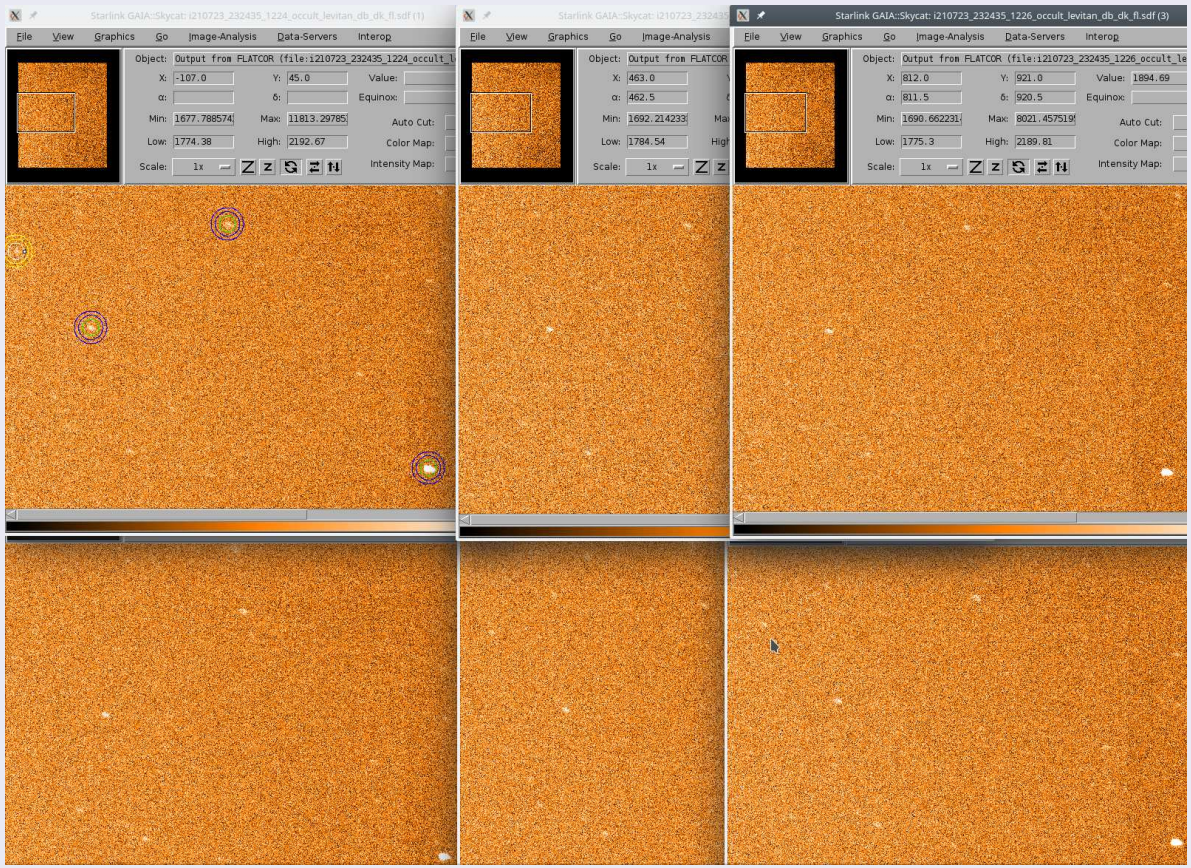
First positive event observed with Zyla

5511 Cloanthus fit by Christian Weber.



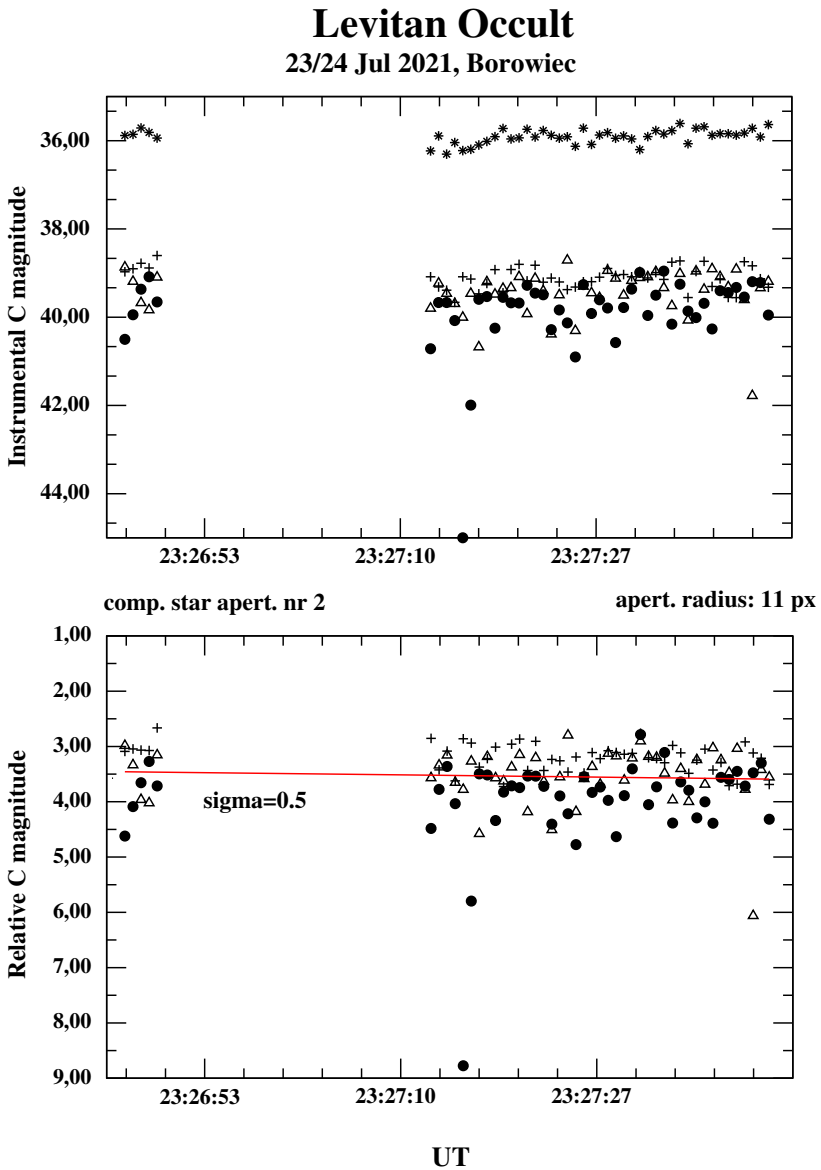
3566 Levitan - a border line case

Event: 23 July 2021. Telescope tracking out of order.



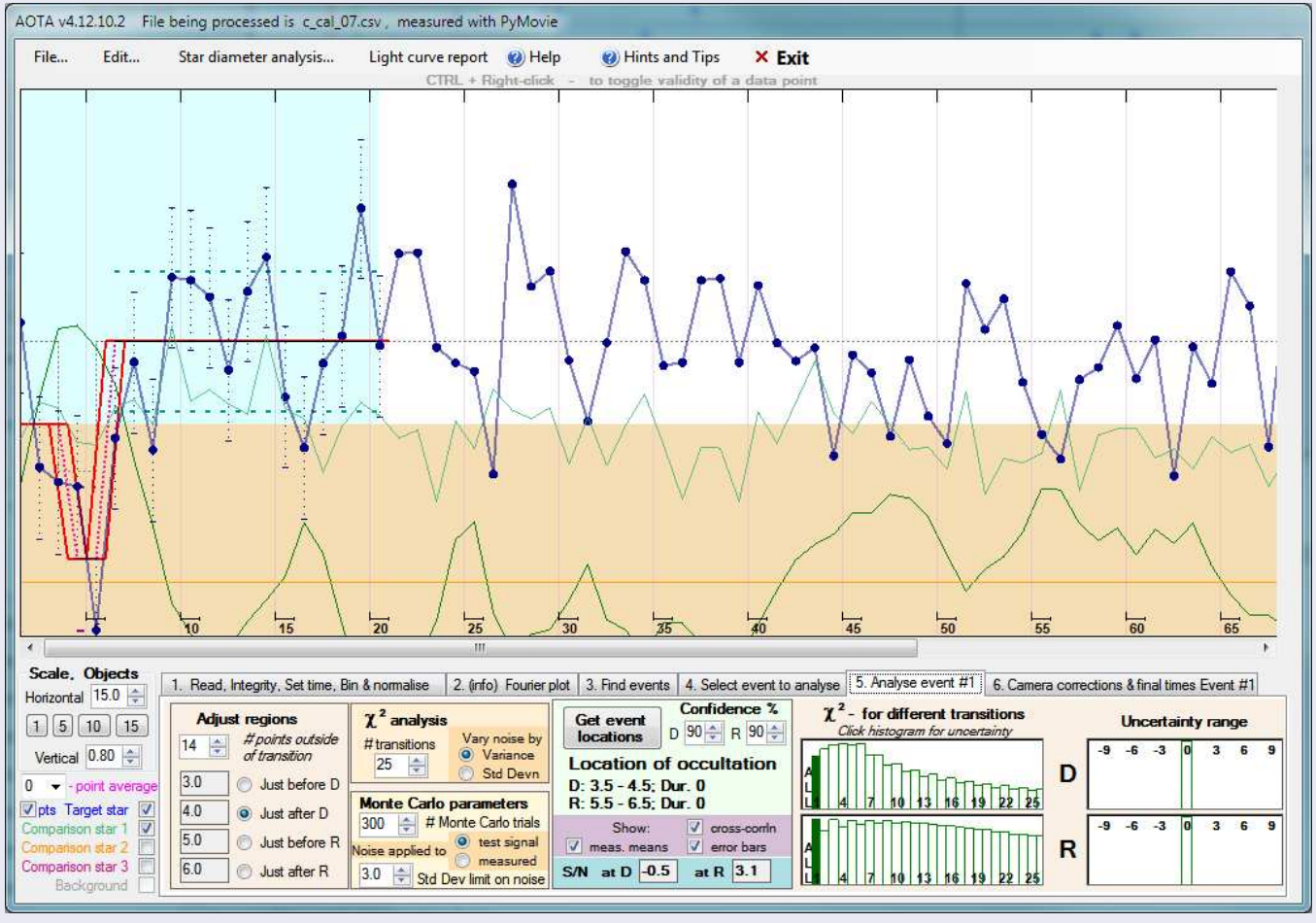
Star: 11.1 mag, max drop 5.9 mag. **Height 10: deg, (full) Moon distace: 22 deg**.
Probability: 90%. Drifting field, 0.7 s exposures, readout: 0.01s.
Probable duration: 1.42 s +/- 0.90 s.
Observers: Anna Marciniak, Iga Mieczkowska, Patrycja Poźniak, Julia Perła, Justyna Olszewska

