

Center of Research in Astronomy, Astrophysics and Geophysics  
(Algiers Observatory)



# Analysis of a new stellar occultation by asteroids among Algeria territory



Presented by :  
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# Outline

- Introduction
- Positive stellar occultation by NEA PHA 3200 Phaethon
- Discovery of stellar duplicity during asteroidal occultation by 283 Emma
- Participative Astronomy occultation in Algeria
- Study of stellar occultation by Near Earth Asteroids
- Near Future prospects
- Summary

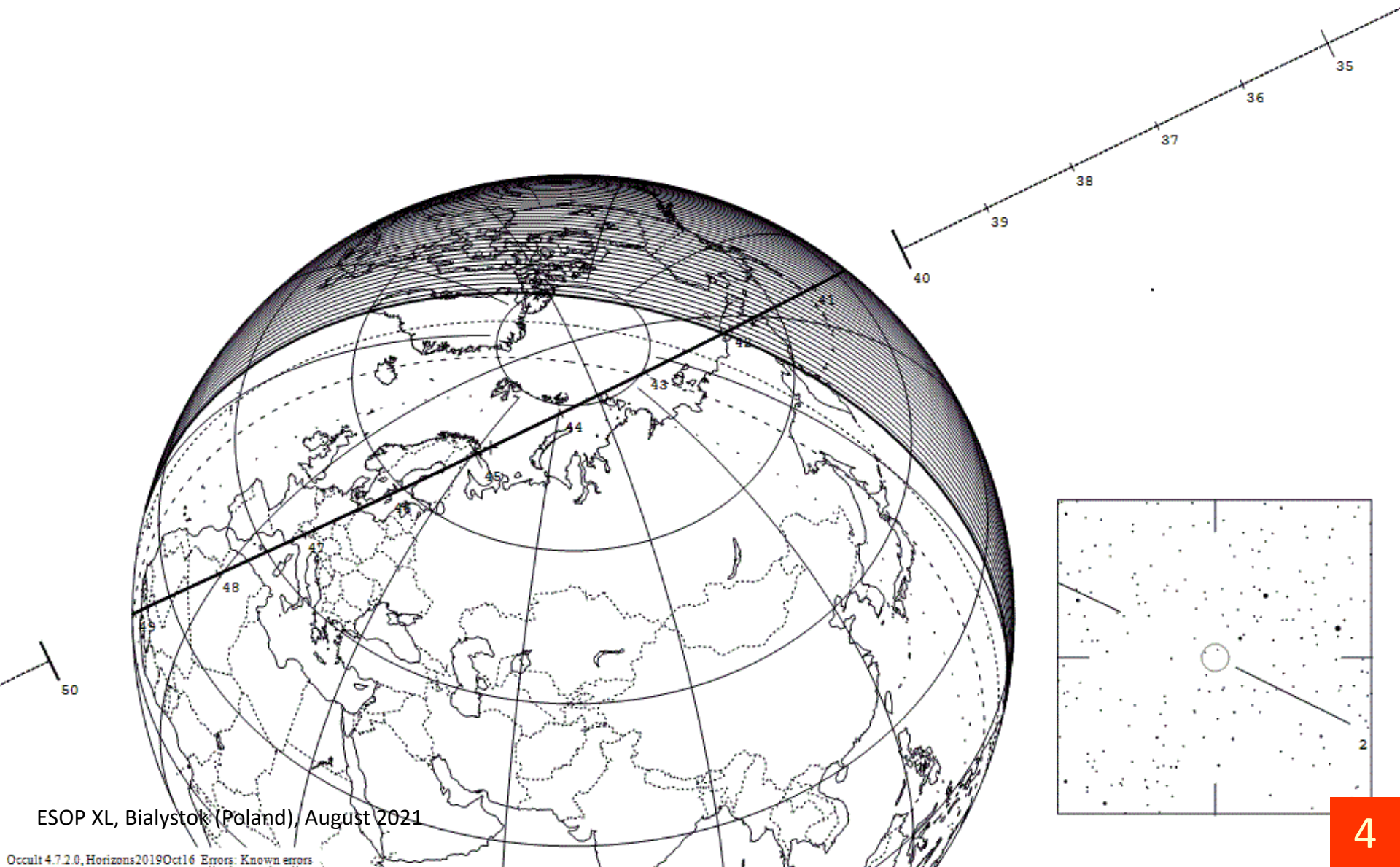
# Positive stellar occultation by NEA PHA 3200 Phaethon

# 3200 Phaethon occults UCAC4 707-014626 on 2019 Oct 15 from 19h 41m to 19h 49m UT

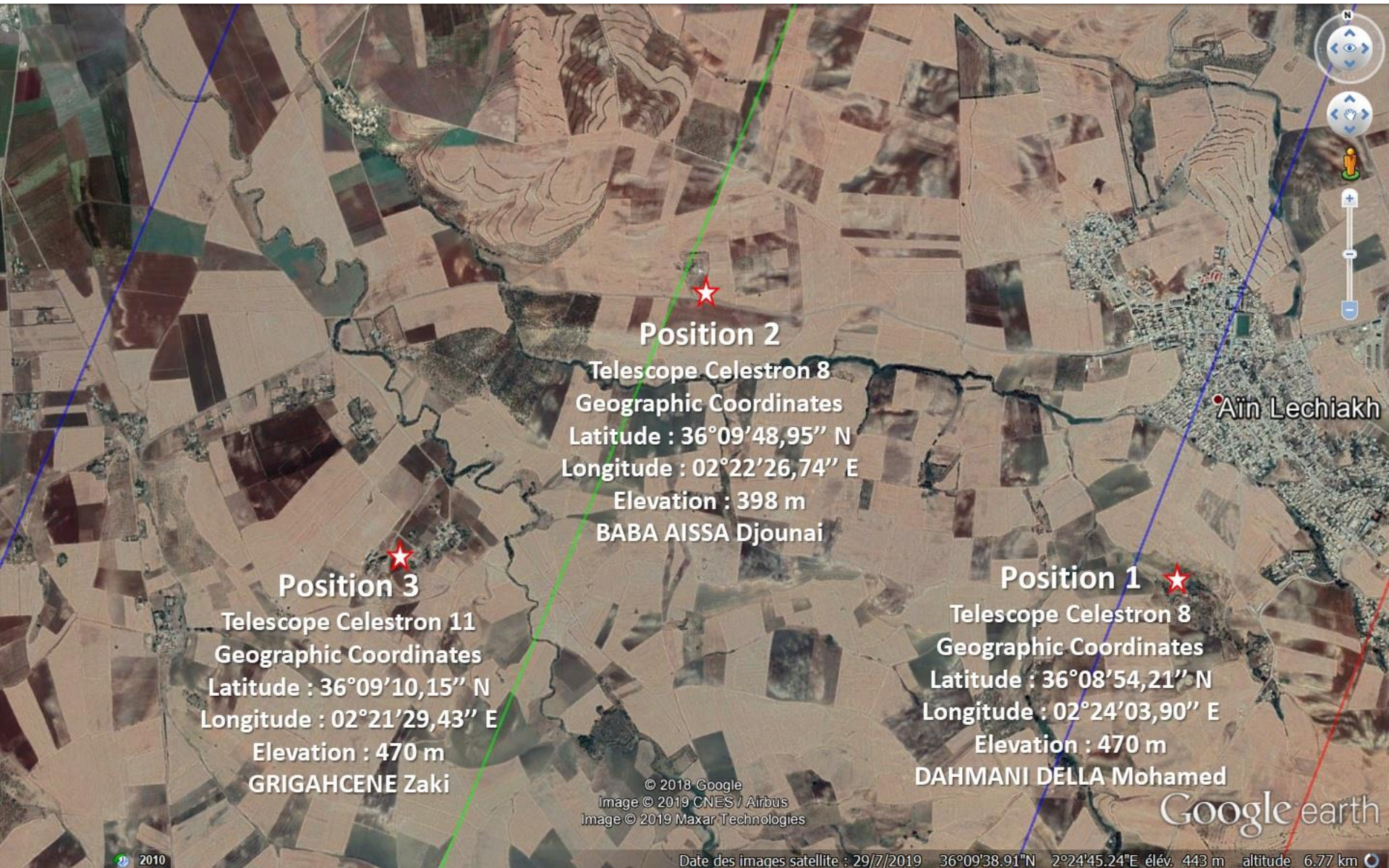
Star:  
Mag V = 11.1; B = 12.8; R = 10.2  
RA = 1 57 50.6930 (BCRS)  
Dec = 51 17 46.087  
[of Date: 1 59 9, 51 23 27]  
Prediction of 2019 Sep 2.0

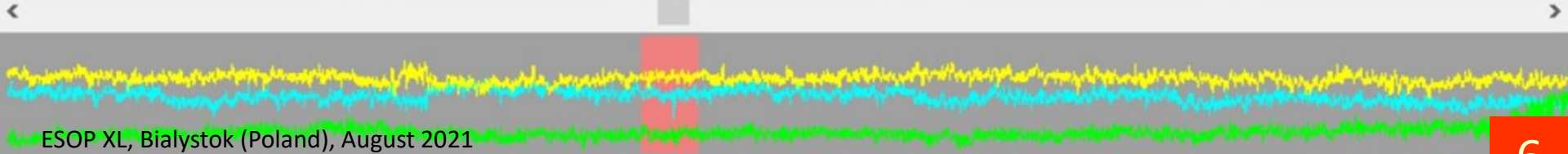
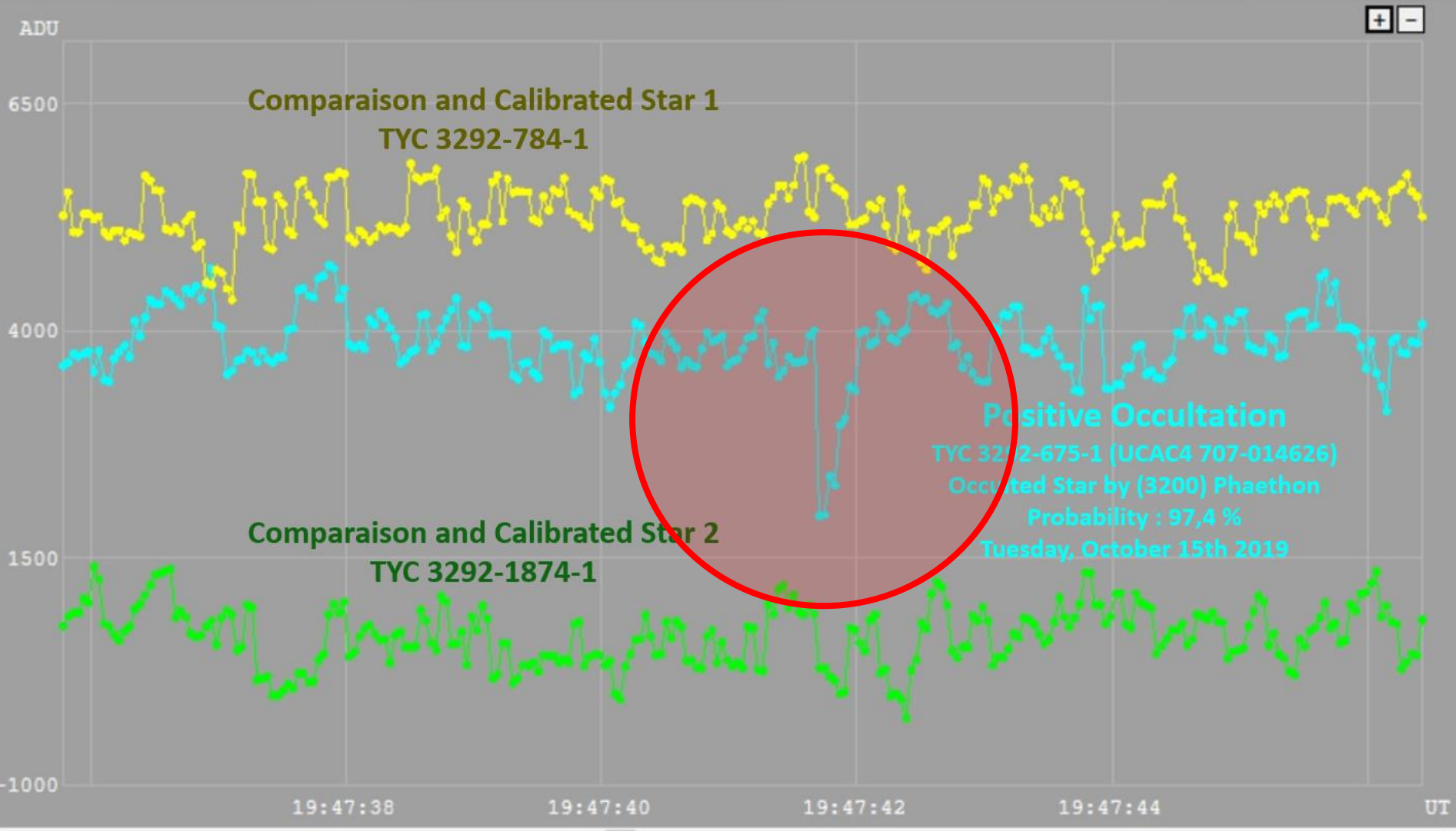
Max Duration = 0.2 secs  
Mag Drop = 5.7 (6.1r)  
Sun : Dist = 137°  
Moon: Dist = 41°  
: illum = 96 %  
E 0.007"x 0.005" in PA 21

Asteroid: (in DAMIT, ISAM)  
Mag = 16.8  
Dia = 5km, 0.007"  
Parallax = 9.448"  
Hourly dRA = -11.696s  
dDec = -52.93"



ESOP XL, Bialystok (Poland), August 2021





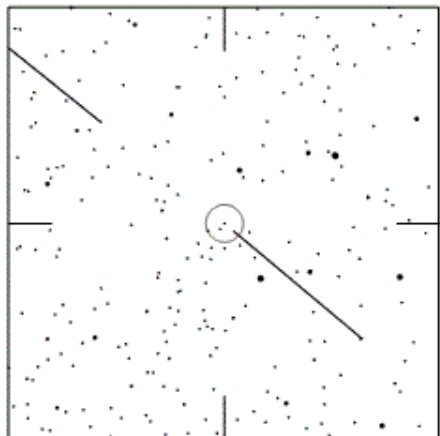


3200 Phaethon occults TYC 3268-00276-1 on 2019 Oct 25 from 22h 17m to 22h 26m UT

Star:  
 Mag V = 11.3; B = 12.5; R = 10.6  
 RA = 1 15 58.7003 (BCRS)  
 Dec = 46 53 0.815  
 [of Date: 1 17 10, 46 59 17]  
 Prediction of 2019 Aug 31.0

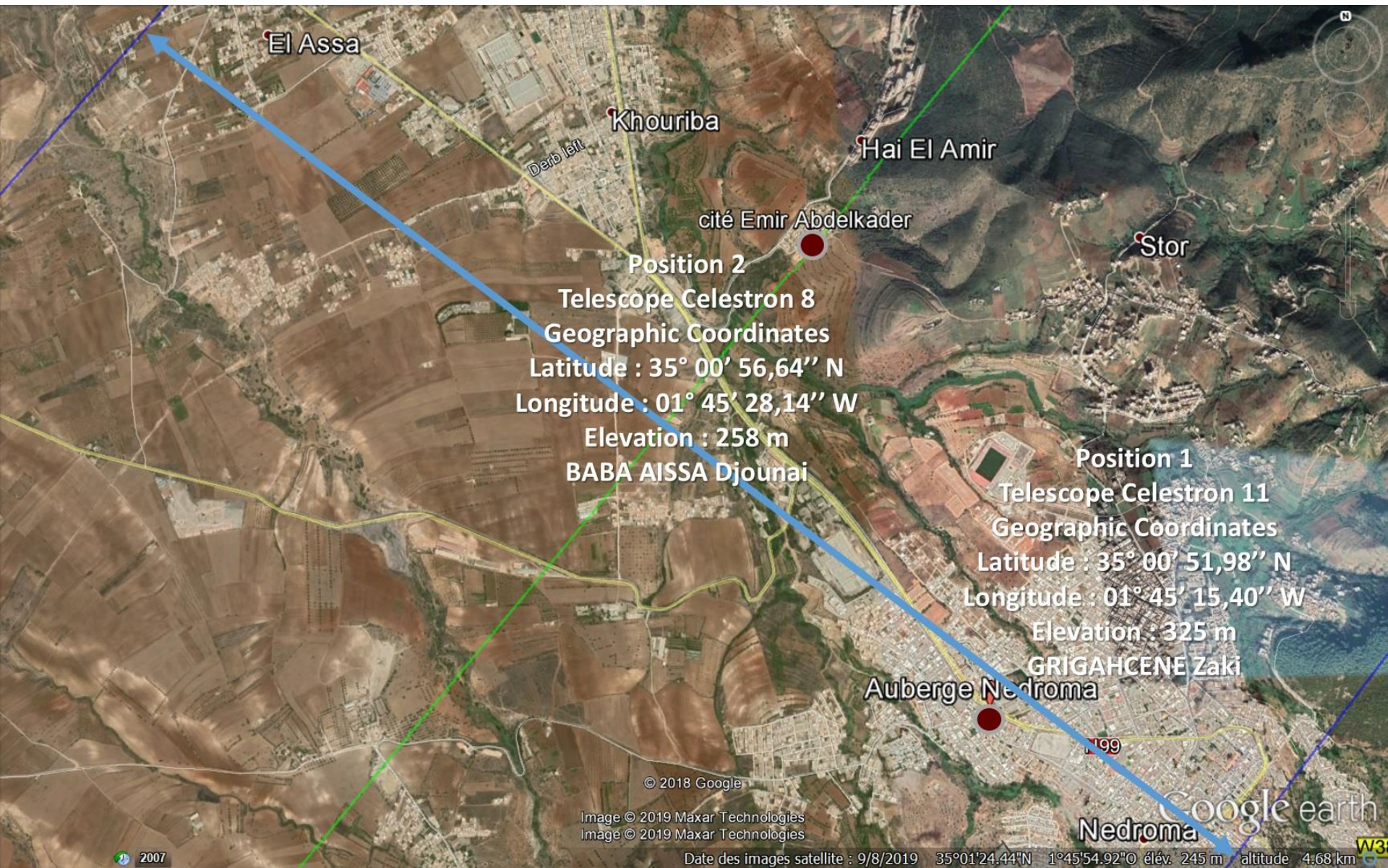
Max Duration = 0.2 secs  
 Mag Drop = 5.6 (5.8r)  
 Sun : Dist = 144°  
 Moon: Dist = 127°  
 : illum = 7 %  
 E 0.007"x 0.003" in PA 32

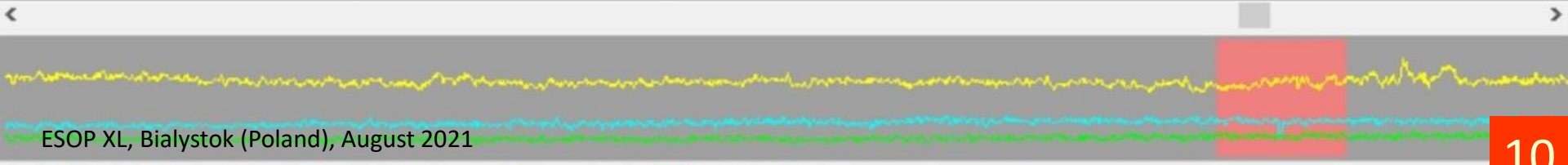
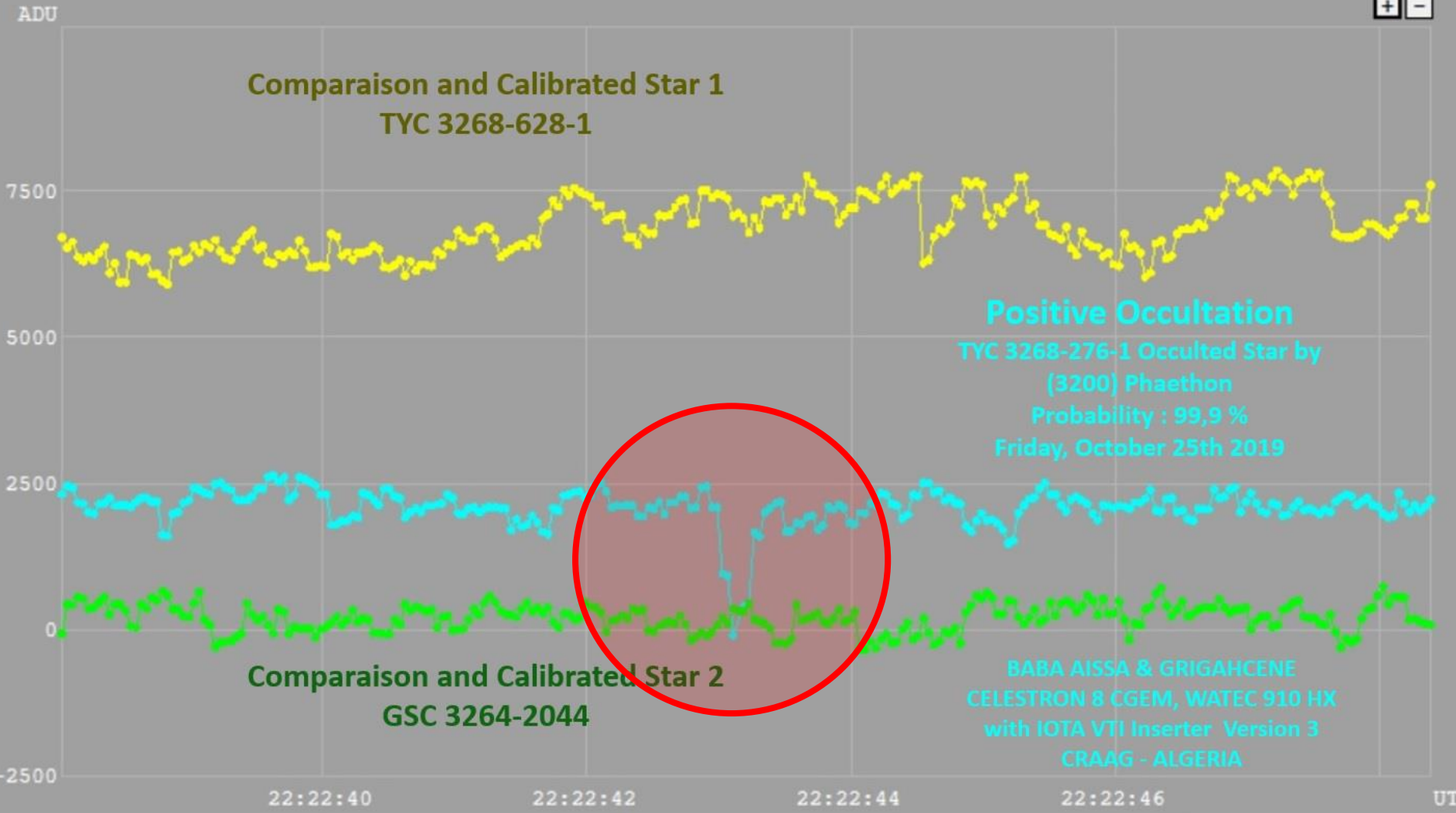
Asteroid: (in DAMIT, ISAM)  
 Mag = 16.8  
 Dia = 5km, 0.007"  
 Parallax = 9.016"  
 Hourly dRA = -8.878s  
 dDec = -75.13"



ESOP XL, Bialystok (Poland), August 2021









# (3200) PHAETHON, FIRST SUCCESSFUL OBSERVATIONS OF OCCULTATIONS BY A SMALL NEAR-EARTH OBJECT

## Paper 2062

### Asteroid Science in the Age of Hayabusa2 and OSIRIS-REx, Tucson, Arizona, 2019 November

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Publication of the  
scientific article about  
the observation of the  
stellar occultation by the  
satellite Triton in  
October 5th, 2017

In Astronomy & Astrophysics journal, 2021

## Structure and evolution of Triton's atmosphere from the 5 October 2017 stellar occultation and previous observations

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González<sup>121</sup>, J. L. Maestre García<sup>122</sup>, J. Marchant<sup>123</sup>, I. Ordóñez-Etxeberria<sup>124</sup>, P. Martorell<sup>124</sup>, J. Salameo<sup>124</sup>, F. Organero<sup>125</sup>, L. Ana<sup>125</sup>, F. Fonseca<sup>125</sup>, V. Peris<sup>126</sup>, O. Brevia<sup>126</sup>, A. Selva<sup>127</sup>, C. Perello<sup>127</sup>, V. Cabedo<sup>128,129</sup>, R. Gonçalves<sup>130</sup>, M. Ferreira<sup>131</sup>, F. Marques Dias<sup>132</sup>, A. Daassou<sup>133,134</sup>, K. Barkaoui<sup>134,135</sup>, Z. Benkhaldoun<sup>134</sup>, M. Guennoun<sup>136</sup>, J. Chouqar<sup>134</sup>, E. Jehin<sup>137</sup>, C. Rinner<sup>138</sup>, J. Lloyd<sup>139</sup>, M. El Moutamid<sup>140</sup>, C. Lamarche<sup>141</sup>, J. T. Pollock<sup>142</sup>, D. B. Caton<sup>142</sup>, V. Kouprianov<sup>143,144</sup>, B. W. Timerson<sup>25,\*\*\*</sup>, G. Blanchard<sup>145</sup>, B. Payet<sup>146</sup>, A. Peyrot<sup>146</sup>, J.-P. Teng-Chuen-Yu<sup>146</sup>, J. Françoise<sup>147</sup>, B. Mondon<sup>147</sup>, T. Payet<sup>147</sup>, C. Boisset<sup>148</sup>, M. Castets<sup>149</sup>, W. B. Hubbard<sup>150</sup>, R. Hill<sup>150</sup>, H. J. Reitsema<sup>151</sup>, O. Mousis<sup>152</sup>, L. Ball<sup>153</sup>, G. Neilsen<sup>153</sup>, S. Hutcheon<sup>153</sup>, K. Lay<sup>153,\*\*\*\*</sup>, P. Anderson<sup>153</sup>, M. Moy<sup>153,†</sup>, M. Jonsen<sup>154</sup>, I. Pink<sup>154</sup>, R. Walters<sup>154,‡</sup>, and B. Downs<sup>155</sup>

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Received mm:dd, yyyy; accepted mm:dd, yyyy

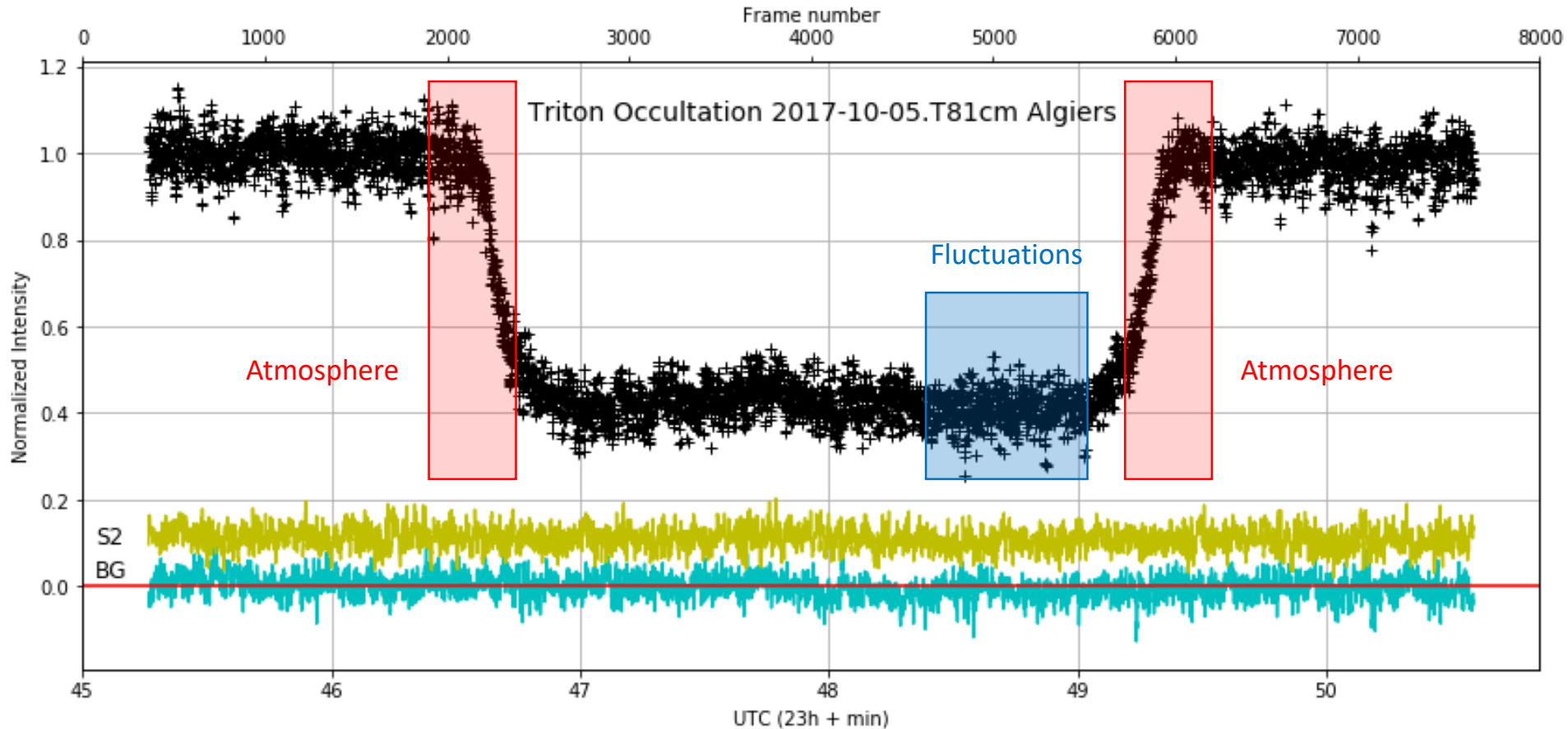
### ABSTRACT

**Context.** A stellar occultation by Neptune's main satellite, Triton, was observed on 5 October 2017 from Europe, North Africa, and USA. We derived 90 light curves from this event, 42 of them yielding a central flash detection.  
**Aims.** We aim at constraining Triton's atmospheric structure and the evolution of its atmospheric pressure since the Voyager 2 epoch (1989). We also derive the shape of the lower atmosphere from central flash analysis.  
**Methods.** We used Abel inversions and direct ray-tracing code to provide the density, pressure, and temperature profiles in the altitude range ~ 8 km to ~ 190 km, corresponding to pressure levels from 9  $\mu$ bar down to a few nbar.  
**Results.** (i) A pressure of  $1.18 \pm 0.03 \mu$ bar is found at a reference radius of 1400 km (47-km altitude). (ii) A new analysis of the Voyager 2 radio science occultation shows that this is consistent with an extrapolation of pressure down to the surface pressure obtained in 1989. (iii) A survey of occultations obtained between 1989 and 2017 suggests an enhancement in surface pressure as reported during the 1990s might be real, but debatable, due to very few high SNR light curves and data accessible for reanalysis. If there were any enhancement in surface pressure during this time period it would have been modest as the Volatile Transport Models that we examined do not support a strong increase in surface pressure. (iv) The central flash structure does not show evidence of an atmospheric distortion. We find an upper limit of 0.0011 for the apparent oblateness of the atmosphere near the 8-km altitude.

**Key words.** methods: data analysis, observational – planets and satellites: atmospheres, physical evolution – techniques: photometric

Use \titlerunning to supply a shorter title and/or \authorrunning to supply a shorter list of authors.