3566 Levitan - a border line case



3566 Levitan - a border line case

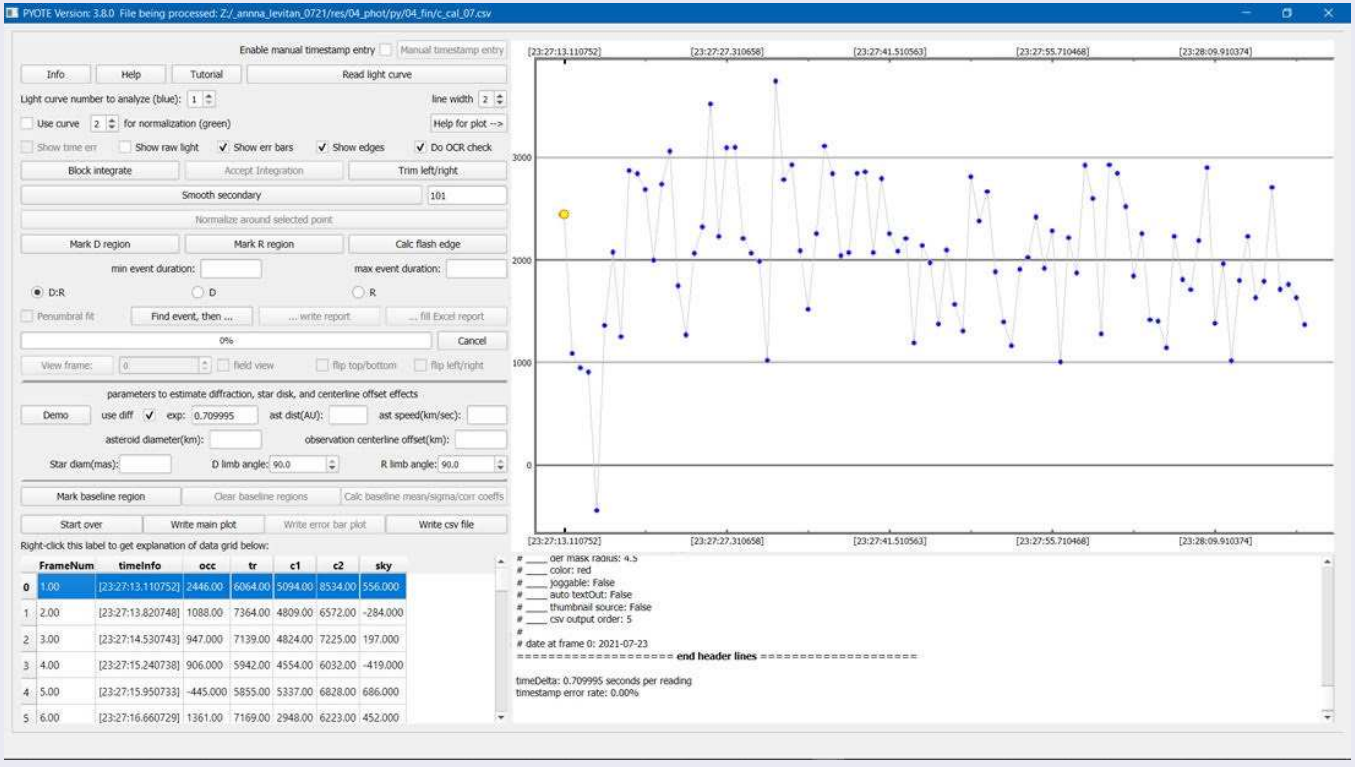
AOTA lightcurve.



Analysis by Christian Weber.

3566 Levitan - a border line case

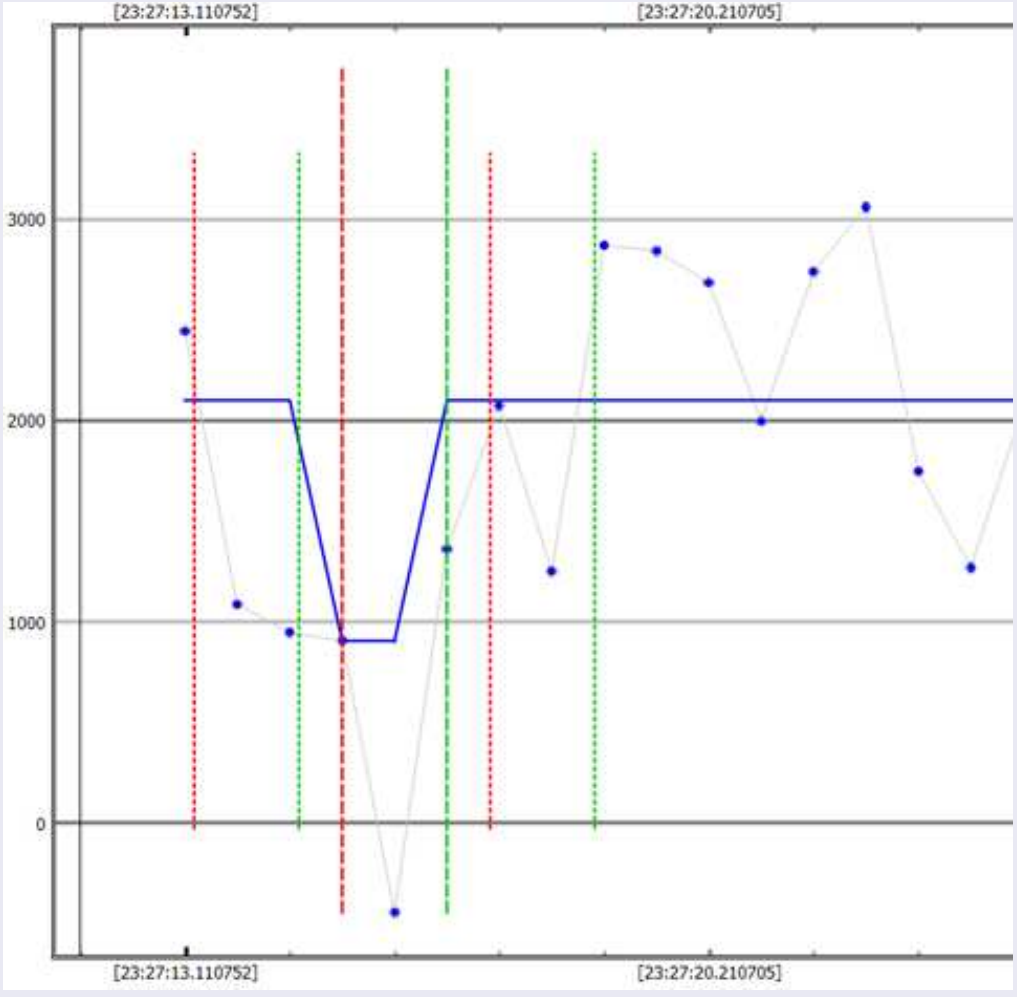
PyOTE lightcurve.



Analysis by Christian Weber.