# After reduce data light Curve processed and normalized



Special thanks for **Bruno Sicardy** and **Mike Kretlow**

Eminent publication of a  
scientific article about the  
observation of a stellar  
occultation by the satellite  
Hi'iaka in April 6th, 2021



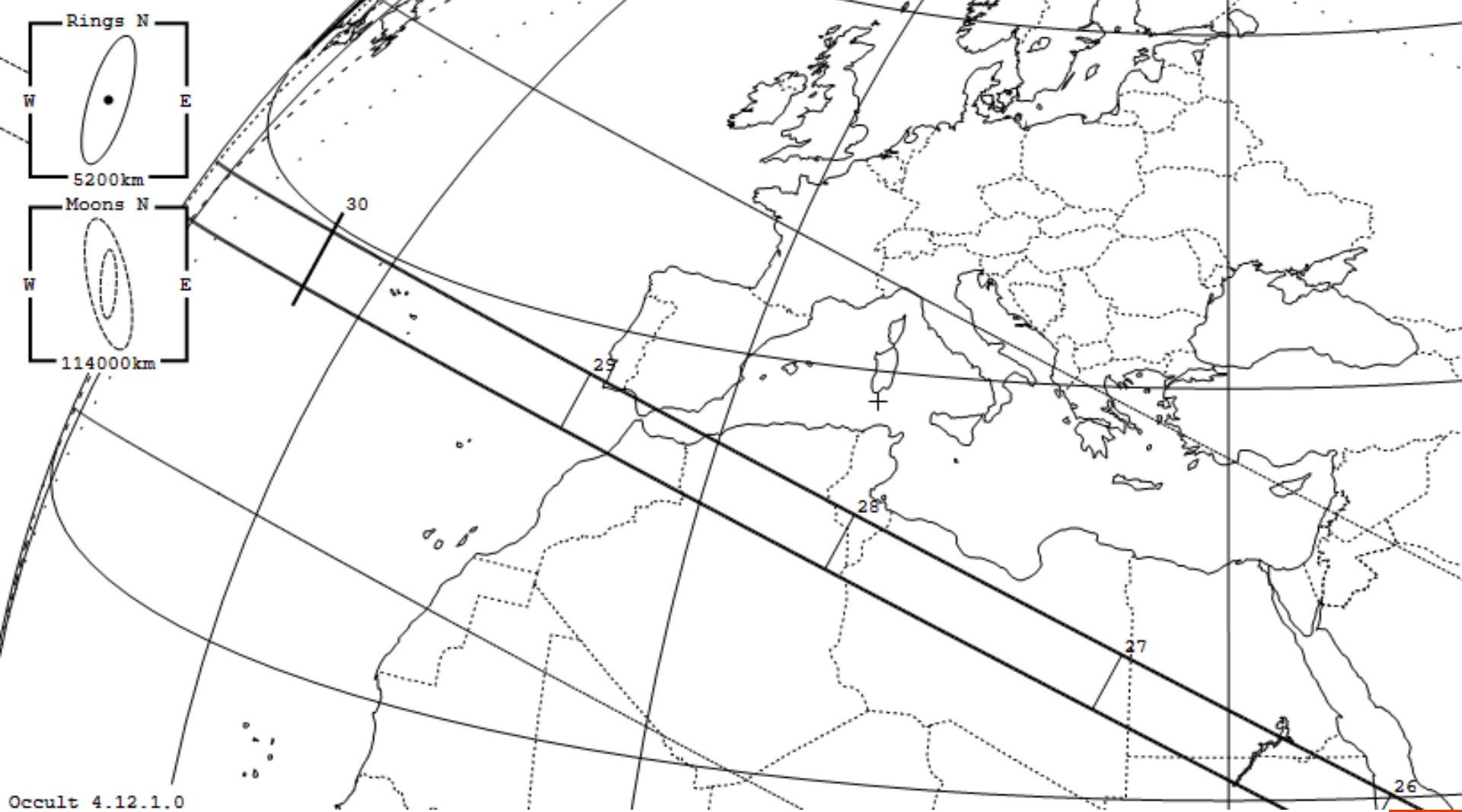
# Illustration of the dwarf planet (136108) Haumea which has a dusty ring around and two satellites (Hi'iaka and Namaka)



# 136108 Hiiaka #1 occults UCAC4 531-05227 on 2021 Apr 6 from 23h 29m to 23h 37m U

Star: Dia < 0.1 mas	Max Duration = 12.6 secs	Asteroid: Mag = 17.3
Mv 12.6; Mb 13.0; Mr 12.1	Mag Drop = 4.7 (4.8r)	Dia = 320 ±40km, 0.009"
RA = 14 24 28.6761 (astrometric)	Sun : Dist = 150°	Parallax = 0.178"
Dec = 16 6 30.952	Moon: Dist = 110°	Hourly dRA = -0.156s
[of Date: 14 25 30, 16 0 41]	: illum = 24 %	dDec = 1.22"
Prediction of 2021 Mar 29.0	E 0.032"x 0.052" in PA 90	
Reliable 1.0 (good),	JPL3/29/2021 Binary solution 1 : Kepler, Star+PeakEphemUncert + binary orbit	

2 moons. {Hi'iaka} 320km at 49880km, Period 49.462days, {Namaka} 160km at 25657km, Period 18.278days Orbit@Miriade  
 Expect fades - star dia. Asteroid has 1 ring.



Occult 4.12.1.0

ESOP XL, Bialystok (Poland), August 2021

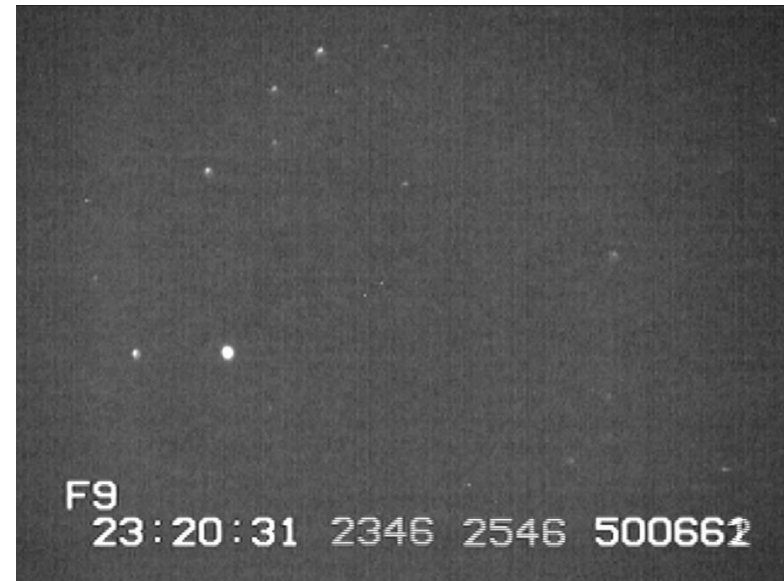
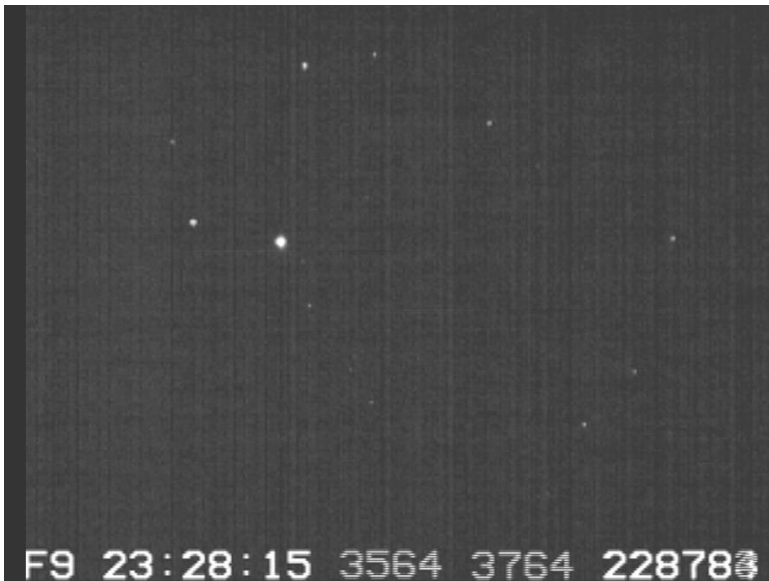
Abstract Type	Research Contributed Presentations
Presentation Type	Oral
Discussion Preference	Slack + Live
Category	Centaur and Kuiper Belt Objects: Physical Characterization
Student Status	Not a student
Is this a dissertation abstract?	No
Newsorthy	Yes
Please indicate the publication status of this work	Not yet submitted to a journal
Which journal are you publishing this work in (or do you hope to publish this work in)?	Nature Astronomy
Have you posted a preprint about this work on arXiv.org?	No

## Physical properties of Hi'iaka from stellar occultation data

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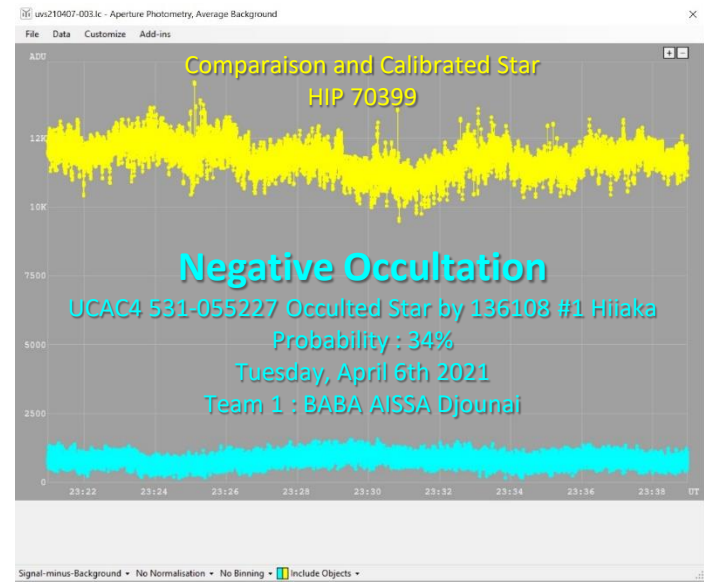
Two very bright stellar occultations by Hi'iaka, the largest satellite of the dwarf planet Haumea, were predicted to take place during the last Spring. Since the uncertainty on Hi'iaka's shadow path was large due to uncertainty on Hi'iaka's position with respect to Haumea, we performed an observational campaign using medium-sized telescopes to obtain high accuracy astrometric data of Hi'iaka's orbit around Haumea. The astrometric data allowed us to successfully observe the first stellar occultation on April 6<sup>th</sup>, with final path crossing North Africa. We only obtained one positive chord in this event from TRAPPIST-North telescope at Oukaimeden Observatory (Morocco), but thanks to this detection, we were able to obtain a more accurate path for the second one on April 16<sup>th</sup>. The second shadow path was predicted to cross the continental US from East to West. We carried out a huge observational campaign involving more than 50 professional and amateurs observatories along the US and the South of Canada. The final path of this second stellar occultation moved slightly to the North of the predicted path and, as a result, we were able to obtain 5 positive chords and negative chords only from the south of the shadow. We also collected photometric data in order to obtain Hi'iaka's rotational light-curve and calculate its three-dimensional shape. The rotational light-curve was obtained by observing the unresolved system of Haumea-Hi'iaka and removing Haumea's rotational light-curve from the data. Using Hi'iaka's rotational light-curve we obtained the rotational phase at which each stellar occultation took place, and allowed us to obtain a three-dimensional model of the satellite. Preliminary results from the stellar occultation show that Hi'iaka, with a triaxial shape as suggested in previous publications, is larger than what has been thought before. In this talk we will present our analysis and preliminary results of some of Hi'iaka's physical properties.



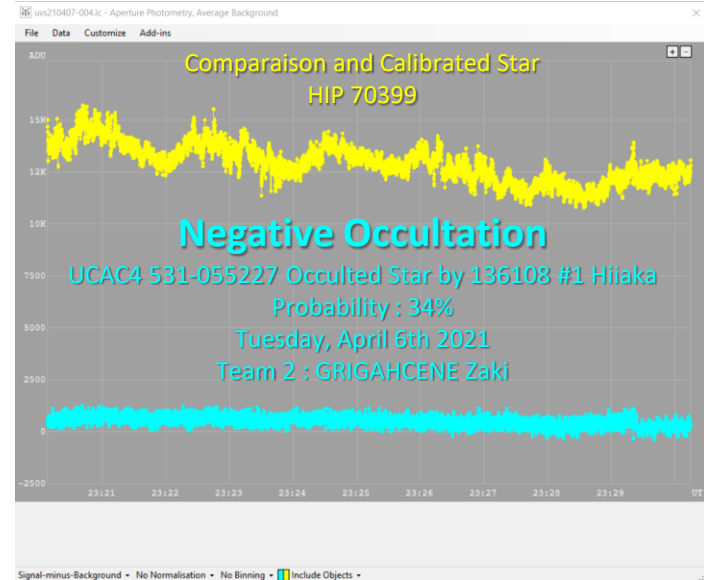
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Satellites: 11 HDOP: 0.93  
UTC: 23:39:38 2021-04-06  
Latitude: 3319.5756 N  
Longitude: 00307.8094 E  
Altitude: 801.0 M MSL  
WGS84 separation: 38.5 M  
  
CPU clock 999992 Hz  
Err Transient  
vSync 20000 CPU us  
External PAL Fullscreen  
Last used 23h 2021-04-06
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Satellites: 10 HDOP: 0.90  
UTC: 20:40:12 2021-04-06  
Latitude: 3229.0942 N  
Longitude: 00341.1941 E  
Altitude: 557.8 M MSL  
WGS84 separation: 36.2 M  
  
CPU clock 1000008 Hz  
Err Transient  
vSync 20000 CPU us  
External PAL TVsafe  
Last used 03h 20101-235-242
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# Team 1 in Bellil (Laghouat) 480 km south of Algiers



# Team 2 in Ghardaia 600 km south of Algiers







# Generate predictions of stellar occultations by near-Earth asteroids using the Occult software



# List of stellar occultations by NEAs from August 2021 to the end of December 2021

Some of chosen criteria from Occult Software using Astorb calculation

Star limit magnitude : 14 ; Mag drop equal or more than 0.2 secondes ; Asteroid smaller than 1 km ; Probability more than 10%

\*Liste des occultations NEA 03-2021 au 12-2021.txt - Bloc-notes

Fichier Edition Format Affichage Aide

Event Summary for Longitude 3.04°, Latitude 30.80° - sorted by Date Astorb

Year	Month	Day	U.T. h m	Diameter km "	Durn sec/m	Star mag	Mag-Drop V R	Elon o	% Ill	Star No.	d	Planet No Name	Alt o	Dist km	Sun Alt	Proba- bility	Moon Elon	☾ ill	☾ c	R.A. (J2000) h m s	Dec. o ' "	Max Proba- bility	
2021	Aug	22	22 13.7	2 0.006	0.4s	12.2	4.2 4.7	142		UCAC4 559-142228	1943	Anteros	50	627		0%	38 100			23 23 9.183	21 39 24.03	3823	17%
2021	Aug	22	22 18.9	2 0.006	0.4s	12.0	4.5 4.9	142		UCAC4 559-142227	1943	Anteros	52	355		0%	38 100			23 23 8.840	21 39 23.47	3824	17%
2021	Aug	23	22 9.9	2 0.004	0.2s	11.0	6.3 6.3	146		TYC 1174-00344-1	V 32906	1994 RH	38	308		0%	21 97			23 56 57.847	10 48 15.28	3847	01%
2021	Aug	24	2 33.4	2 0.003	0.3s	12.4	5.8 5.8	118		UCAC4 620-003412	303174	2004 FH11	84	27		1%	48 97			1 12 44.079	33 50 47.30	3851	01%
2021	Aug	27	4 30.3	3 0.002	0.3s	12.6	8.2 8.2	121		UCAC4 486-002930	416567	2004 EB	63	780	-11	0%	4 78			2 10 34.874	7 2 24.67	3910	00%
2021	Aug	29	23 23.9	2 0.004	0.2s	11.3	5.7 5.9	150		TYC 1177-01499-1	32906	1994 RH	61	252		0%	61 53			23 51 30.913	13 20 57.33	3967	01%
2021	Sep	1	19 25.4	1 0.004	0.5s	12.8	4.1 4.3	124		UCAC4 679-106869	285571	2000 PQ9	50	998		0%	97 27			21 34 36.766	45 42 9.80	4026	00%
2021	Sep	3	21 54.4	1 0.001	0.6s	11.3	10.0 10.5	121		UCAC4 318-218029	7088	Ishtar	26	5		1%	159 11	c		18 54 3.361	-26 30 13.10	4062	01%
2021	Sep	5	2 58.1	1 0.004	0.4s	12.7	4.4 4.9	125		UCAC4 679-108214	285571	2000 PQ9	37	784		0%	114 5			21 38 33.607	45 39 15.05	4082	00%
2021	Sep	6	21 32.6	1 0.001	0.5s	12.4	7.3 7.5	108		UCAC4 616-064608	189011	Ogmios	64	371		0%	105 0			18 47 3.699	33 9 15.21	4130	00%
2021	Sep	10	23 1.7	2 0.011	0.7s	12.7	1.7 1.8	158		UCAC4 469-132446	68063	2000 YJ66	62	90		1%	111 19	c		21 56 38.631	3 42 6.04	4224	01%
2021	Sep	11	3 0.8	1 0.004	0.3s	13.0	4.4 4.5	126		UCAC4 676-108451	285571	2000 PQ9	33	963		0%	111 20			21 45 46.784	45 6 3.13	4228	00%
2021	Sep	16	21 56.1	1 0.003	0.3s	12.0	5.6 5.7	128		TYC 3197-00629-1	285571	2000 PQ9	76	334		0%	70 82			21 52 55.146	44 7 21.78	4351	00%
2021	Sep	17	1 7.2	2 0.002	0.3s	12.8	5.6 5.6	143		UCAC4 400-002281	25330	1999 KV4	47	477		0%	78 83			2 2 17.737	-10 8 36.06	4356	01%
2021	Sep	17	1 29.5	1 0.002	0.4s	11.8	7.3 7.3	121		TYC 2839-01688-1	162273	1999 VL12	72	216		0%	104 83			2 29 17.791	42 13 41.81	4357	00%
2021	Sep	17	20 4.4	1 0.003	0.2s	12.5	5.1 5.4	128		UCAC4 670-105975	285571	2000 PQ9	64	870		0%	65 89			21 54 5.443	43 56 0.11	4378	00%
2021	Sep	18	4 4.4	2 0.006	0.5s	12.9	5.2 5.3	121		UCAC4 721-088983	442742	2012 WP3	25	924		0%	74 91			22 11 34.427	54 10 39.63	4383	00%
2021	Sep	19	21 24.7	2 0.006	0.5s	11.4	6.7 7.0	122		UCAC4 720-089720	442742	2012 WP3	65	155		0%	66 98			22 13 54.149	53 48 46.28	4422	03%
2021	Sep	21	19 49.9	2 0.011	0.7s	12.6	1.9 2.2	151		UCAC4 487-134866	68063	2000 YJ66	54	922		0%	39 99	c		22 3 55.340	7 17 50.73	4471	01%
2021	Sep	25	4 56.5	5 0.006	0.3s	12.9	3.8 4.0	102		UCAC4 633-023594	5143	Heracles	83	566	-10	0%	33 84	c		5 12 19.669	36 30 37.95	4537	05%
2021	Sep	26	22 22.4	7 0.004	0.4s	12.2	8.0 8.0	142		UCAC4 579-120970	52762	1998 MT24	79	557		0%	85 70			22 14 39.497	25 43 51.53	4565	04%
2021	Sep	29	20 20.3	1 0.004	0.2s	12.4	4.9 5.1	140		UCAC4 529-144276	283460	2001 PD1	72	216		0%	123 43			21 50 15.376	15 38 12.49	4640	02%
2021	Oct	3	1 25.9	5 0.002	0.3s	10.9	9.5 10.0	81		TYC 171-04231-1	5587	1990 SB	18	174		0%	43 14	\$		7 12 25.568	4 23 2.81	4718	05%
2021	Oct	3	4 54.8	2 0.006	0.3s	12.3	7.2 7.2	73		UCAC4 536-044921	363505	2003 UC20	60	850	-11	0%	32 13			7 52 39.099	17 1 8.38	4720	23%
2021	Oct	4	21 33.0	2 0.005	0.4s	11.5	5.4 5.6	146		UCAC4 504-143318	1943	Anteros	70	171		0%	155 3			22 28 56.734	10 41 28.74	4762	14%
2021	Oct	5	20 45.0	2 0.007	0.2s	10.8	6.8 6.8	130		TYC 3625-00083-1	442742	2012 WP3	71	506		0%	126 1			22 43 49.131	47 19 50.16	4781	03%
2021	Oct	8	2 55.3	3 0.004	0.6s	12.5	5.4 5.9	113		UCAC4 629-022125	138205	2000 EZ148	76	316		0%	135 4			5 15 43.498	35 45 30.34	4835	00%
2021	Oct	11	0 17.4	2 0.006	0.3s	11.0	5.4 5.7	138		TYC 2735-01098-1	32906	1994 RH	48	749		0%	94 27			22 33 38.667	30 7 17.72	4898	02%
2021	Oct	16	3 18.9	2 0.001	0.3s	12.5	8.3 8.6	123		UCAC4 549-013470	K 90075	2002 VU94	79	287		0%	108 80			5 14 7.736	19 36 22.54	4984	04%
2021	Oct	21	20 23.2	5 0.009	0.2s	11.6	4.2 4.4	118		UCAC4 577-121533	16960	1998 QS52	74	218		0%	74 99			21 27 11.262	25 18 25.26	5100	02%
2021	Oct	21	22 10.3	5 0.009	0.2s	12.4	3.3 3.6	117		UCAC4 577-121510	16960	1998 QS52	51	105		1%	75 98			21 26 56.521	25 15 50.39	5102	02%

Ln 5, Col 1 | 100% | Windows (CRLF) | UTF-8 avec nomenclature

Event Summary for Longitude 3.04°, Latitude 30.80° - sorted by Date Astorb

Date	U.T.	Diameter	Durn	Star	Mag-Drop	Elon	%	Star	d	Planet	Alt	Dist	Sun	Proba-	Moon	☉	R.A. (J2000)	Dec.	Max	
y m d	h m	km "	sec/m	mag	V R	o	Ill	No.		No Name	o	km	Alt	bility	Elon	ill	h m s	o ' "	Probability	
2021 Oct 24	3 10.8	3 0.024	0.2s	11.3	4.0 4.0	68		TYC 3454-00372-1	159857	2004 LJ1	20	310		0%	85 89		11 52 57.371	50 28 49.43	5129	01%
2021 Oct 24	19 23.5	17 0.013	0.7s	10.0	4.4 4.8	71		TYC 6293-01566-1		433 Eros	23	889		0%	155 85	§	18 53 13.822	-20 58 58.40	5145	31%
2021 Oct 26	0 9.8	5 0.012	0.2s	11.2	3.7 3.8	106		TYC 2952-00145-1		5143 Heracles	34	356		0%	22 76	☾	7 18 35.266	43 2 45.27	5169	10%
2021 Oct 26	0 22.9	2 0.001	0.2s	10.4	13.6 13.8	105		TYC 166-00940-1	462041	2007 DL8	25	366		0%	27 76		7 1 31.675	2 56 43.42	5170	00%
2021 Oct 27	20 0.8	5 0.010	0.3s	11.0	4.7 4.9	109		UCAC4 559-131346	16960	1998 QS52	68	883		0%	129 60		21 8 50.644	21 40 52.90	5206	02%
2021 Oct 28	18 40.3	0 0.001	0.2s	13.0	8.5 8.6	107		UCAC4 552-127589	363344	2002 QC7	79	75		0%	135 51		21 3 35.285	20 23 14.91	5228	00%
2021 Oct 28	22 59.4	5 0.013	0.2s	12.8	2.1 2.1	105		UCAC4 668-052917		5143 Heracles	20	643		0%	24 49	☾	7 41 33.483	43 24 26.41	5235	11%
2021 Oct 30	2 53.8	3 0.004	0.2s	12.8	7.0 7.1	169		UCAC4 501-004504	234061	1999 HE1	47	591		0%	97 37		2 58 58.905	10 3 8.02	5256	02%
2021 Oct 30	3 8.2	3 0.027	0.2s	12.6	2.3 2.3	74		UCAC4 651-050599	159857	2004 LJ1	33	456		0%	24 37		10 36 49.262	40 6 57.47	5257	01%
2021 Oct 30	20 20.3	2 0.001	0.4s	12.5	11.9 11.9	110		UCAC4 428-122435	445025	2008 NS1	50	56		0%	166 30		21 46 27.470	- 4 29 26.86	5275	00%
2021 Nov 3	5 4.6	2 0.002	0.2s	12.3	8.9 8.8	128		UCAC4 617-032648	144901	2004 WG1	65	374		0%	105 4		6 10 16.437	33 19 13.51	5349	01%
2021 Nov 5	1 31.0	3 0.027	0.2s	11.8	2.7 2.9	84		UCAC4 579-043938	159857	2004 LJ1	25	334		0%	87 0		9 38 19.539	25 39 53.06	5387	01%
2021 Nov 5	21 35.9	1 0.002	0.3s	12.1	6.3 6.3	137		UCAC4 610-022644	162149	1998 YQ11	29	679		0%	151 2		5 40 35.756	31 59 29.38	5411	00%
2021 Nov 8	20 39.5	1 0.005	0.2s	12.7	5.2 5.5	73		UCAC4 633-061604	518678	2008 UZ94	22	544		0%	63 21		18 26 15.514	36 30 44.09	5493	00%
2021 Nov 10	1 56.5	3 0.001	0.2s	9.4	12.0 12.0	125		UCAC4 558-035586	242216	2003 RN10	68	957		0%	162 34		6 52 21.311	21 29 35.30	5518	00%
2021 Nov 11	3 23.7	3 0.025	0.2s	11.6	2.8 2.9	96		UCAC4 503-050857	159857	2004 LJ1	56	451		0%	168 46		8 54 25.304	10 34 45.67	5551	01%
2021 Nov 12	23 32.8	2 0.001	0.3s	12.9	9.4 9.6	113		UCAC4 581-041040		3671 Dionysus	27	417		0%	139 65	☾	8 2 54.067	26 1 17.39	5605	01%
2021 Nov 13	5 13.2	3 0.024	0.2s	9.8	4.4 4.7	99		TYC 223-01542-1	159857	2004 LJ1	65	575		0%	145 68		8 42 10.322	5 59 22.81	5612	01%
2021 Nov 14	1 25.5	1 0.003	0.3s	12.6	5.4 5.4	144		UCAC4 603-025407	162149	1998 YQ11	82	192		0%	95 75		5 46 14.529	30 32 19.97	5637	00%
2021 Nov 14	18 10.9	2 0.001	0.2s	12.6	9.2 9.2	111		UCAC4 523-148916	138846	2000 VJ61	72	938		0%	31 81		22 31 20.189	14 26 44.17	5664	00%
2021 Nov 14	22 47.7	1 0.002	0.2s	10.9	8.0 7.8	124		TYC 5373-00732-1	68031	2000 YK29	19	239		0%	92 83		6 32 47.515	-11 46 59.70	5671	01%
2021 Nov 14	23 42.9	1 0.007	0.3s	12.8	1.9 2.2	166		UCAC4 613-009552		4660 Nereus	85	893		0%	53 83		3 11 41.386	32 31 27.02	5673	03%
2021 Nov 16	23 53.8	3 0.022	0.2s	11.4	3.0 3.3	105		UCAC4 444-046016	159857	2004 LJ1	18	294		1%	98 95		8 22 34.414	- 1 19 39.47	5725	01%
2021 Nov 19	2 0.9	3 0.004	0.3s	12.2	5.5 5.6	158		UCAC4 647-018547	138205	2000 EZ148	67	49		0%	24 100		4 20 43.089	39 13 17.49	5784	00%
2021 Nov 20	1 5.8	1 0.009	0.3s	13.0	1.4 1.7	163		UCAC4 629-010978	4660	Nereus	65	272		0%	19 100		3 16 51.702	35 47 27.97	5821	03%
2021 Nov 22	4 16.3	1 0.012	0.3s	10.1	3.8 4.4	161		TYC 2861-01082-1	s 4660	Nereus	27	881		0%	36 93		3 20 11.823	37 33 37.91	5899	04%
2021 Nov 22	22 49.2	1 0.011	0.2s	12.1	1.9 2.0	161		UCAC4 642-013556	4660	Nereus	81	717		0%	43 89		3 21 47.196	38 18 5.81	5933	04%
2021 Nov 22	23 16.0	1 0.011	0.2s	12.7	1.5 1.6	161		UCAC4 642-013557	4660	Nereus	81	154		0%	44 89		3 21 49.276	38 19 7.15	5934	04%
2021 Nov 23	17 43.5	1 0.013	0.3s	11.3	4.0 3.8	97		TYC 4408-00589-1	163899	2003 SD220	20	100		0%	66 84		13 38 17.117	73 49 34.95	5976	54%
2021 Nov 24	0 45.6	1 0.011	0.2s	10.6	3.2 3.5	160		TYC 2865-00108-1	4660	Nereus	67	22		0%	54 82		3 24 5.935	39 23 52.25	6000	04%

Event Summary for Longitude 3.04°, Latitude 30.80° - sorted by Date Astorb

Year	Month	Day	U.T. h m	Diameter km	Durn sec/m	Star mag	Mag-Drop V R	Elon o Ill	%	Star No.	d	Planet No Name	Alt o	Dist km	Sun Alt	Probability	Moon Elon	☉ Elon	R.A. (J2000) h m s	Dec. o ' "	Max Probability	
2021	Nov	24	3 30.7	3 0.018	0.3s	10.5	4.0 3.9	114		TYC 5419-01737-1	159857	2004 LJ1	48	158		1%	37 81	7 51	55.366	-11 37 2.75	6008	01%
2021	Nov	24	4 22.6	1 0.011	0.2s	12.1	1.8 1.9	160		UCAC4 648-014316	4660	Nereus	26	173		0%	56 81	3 24	22.907	39 32 44.93	6010	04%
2021	Nov	24	17 31.9	1 0.012	0.2s	12.2	1.7 1.7	159		TYC 2865-01443-1	4660	Nereus	25	669	-10	0%	62 76	3 26	4.158	40 9 6.64	6040	04%
2021	Nov	24	17 35.8	2 0.006	0.2s	9.5	6.8 6.9	126		UCAC4 536-000441	68063	2000 YJ66	57	517	-11	0%	109 76	0 14	1.681	17 9 49.99	6041	01%
2021	Nov	25	4 43.2	1 0.012	0.2s	11.9	1.9 2.0	159		UCAC4 654-015125	4660	Nereus	22	89		0%	66 73	3 27	1.229	40 41 29.09	6063	04%
2021	Nov	25	23 20.1	2 0.006	0.2s	12.5	3.9 4.2	126		UCAC4 537-000570	68063	2000 YJ66	40	825		0%	122 65	0 17	6.634	17 15 34.86	6111	01%
2021	Nov	25	23 27.9	1 0.012	0.2s	11.3	2.3 2.3	158		TYC 2869-00321-1	4660	Nereus	77	92		0%	75 65	3 29	30.309	41 40 17.19	6113	05%
2021	Nov	26	2 14.6	3 0.017	0.3s	12.6	2.1 2.4	116		UCAC4 382-038724	159857	2004 LJ1	43	305		0%	42 64	7 44	38.898	-13 43 6.62	6122	01%
2021	Nov	26	4 0.1	1 0.013	0.2s	10.7	2.9 2.9	158		TYC 2869-01881-1	4660	Nereus	30	637		0%	76 64	3 29	59.151	41 53 53.52	6125	05%
2021	Nov	26	20 52.4	1 0.013	0.2s	12.6	1.3 1.2	157		UCAC4 665-018305	4660	Nereus	62	936		0%	84 57	3 32	39.649	42 51 43.65	6170	05%
2021	Nov	26	23 54.3	1 0.013	0.2s	11.2	2.3 2.9	157		UCAC4 666-018142	4660	Nereus	73	721		0%	85 55	3 33	2.581	43 2 15.88	6174	05%
2021	Nov	27	2 14.3	1 0.004	0.3s	9.4	8.2 8.9	103		TYC 7638-01516-1	7482	1994 PC1	16	778		0%	72 54	7 19	4.963	-42 58 1.33	6181	00%
2021	Nov	27	4 50.8	2 0.003	0.2s	8.8	9.6 9.8	105		UCAC4 573-046772	86324	1999 WA2	82	749		0%	12 53	9 43	24.347	24 35 12.80	6192	06%
2021	Nov	28	1 49.2	3 0.016	0.3s	9.9	4.8 4.4	118		TYC 5980-00171-1	159857	2004 LJ1	41	644		0%	58 44	7 37	34.990	-15 35 47.95	6234	01%
2021	Nov	29	4 0.9	1 0.003	0.2s	12.3	6.1 6.6	82		UCAC4 241-039620	506459	2002 AL14	16	335		0%	56 33	9 45	13.974	-41 51 40.37	6274	02%
2021	Nov	29	18 9.2	2 0.005	0.2s	12.2	4.4 4.4	125		UCAC4 538-000832	68063	2000 YJ66	66	212		0%	160 27	0 26	35.335	17 32 57.85	6295	01%
2021	Nov	30	4 32.1	3 0.016	0.3s	12.0	2.8 2.8	120		TYC 5983-00502-1	159857	2004 LJ1	35	747		0%	80 23	7 30	22.670	-17 20 13.83	6310	01%
2021	Dec	1	19 44.6	2 0.005	0.2s	11.8	4.9 5.0	124		UCAC4 539-000955	68063	2000 YJ66	77	420		0%	155 9	0 31	44.062	17 42 22.39	6374	01%
2021	Dec	2	1 41.7	3 0.015	0.4s	12.2	2.7 2.8	122		UCAC4 357-028372	159857	2004 LJ1	39	242		0%	100 7	7 24	16.996	-18 40 53.71	6386	01%
2021	Dec	2	2 24.2	1 0.018	0.2s	12.5	2.2 2.2	99		UCAC4 836-014263	163899	2003 SD220	21	395		0%	92 7	16 36	25.846	77 6 35.18	6388	68%
2021	Dec	2	17 38.7	1 0.019	0.2s	12.9	1.8 1.9	99		UCAC4 835-014397	163899	2003 SD220	31	519	-11	0%	94 4	16 56	31.956	76 59 51.20	6415	70%
2021	Dec	2	23 18.3	1 0.005	0.3s	12.1	4.2 4.0	154		TYC 2874-00447-2	153591	2001 SN263	73	371		0%	152 3	3 33	23.642	44 44 25.65	6430	00%
2021	Dec	3	0 3.5	3 0.015	0.4s	10.4	4.5 4.5	122		TYC 5974-01191-2	D159857	2004 LJ1	30	498		0%	110 3	7 21	21.386	-19 16 49.61	6432	01%
2021	Dec	3	1 40.6	3 0.004	0.3s	12.2	5.4 5.4	127		UCAC4 561-046859	K 20460	Robwhiteley	64	527		0%	109 2	8 28	54.224	22 11 19.91	6439	03%
2021	Dec	3	3 5.5	1 0.019	0.2s	11.9	2.7 2.6	99		TYC 4568-00097-1	163899	2003 SD220	21	62		0%	96 2	17 10	56.561	76 49 13.33	6445	71%
2021	Dec	3	5 21.5	2 0.011	0.2s	12.0	5.9 6.0	93		UCAC4 418-052275	W363505	2003 UC20	53	804		0%	78 2	10 15	55.197	- 6 24 33.24	6447	42%
2021	Dec	3	17 44.1	1 0.019	0.2s	11.8	2.7 3.0	99		UCAC4 833-015600	163899	2003 SD220	32	818		0%	98 1	17 30	48.182	76 32 18.94	6481	72%
2021	Dec	3	17 39.8	5 0.012	0.2s	10.9	5.1 5.6	46		UCAC4 421-124349	16960	1998 QS52	33	253	-11	0%	54 1	19 39	22.835	- 5 55 41.36	6483	02%
2021	Dec	3	19 12.3	1 0.019	0.2s	12.2	2.3 2.6	99		UCAC4 833-015632	163899	2003 SD220	27	1		37%	99 0	17 32	52.300	76 28 52.28	6486	72%
2021	Dec	3	21 13.8	3 0.004	0.3s	11.9	5.9 6.5	161		UCAC4 642-016445	138205	2000 EZ148	68	44		0%	163 0	3 54	35.733	38 14 45.68	6491	00%
2021	Dec	4	0 13.6	1 0.020	0.2s	12.9	1.7 1.9	99		UCAC4 832-015663	163899	2003 SD220	17	888		0%	99 0	17 40	36.239	76 18 45.75	6496	72%