3566 Levitan - a border line case

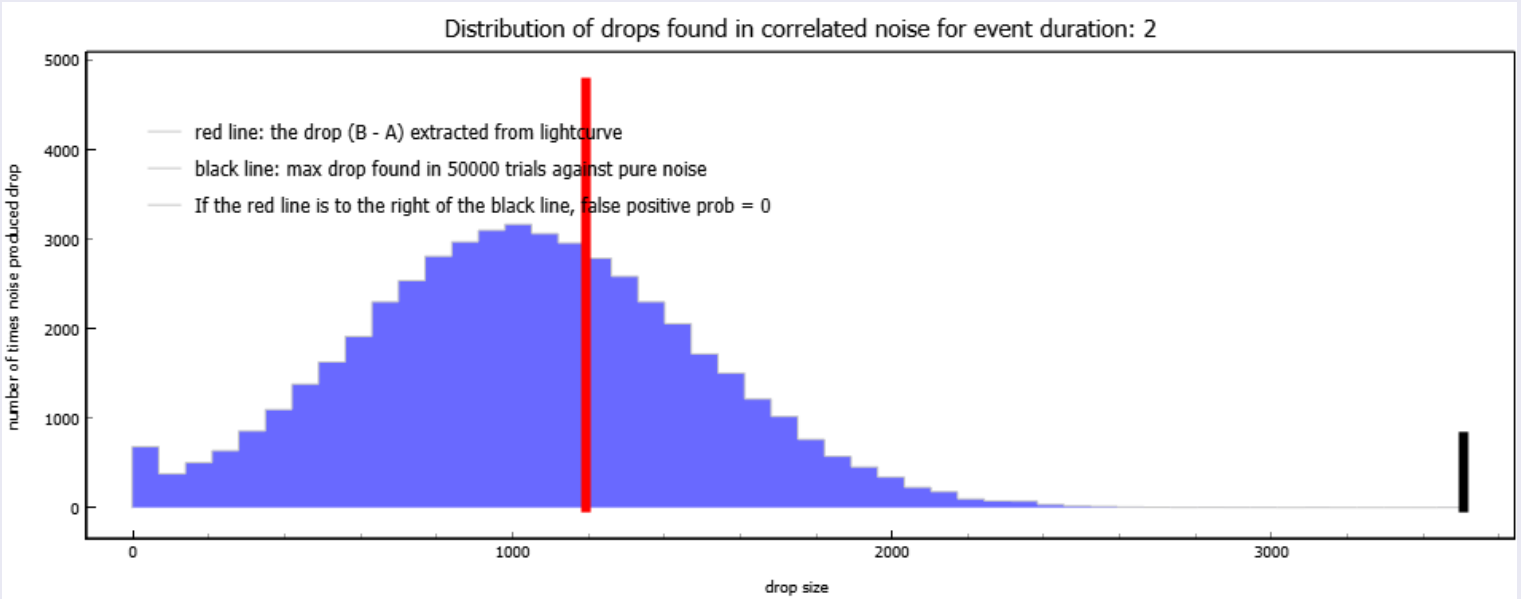
PyOTE event analysis.



Analysis by Christian Weber.

3566 Levitan - a border line case

PyOTE histogram. Warning of possible false detection.



Analysis by Christian Weber.

All occultations observed at Borowiec since October 2020

Month	Predicted events	Observed events	Highlights
October 2020	14	2	657 Gunlod, negative 2252 CERGA uncertain (single frame positive)
November 2020	5	1	18521 Chaos, negative **(16.8 mag star)**
December 2020	8	3	41 Daphne, **positive**
January 2021	14	2	2 negatives
February 2021	9	2	2 negatives
March 2021	5	2	499 Venusia, **positive**
Aprl 2021	(1)	0	
May 2021	5	1	2002 AL134, negative
June 2021	10	3	5511 Cloanthus, **positive**, + 2 other negative events
July 2021	9	1	3566 Levitan, uncertain (difficult conditions)
August 2021	4	0	

Summary: 5 events observed after the camera exchange, 1 positive.
In all: 17 observed events, 3 positives.

Summary

- Slow rotators campaign now on IOTA/ES websites and with own OW tag.
- Please follow and join the campaigns!
- 23 events observed since October 2020 across Europe, 2 with multiple positive chords.
- Meanwhile 3 slow rotators scaled by archival occultations (A&A paper upcoming).
- Observations from Borowiec site: all interesting (and feasible) occultation events.
- Switch from SBIG ST7 CCD camera to Andor Zyla 5.5 sCMOS in Spring 2021.
- Readout time decreased from 1.1 seconds to 0.01 second!
- Slight decrease in sensitivity.
- First results promising (even without telescope tracking...)
- New occultation observing site: Chalin (30-cm telescopes with Zyla 5.5 cameras)

Special thanks to:

Krzysztof Kamiński
Jakub Tokarek
Roman Hirsch
Wojciech Dimitrow

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