# We have selected 3 NEAs candidates as **1943 Anteros** ; **5143 Heracles** and **2003 SD220** because the occultations that can produce have a probability of more than 30% We used JPL and AstOrb calculation

\*Liste des occultations NEA 03-2021 au 12-2021.txt - Bloc-notes

Fichier Edition Format Affichage Aide

Event Summary for Longitude 3.04°, Latitude 30.80° - sorted by Date Astorb

Year	Month	Day	U.T. h	U.T. m	Diameter km	Durn sec/m	Star mag	Mag-V	Drop-R	Elon o	% Ill	Star No.	d	Planet No	Planet Name	Alt o	Dist km	Sun Alt	Proba-bility	Moon Elon	☉ Elon	R.A. (J2000) h	R.A. (J2000) m	R.A. (J2000) s	Dec. o	Dec. ' "	Max Proba-bility
2021	Dec	4	22	9.3	4 0.007	0.5s	12.5	3.7	3.9	144		UCAC4 559-040215	7358	Oze	35	106		0%	152	1	7 21 35.320	21 36 48.48			6542	04%	
2021	Dec	4	22	9.2	1 0.020	0.2s	12.1	2.3	2.3	99		UCAC4 828-018045	163899	2003 SD220	20	589		0%	101	1	18 11 0.311	75 31 8.35			6544	74%	
2021	Dec	5	0	15.0	3 0.014	0.4s	12.1	2.9	2.9	124		UCAC4 348-025191	159857	2004 LJ1	32	625		0%	128	1	7 15 12.746	-20 25 53.84			6549	01%	
2021	Dec	5	0	32.7	1 0.020	0.2s	9.9	4.4	4.3	99		TYC 4570-02206-1	163899	2003 SD220	16	470		0%	101	1	18 14 39.226	75 24 24.09			6550	74%	
2021	Dec	5	0	33.0	1 0.020	0.2s	12.7	1.8	2.0	99		UCAC4 828-018120	163899	2003 SD220	16	939		0%	101	1	18 14 37.620	75 24 8.77			6551	74%	
2021	Dec	5	21	56.6	1 0.021	0.2s	12.1	2.2	2.3	98		TYC 4442-00338-1	163899	2003 SD220	21	587		0%	101	4	18 42 43.521	74 18 55.59			6596	76%	
2021	Dec	6	17	27.6	1 0.005	0.4s	12.2	4.0	4.1	151		TYC 3312-00970-1	153591	2001 SN263	34	744	-9	0%	130	8	3 26 8.729	45 3 1.50			6629	00%	
2021	Dec	7	22	11.4	3 0.013	0.4s	11.8	3.3	3.4	126		TYC 5976-02756-1	159857	2004 LJ1	16	223		1%	130	18	7 6 46.512	-21 47 41.36			6665	01%	
2021	Dec	8	22	6.5	6 0.017	0.3s	12.0	4.1	4.2	129		UCAC4 399-002629	88263	2001 KQ1	46	111		0%	69	28	2 20 58.295	-10 15 10.81			6690	14%	
2021	Dec	8	22	32.2	1 0.005	0.4s	12.6	3.6	3.5	150		TYC 3311-00023-1	153591	2001 SN263	74	96		0%	101	28	3 21 46.788	45 10 15.94			6692	00%	
2021	Dec	10	20	25.5	1 0.006	0.4s	11.1	5.0	5.3	148		UCAC4 677-018311	153591	2001 SN263	68	720		0%	77	48	3 18 5.610	45 14 5.39			6740	00%	
2021	Dec	11	19	40.1	1 0.006	0.4s	12.1	4.0	4.0	147		UCAC4 677-018030	153591	2001 SN263	62	733		0%	66	58	3 16 14.857	45 15 2.74			6763	00%	
2021	Dec	14	3	45.2	4 0.003	0.3s	10.0	9.1	9.2	124		TYC 4868-00324-1	W138013	2000 CN101	55	155		0%	105	79	8 47 24.444	-3 5 23.15			6810	03%	
2021	Dec	15	1	22.8	4 0.007	0.4s	12.2	3.8	3.8	158		UCAC4 557-037289	7358	Oze	80	73		1%	67	86	7 5 48.651	21 14 51.40			6824	04%	
2021	Dec	16	3	39.4	8 0.008	0.6s	12.9	2.9	3.0	167		UCAC4 517-020685	1627	Ivar	40	520		0%	41	92	6 7 41.349	13 17 44.13			6839	68%	
2021	Dec	16	20	2.4	3 0.001	0.4s	12.7	9.7	9.8	107		UCAC4 492-000976	K416567	2004 EB	61	990		0%	48	95	0 37 51.910	8 13 24.02			6846	00%	
2021	Dec	16	20	53.9	1 0.001	0.3s	12.7	7.0	7.0	99		UCAC4 700-114976	307161	2002 DY3	40	365		0%	67	95	22 39 36.355	49 50 9.05			6847	00%	
2021	Dec	20	2	0.8	3 0.010	0.5s	12.3	3.3	3.4	131		UCAC4 328-014336	159857	2004 LJ1	31	672		0%	51	99	6 37 15.380	-24 27 28.47			6897	00%	
2021	Dec	20	23	48.5	1 0.002	0.2s	12.9	5.9	6.0	129		UCAC4 430-003712	87024	2000 JS66	35	856		0%	71	97	2 58 18.547	-4 9 8.38			6904	00%	
2021	Dec	21	19	14.5	1 0.001	0.3s	12.0	8.8	9.2	135		UCAC4 569-005793	155334	2006 DZ169	72	116		0%	72	94	2 43 39.301	23 45 8.90			6910	01%	
2021	Dec	25	19	3.7	1 0.007	0.7s	12.0	3.9	4.1	134		UCAC4 673-015537	153591	2001 SN263	69	742		0%	108	64	2 54 22.779	44 32 41.27			6943	00%	
2021	Dec	26	17	31.6	1 0.007	0.8s	12.7	3.3	3.7	133		UCAC4 673-015446	153591	2001 SN263	54	790	-8	0%	119	54	2 53 25.300	44 26 22.77			6955	00%	
2021	Dec	30	0	19.6	4 0.006	0.4s	12.8	3.0	3.1	177		UCAC4 554-029926	7358	Oze	78	402		0%	127	20	6 40 20.367	20 46 35.74			7018	04%	
2021	Dec	30	17	53.2	1 0.010	0.4s	10.5	6.0	6.2	63		TYC 573-00377-1	7341	1991 VK	50	565		0%	104	13	22 30 31.256	5 10 41.74			7046	16%	
2021	Dec	30	19	29.1	1 0.020	0.2s	12.8	3.7	3.9	56		UCAC4 372-180089	K163899	2003 SD220	19	231		0%	97	13	22 36 23.713	-15 43 33.38			7048	73%	

Ln 6, Col 1

100%

Windows (CRLF)

UTF-8 avec nomenclature

# Observed Results of some stellar occultations produced by Near-Earth asteroids

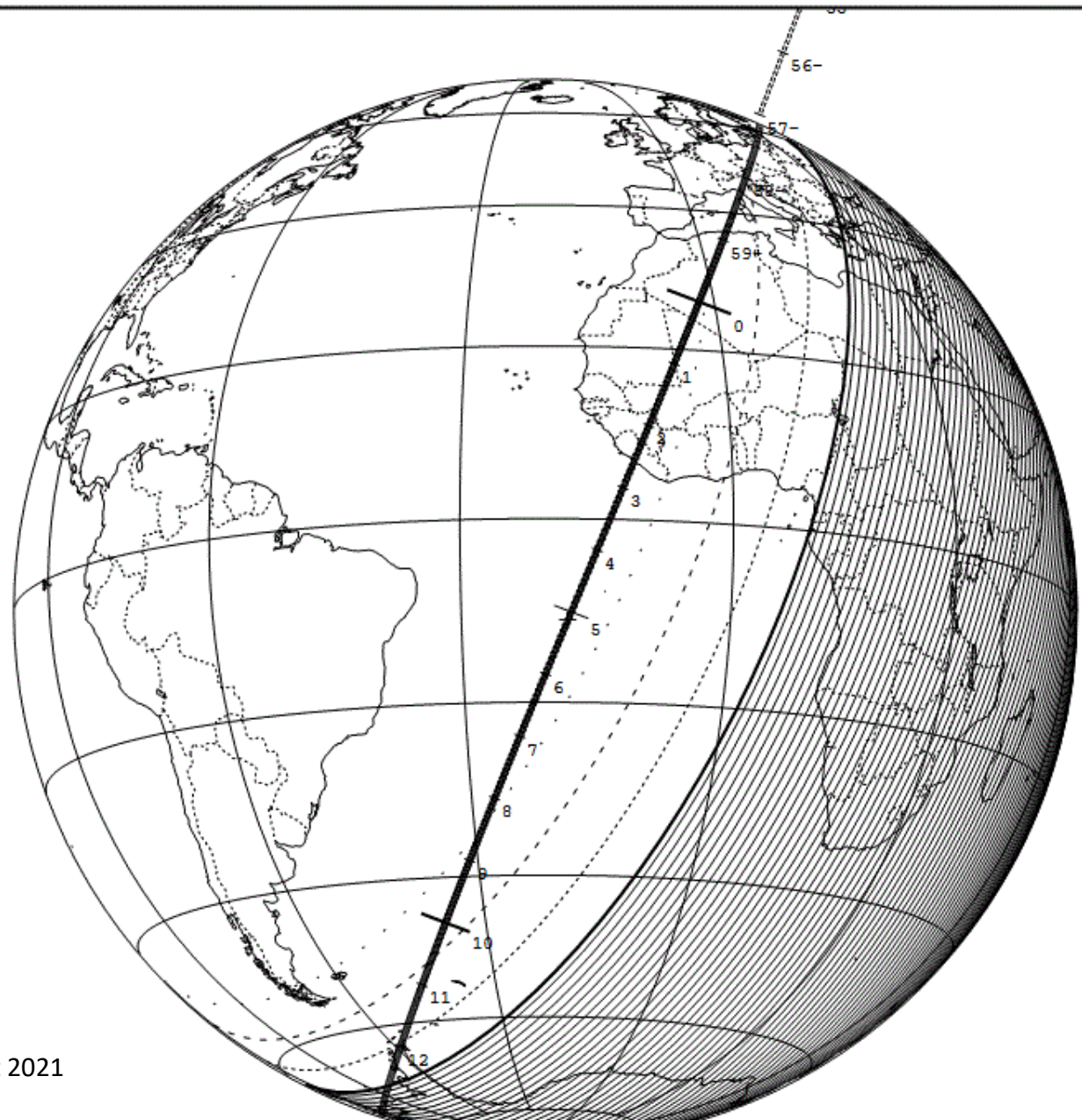
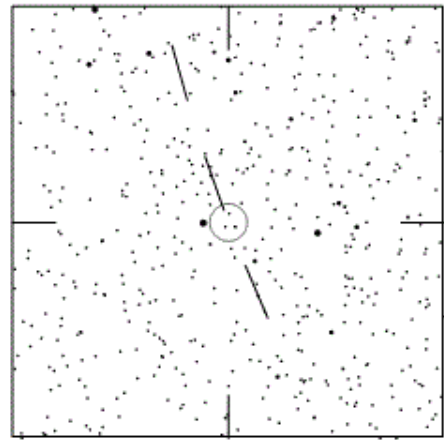
- **15-10-2019 a stellar occultation by NEA PHA Apollo 3200 Phaethon at Ain Defla (160 kms West of Algiers) - First positive observation with C8 Telescope.**
- **25-10-2019 a stellar occultation by NEA PHA Apollo 3200 Phaethon at Nedroma (570 kms West of Algiers) - Positive observation with C8 Telescope.**
- 17-11-2020 a stellar occultation by NEA Amor 1036 Ganymed at Laghouat (500 kms South of Algiers) - Technical problems.
- **20-01-2021 a stellar occultation by NEA PHA Amor 3122 Florence at Bechar (1000 kms South West of Algiers) - One negative observation with C8 Telescope.**
- 28-01-2021 a stellar occultation by NEA Amor 1999 AP10 at Ain Temouchent (500 kms West of Algiers) - Mists and Full moon near the star.
- **16-03-2021 a stellar occultation by NEA Amor 2009 WF104 at Tebessa (600 kms East of Algiers) - One Negative observation and acquisition problems.**
- **22-08-2021 a stellar occultation by NEA Amor 1943 Anteros at El-Affroun (Blida) (60 kms West of Algiers) - One Negative Observation with C11 Telescope.**

# 1036 Ganymed occults UCAC4 400-029007 on 2020 Nov 17 from 4h 57m to 5h 13m UT

Star:  
Mag V = 11.5  
RA = 7 28 5.8630 (astrometric)  
Dec = -10 2 28.833  
[of Date: 7 29 5, -10 4 55]  
Prediction of 2020 Oct 28.0

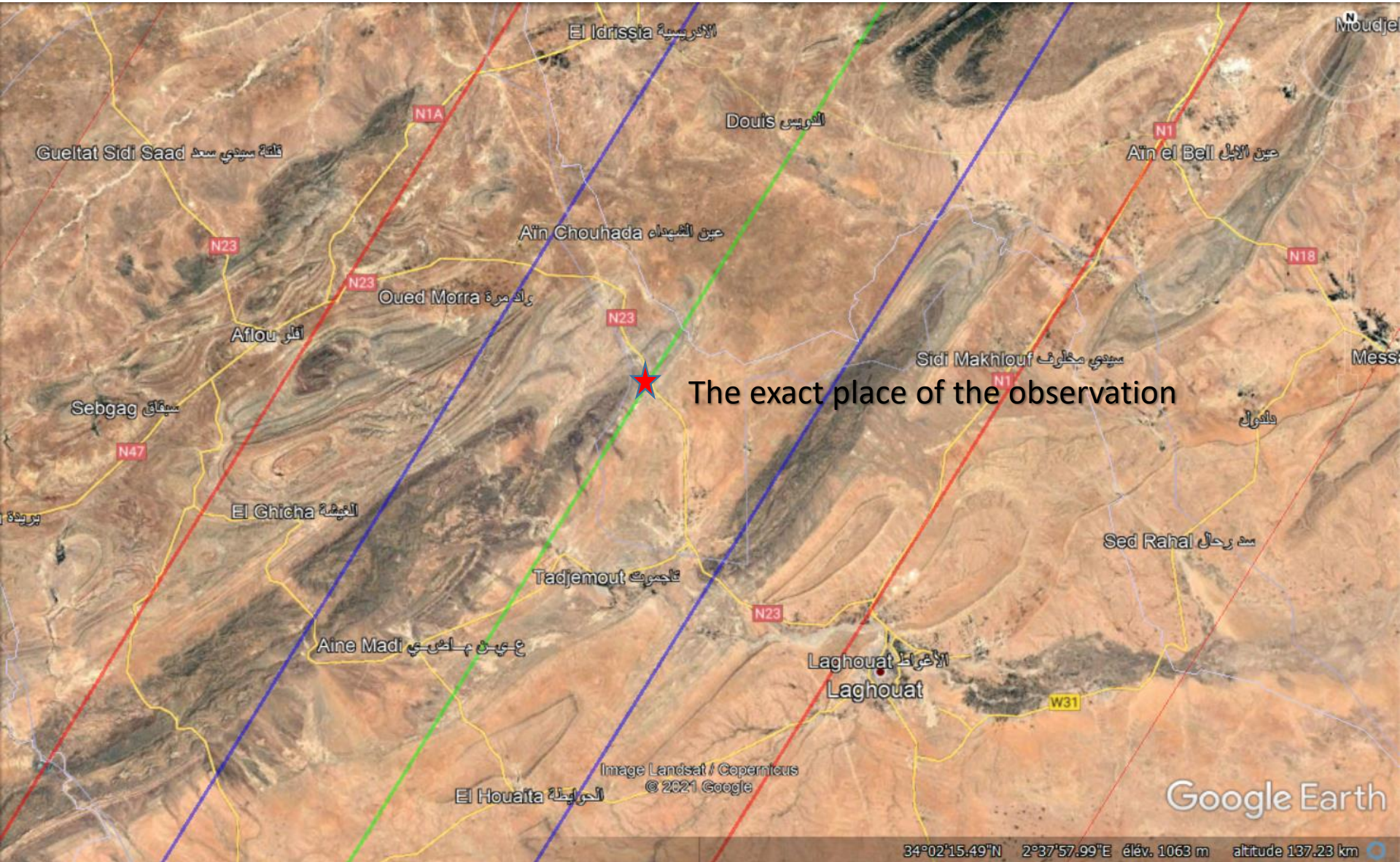
Max Duration = 2.7 secs  
Mag Drop = 2.0 (0.0r)  
Sun : Dist = 115°  
Moon: Dist = 136°  
illum = 6 %  
E 0.015"x 0.011" in PA 84

Asteroid: (in DAMIT, ISAM)  
Mag = 13.3  
Dia = 36 ±2km, 0.030"  
Parallax = 5.373"  
Hourly dRA = -0.968s  
dDec = -37.63"



ESOP XL, Bialystok (Poland), August 2021

# The stellar occultation by the NEA Amor 1036 Ganymed near Laghouat (450 km South of Algiers) We had technical problems







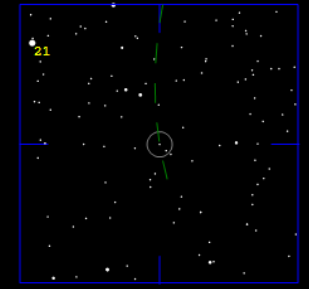
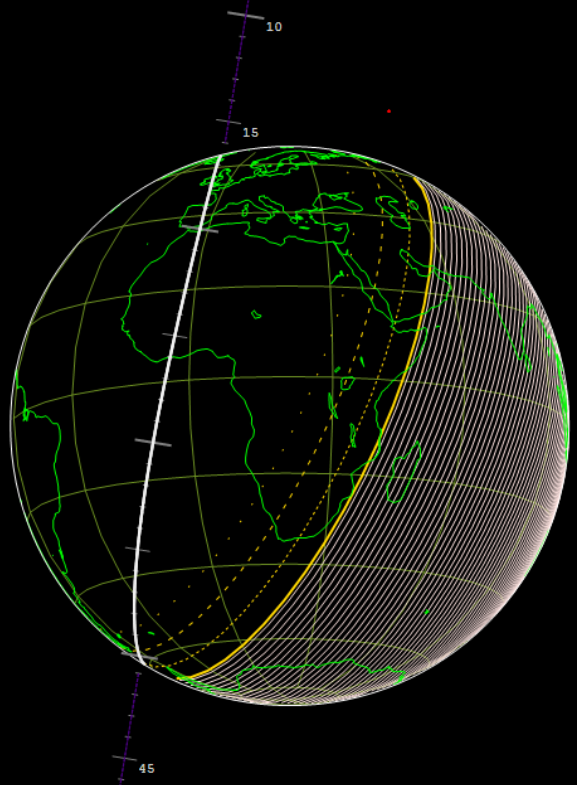
# The stellar occultation by the NEA PHA Amor 3122 Florence near Bechar (970 km South West of Algiers) and we had one negative observation

## Probability : 10%

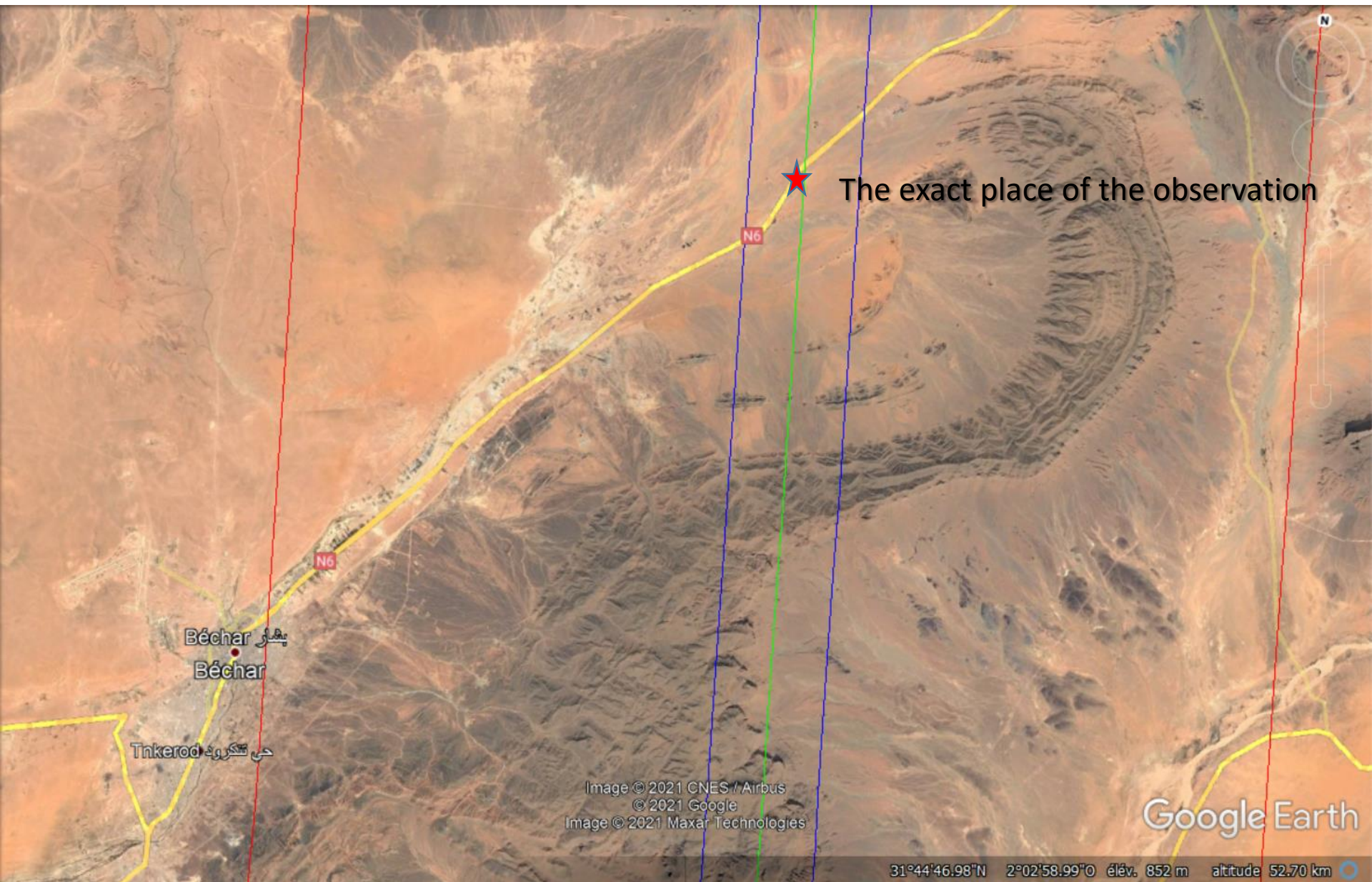
3122 Florence occults TYC 5530-01810-1 on 2021 Jan 20 from 3h 17m to 3h 40m UT

Star:	Max Duration = 0.5 secs	Asteroid:
Mag V = 10.5; B = 11.4; R = 10.0	Mag Drop = 8.1 (8.2r)	Mag = 18.6
RA = 12 30 4.8265 (astrometric)	Sun : Dist = 109°	Dia = 4 ±0km, 0.003"
Dec = -10 10 42.681	Moon: Dist = 165°	Parallax = 4.488"
[oF Date: 12 31 10, -10 17 36]	: illum = 43 %	Hourly dRA = -0.227s
Prediction of 2021 Jan 14.0	E 0.012"x 0.012" in PA 90	dDec = -20.44"

2 moons. (?) 0km at 5km, Period 0.300days, (?) 0km at 10km, Period 1.020days  
Amor + PHA



Occult 4.11.0.1.Astorb2021Jan13 Errors: Star+PeakEphemUncert



The exact place of the observation

Béchar  
بشار

Tnkerod  
حي تڨرود

Image © 2021 CNES / Airbus  
© 2021 Google  
Image © 2021 Maxar Technologies

Google Earth

31°44'46.98"N 2°02'58.99"O élév. 852 m altitude 52.70 km



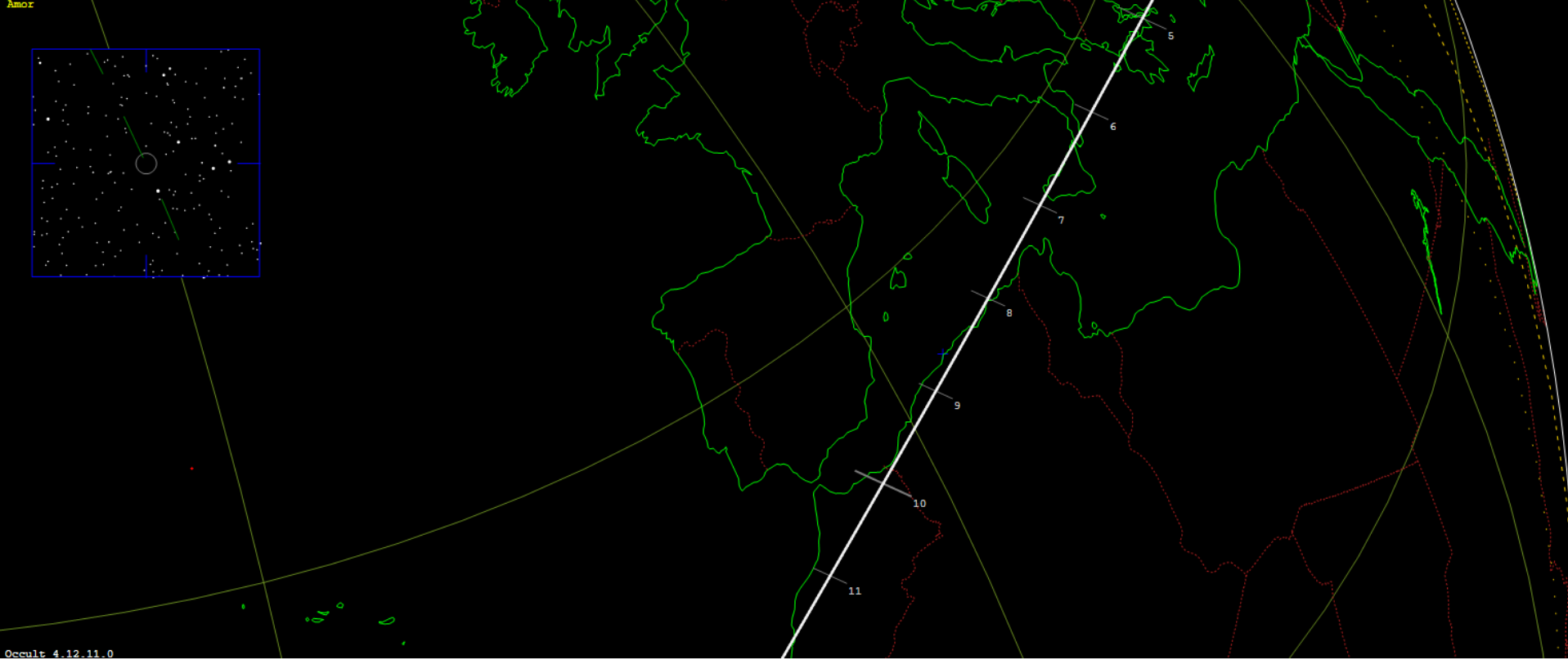
ESOP XL, Bialystok (Poland), August 2021

# The stellar occultation by NEA Amor 1999 AP10 near Ain Temouchent (490 km East of Algiers) We had mists and full moon near the star Probability : 35%

159402 1999 AP10 occults UCAC4 648-046008 on 2021 Jan 28 from 3h 2m to 3h 32m UT  
Star: (Dia < 0.1 mas)  
Mv 12.9; Mb 13.3; Mr 12.4  
RA = 7 56 26.7127 (astrometric)  
Dec = 39 31 35.631  
[of Date: 7 57 52, 39 28 11]  
Prediction of 2021 Aug 28.0  
Reliable 1.2 (good),

Max Duration = 0.33 secs  
Mag Drop = 3.7 (3.8r)  
Sun : Dist = 156°  
Moon: Dist = 16°  
: illum = 99 %  
Error 4.6x4.6 mas in PA 90°

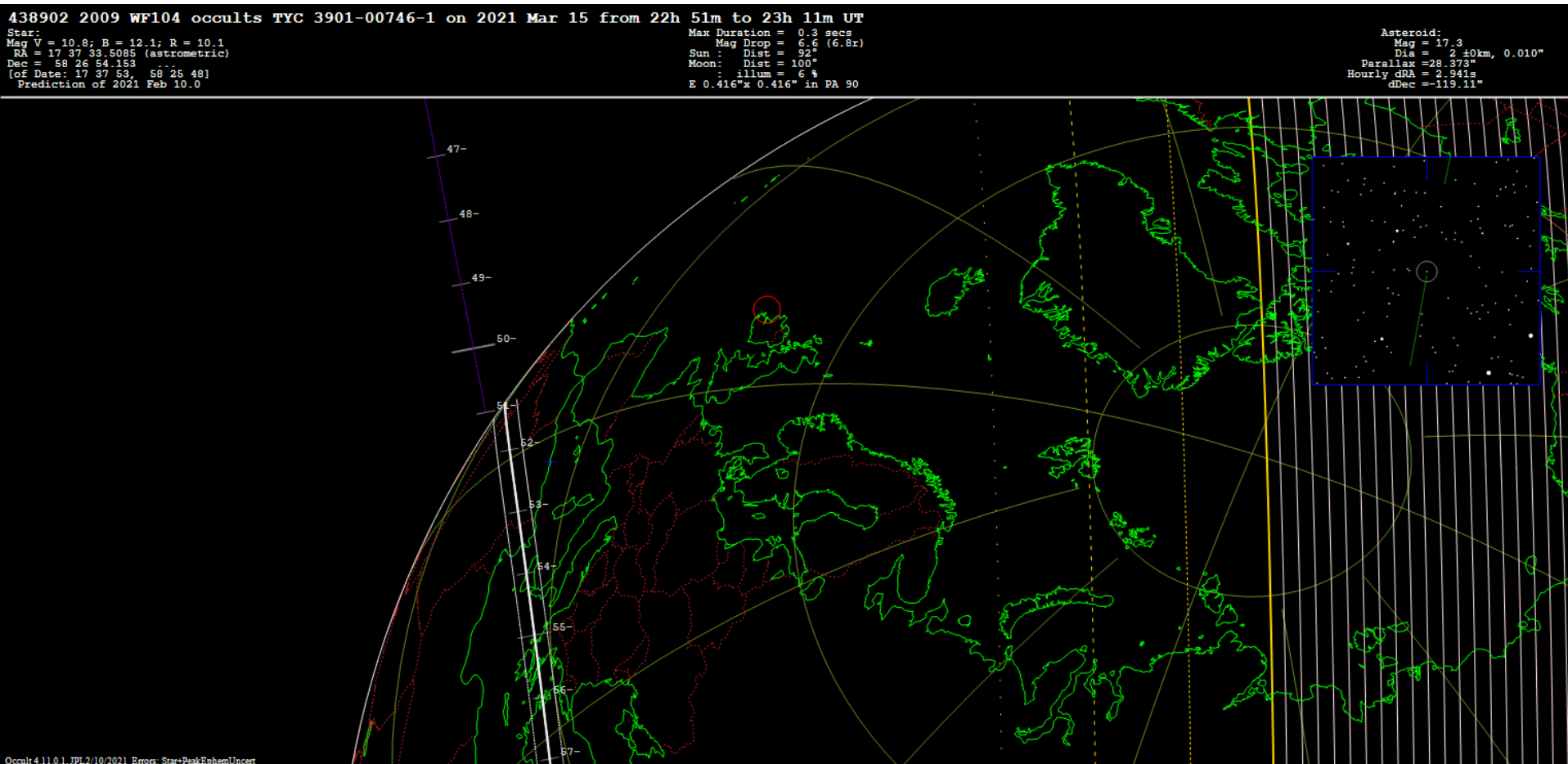
Asteroid:  
Mag = 16.6  
Dia = 1.90 ± 0.19km, 5.4 mas  
Parallax = 18.129"  
Hourly dRA = -2.137/s  
dDec = -54.20"  
Astorb2021 Jun 27, Star+PeakEphemUncert



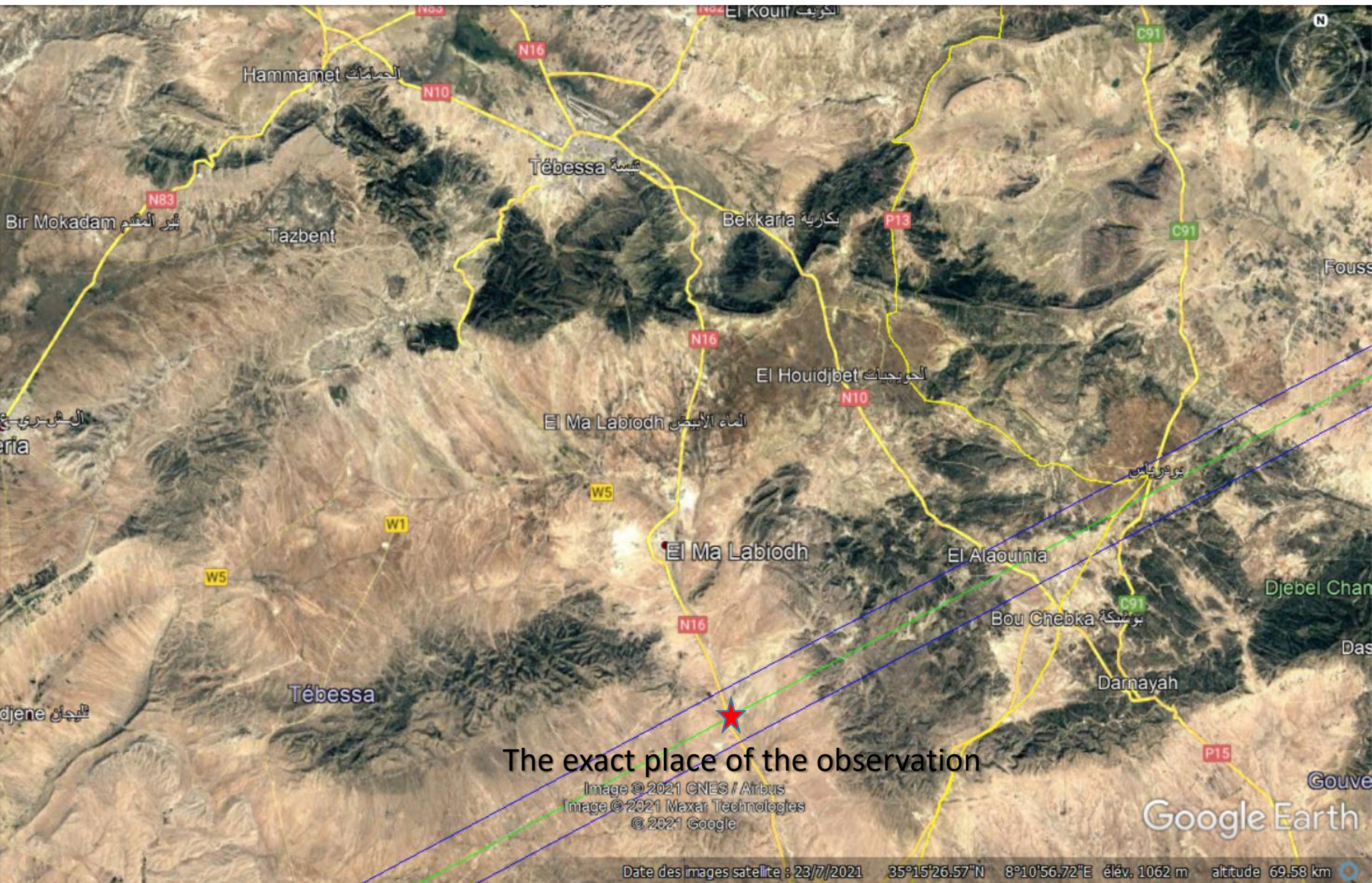


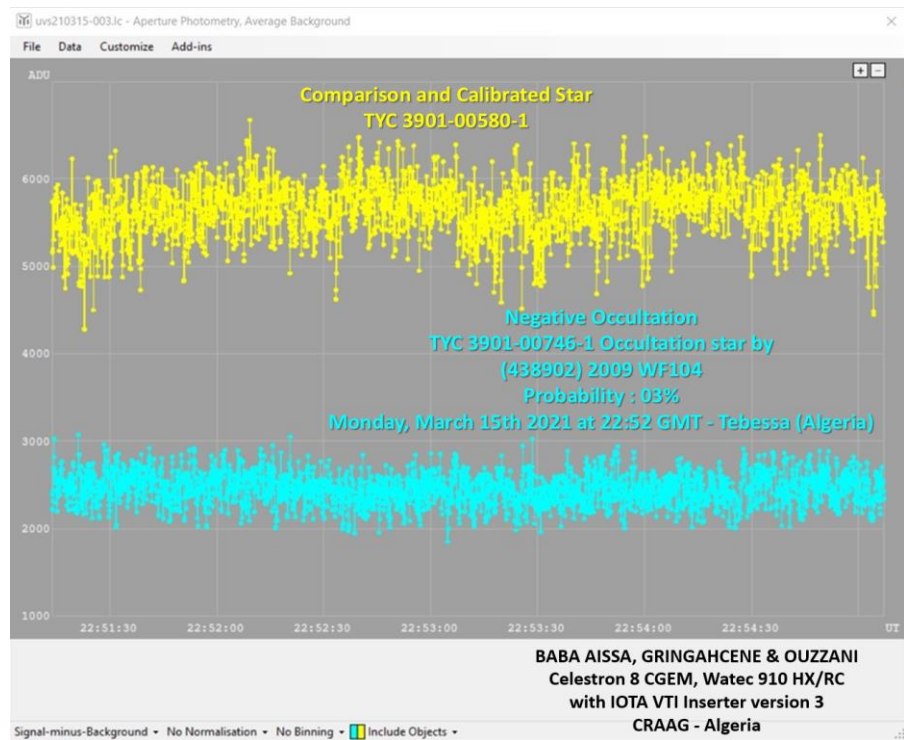
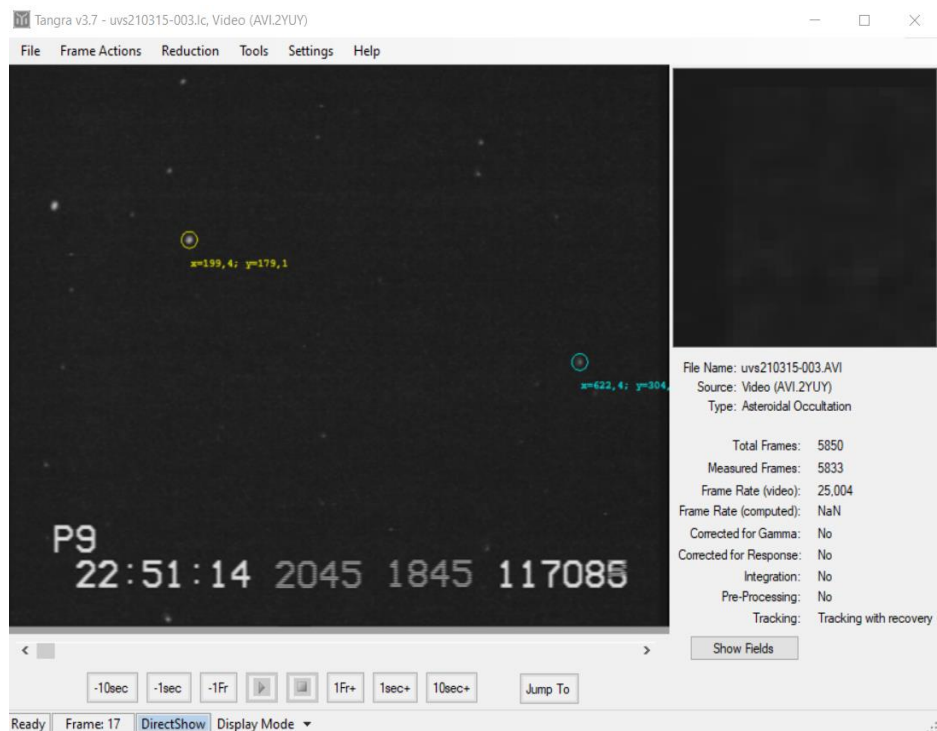


# The stellar occultation by NEA Amor 2009 WF104 near Tebessa (630 km East of Algiers) One Negative observation and acquisition problems Probability : 19%







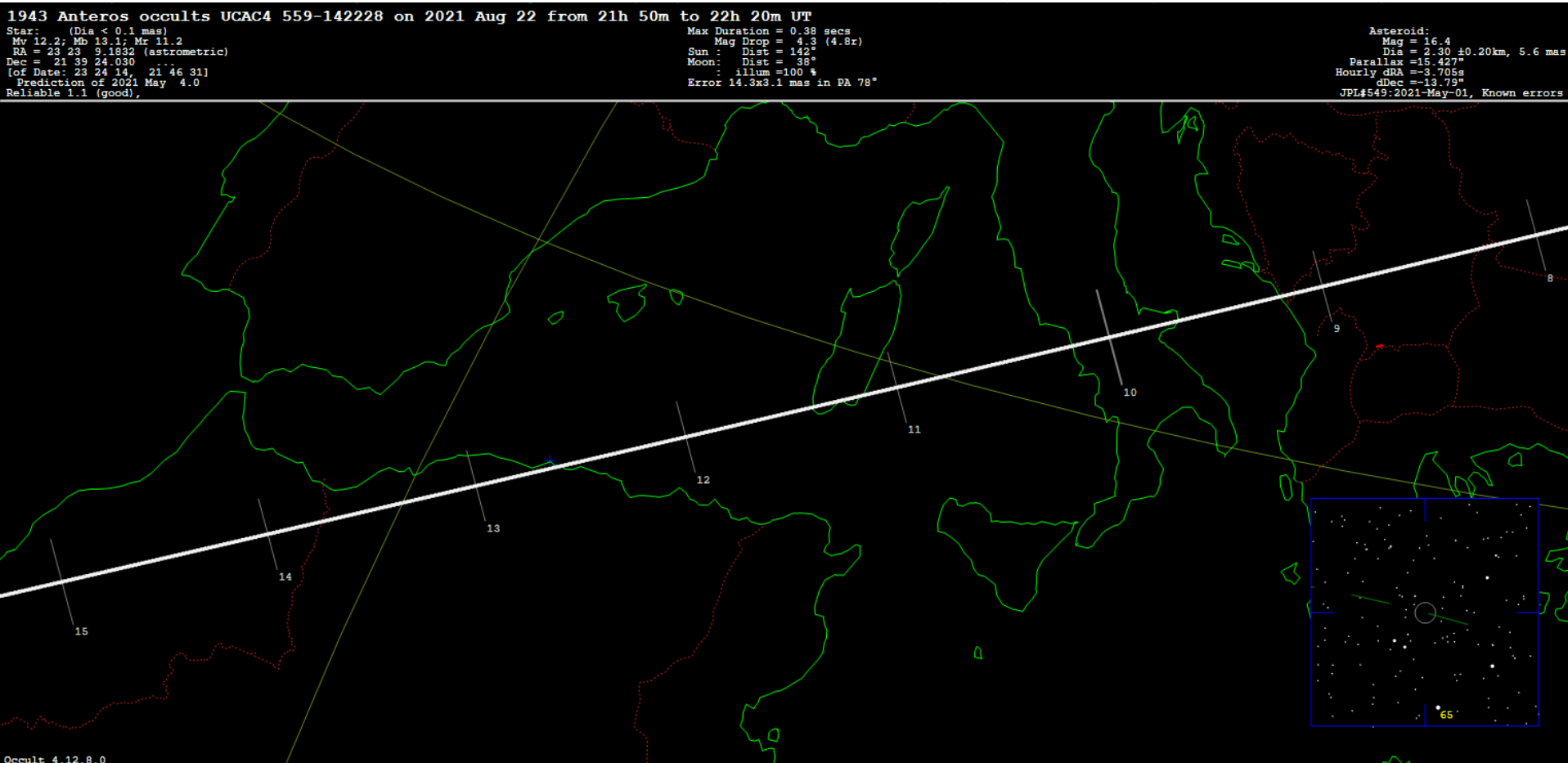


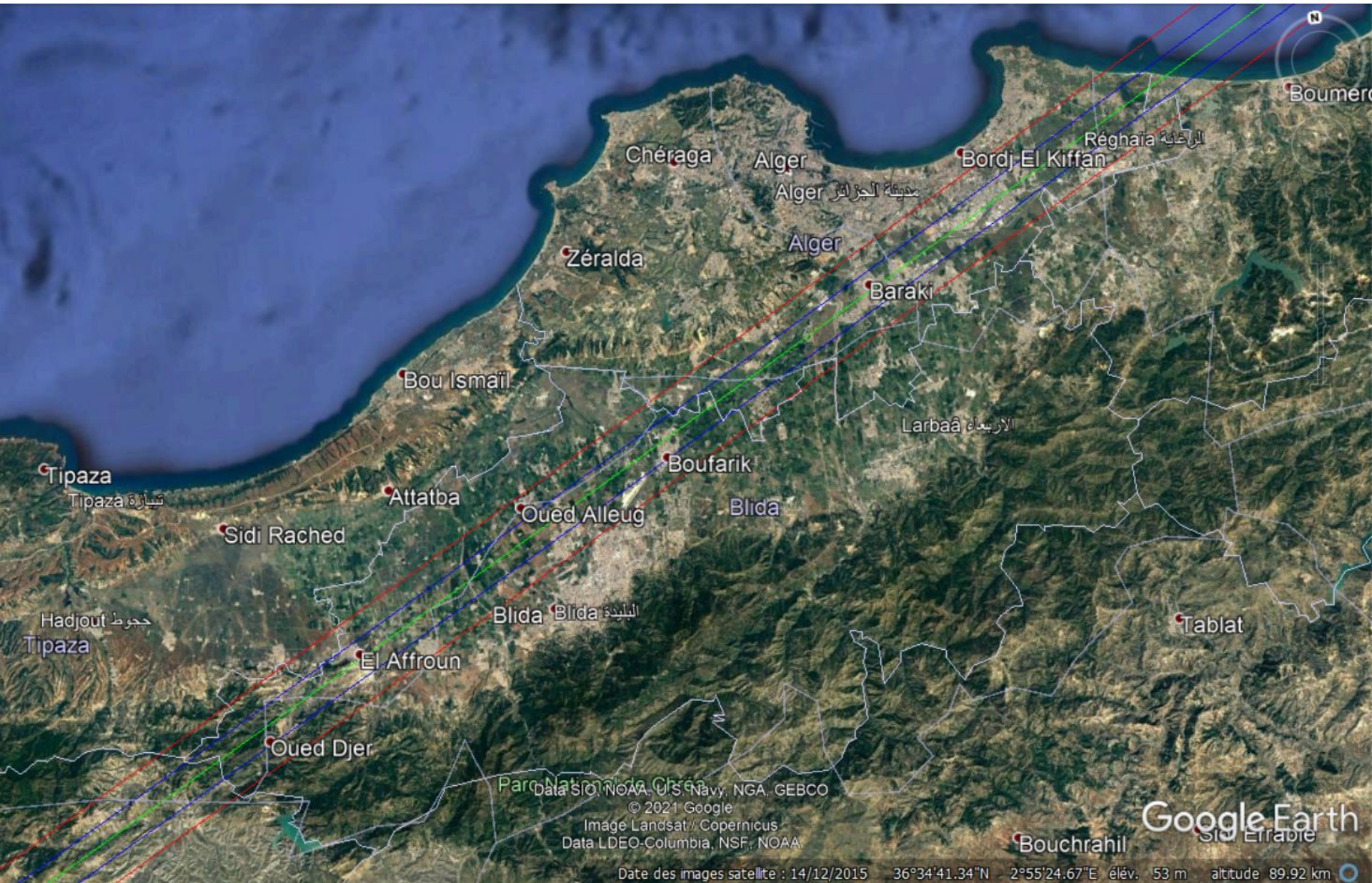


# The stellar occultation by NEA Amor 1943 Anteros near El-Affroun (Blida) (70 km East of Algiers)

One Negative observation

Probability : 62%







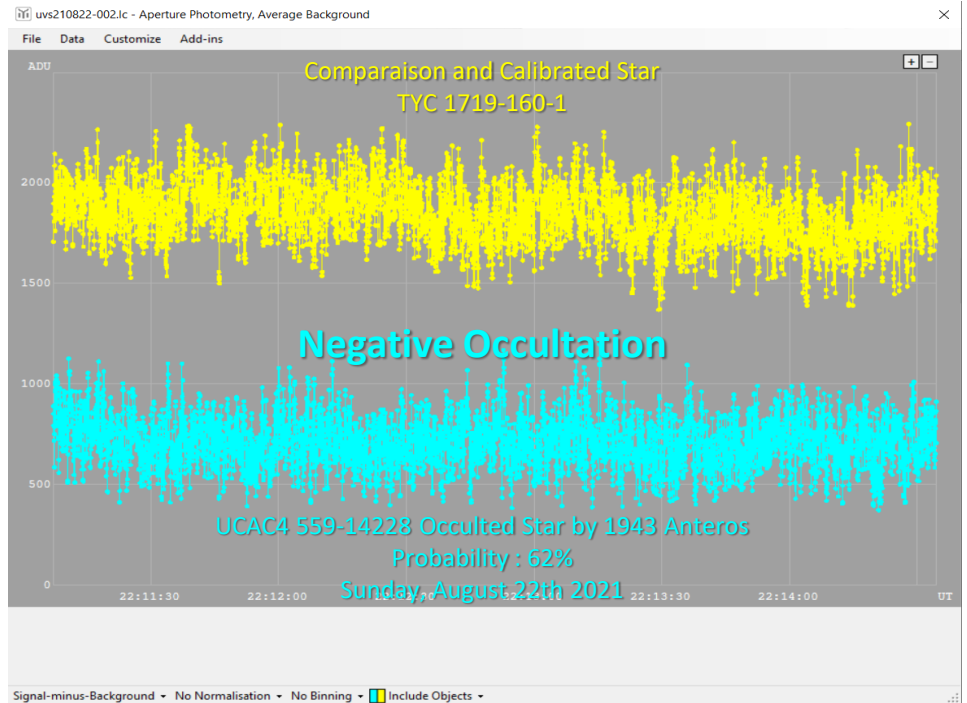
The exact place of the observation



```

Satellites: 9 HDOP: 0.90
UTC: 22:15:29 2021-08-22
Latitude: 3627.0423 N
Longitude: 00236.3381 E
Altitude: 126.0 M MSL
WGS84 separation: 46.5 M

CPU clock 1000008 Hz
Err Transient
vSync 20000 CPU us
External PAL TVsafe
Last used 22h 2021-08-22
  
```







# Publication of the scientific article about the discovery of a double star In Journal of Double star Observations, 2021

## TYC 2392-01288-1, Discovery of Stellar Duplicity During Asteroidal Occultation by (283) Emma

Eric Frappa (European IOTA coordinator)<sup>1</sup>, Petr Zeleny<sup>2,3,8</sup>, Pietro Baruffetti<sup>4,9</sup>,  
Abdelhak Bendjeddou<sup>5</sup>, Michele Bigi<sup>4,9</sup>, Omar Bouazara<sup>5</sup>, Abderrahman Gacem<sup>5</sup>,  
Hadj Mahmoud Khenifer<sup>5</sup>, Lakhdar Mokhtari<sup>5</sup>, Peter Nosal<sup>6</sup>, Hicham Rayane<sup>5</sup>,  
Tarek El Mokhtar Selimi<sup>5</sup>, Stefano Sposetti<sup>7</sup>, and Djounai Baba Aissa<sup>10</sup>

1. Euraster, Faycelles, France
2. Observatory Valasske Mezirici, Czechia
3. Occultation & Astrometry Section of Czech Astronomical Society
4. Gruppo Astrofili Massesi, Massa, Italy
5. Association Suhail d'Astronomie, Laghouat, Algeria
6. Viglas, Slovakia
7. Gnosca, Switzerland
8. International Occultation Timing Association (IOTA-ES)
9. European Asteroidal Occultation Network (EAON)
10. Centre de Recherche en Astronomie, Astrophysique et Géophysique (CRAAG),  
Alger, Algeria

**Abstract:** An occultation of TYC 2392-01288-1 by the minor planet (283) Emma on November 24, 2020 showed this star to be a previously unknown double star. The occultation of the main component alone was observed by one visual double station in Algeria. The occultation of the secondary component alone was observed by three stations in Czechia and Italy. Two negative observations were also reported from Slovakia and Switzerland. From a Gaia G magnitude of 8.73 for the target star, an estimated V magnitude of 12.8 for the asteroid, and a 0.18 mag drop measured for the occultation of the secondary component, we conclude that the approximate G (or V) magnitudes of the two components are 8.9 and 10.7. Two solutions for the separation and position angle of the components are derived from a fit of the chords on the 3D model DAMIT #1859 of the asteroid. The separation of the two components in solution 1 is found to be  $0.7000 \pm 0.0038$  arcseconds at a position angle of  $105.0 \pm 0.2$  degrees. The separation of the two components in solution 2 is found to be  $0.7530 \pm 0.0026$  arcseconds at a position angle of  $109.6 \pm 0.2$  degrees.

### Circumstances

On November 24, 2020 an occultation of TYC 2392-01288-1 by (283) Emma and its moon S2003-283-1 was first predicted by Steve Preston (using Occult software) to pass across Russia, Europe and North Africa. Figure 1 shows the predicted path of the main body's shadow, and Figure 2 shows the predicted path of its moon's shadow, about 450 km to the northwest.

The predicted magnitude drop was 4.1 (V) with a predicted max duration of 11.5 s for Emma and 0.9 s for its moon.

### Observations

Seven reports from six different stations were received for this event (summarized in Table 1). Three stations in Europe, one in Czechia and two in Italy, originally waiting for a possible short occultation by the asteroid's moon, recorded actually a ~10 s event with a very low 0.1-0.2 magnitude drop, suggesting that the target star is double and that the asteroid has occulted a faint companion from these locations (Figures 3, 4 and 5). Fortunately, the occultation of the main star was also observed by a team of observers in Algeria, divided in two groups to make a visual double station, who reported a 7 s occultation allowing the measurement of the double star. Two additional stations from

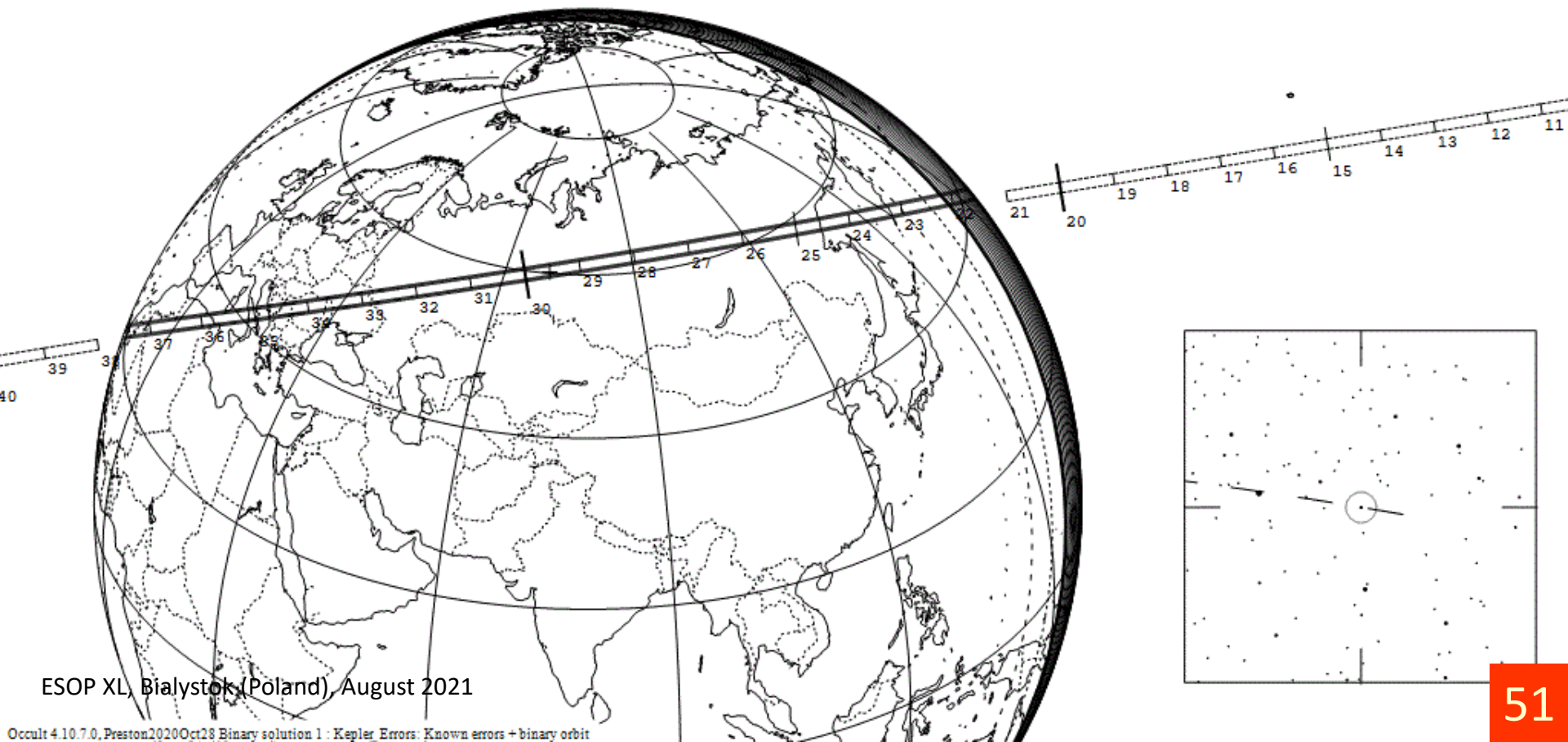
283 Emma #1 occults TYC 2392-01288-1 on 2020 Nov 24 from 19h 21m to 19h 38m UT

Star:  
 Mag V = 8.6  
 RA = 5 1 52.3239 (astrometric)  
 Dec = 32 14 29.404  
 [of Date: 5 3 14, 32 16 14]  
 Prediction of 2020 Oct 28.0

Max Duration = 11.5 secs  
 Mag Drop = 4.2 (0.0r)  
 Sun : Dist = 163°  
 Moon: Dist = 77°  
 : illum = 74 %  
 E 0.027"x 0.015" in PA 90

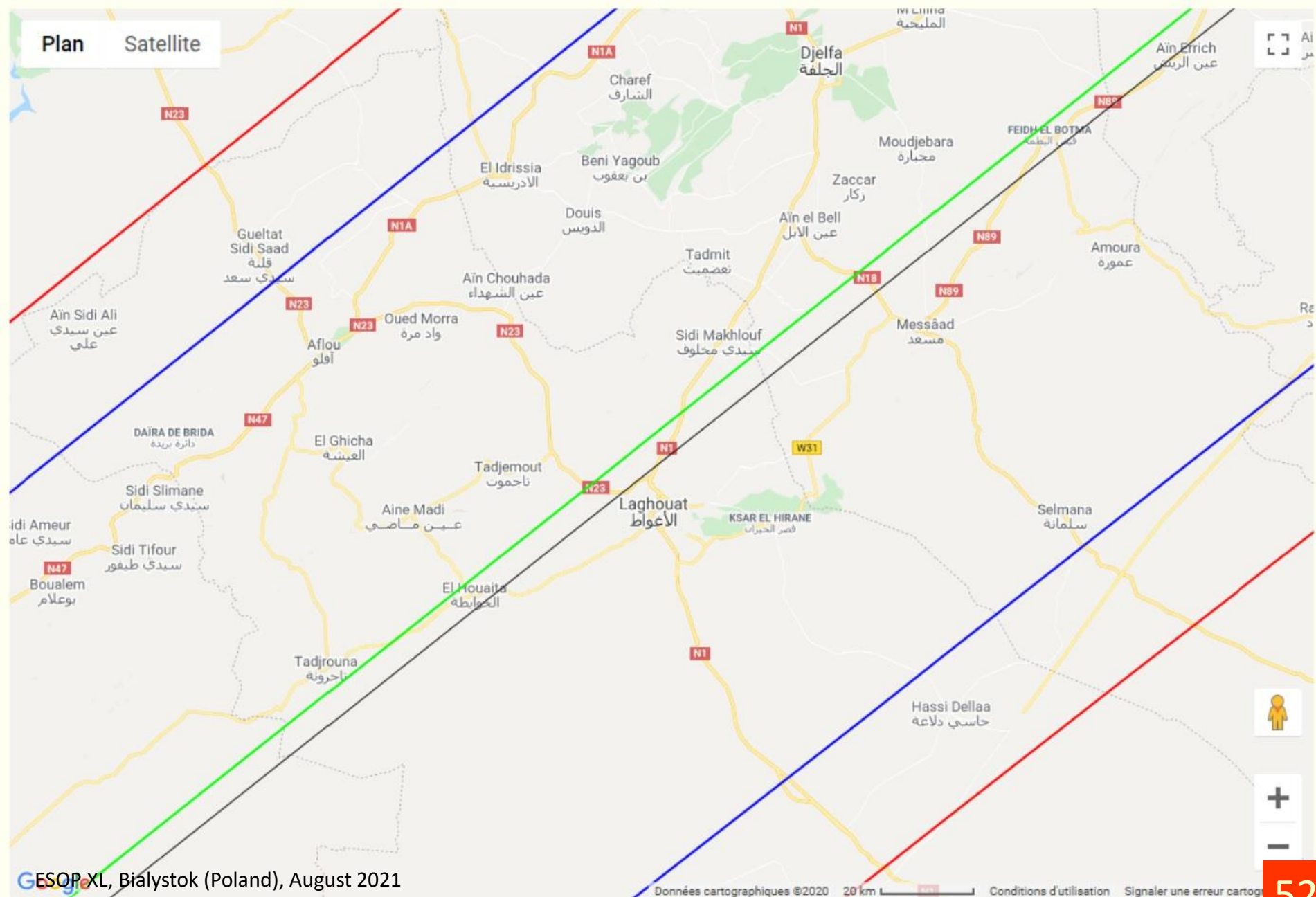
Asteroid: (in DAMIT, ISAM)  
 Mag = 12.8  
 Dia = 134 ±4km, 0.097"  
 Parallax = 4.603"  
 Hourly dRA = -2.360s  
 dDec = -4.88"

1 moon. {S/2003(283)1} 9km at 581km, Period 3.353days Orbit@Miriade



ESOP XL, Bialystok (Poland), August 2021

Occult 4.10.7.0, Preston2020Oct28 Binary solution 1 - Kepler Errors: Known errors + binary orbit



2020/11/24 | 283 | Emma | TYC 2392-01288-1

chords

chords + DAMIT model solution 1 (primary and secondary star events aligned)

chords + DAMIT model solution 2 (primary and secondary star events aligned)

asteroid measurement: at least 122 km

double star solution 1: Sep 0.700", PA 105.0°

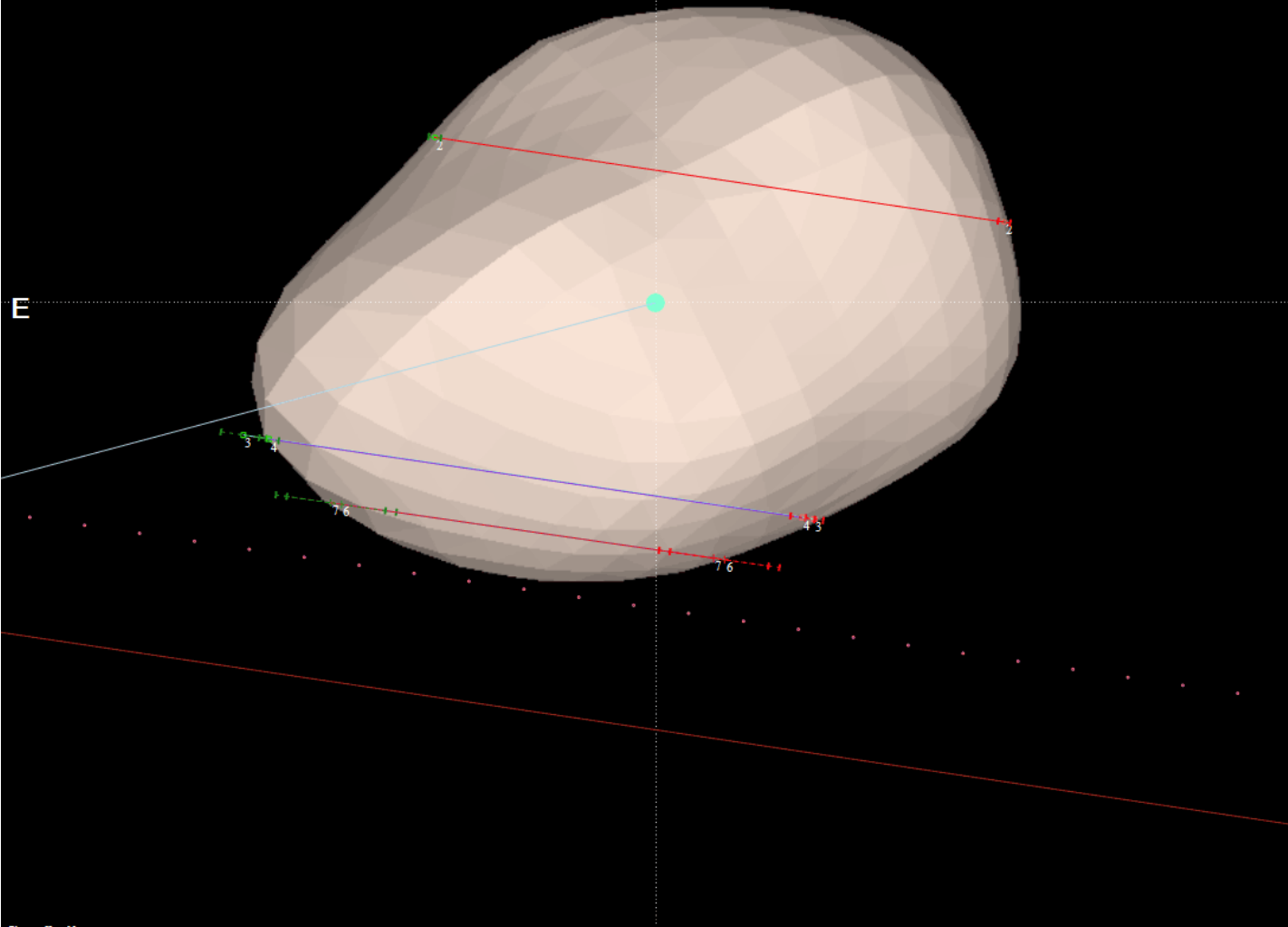
double star solution 2: Sep 0.753", PA 109.6°

```
P+ | prediction | 19:35:32 | 19:35:32 | | | | E 10 00 00 | N 38 29 36 | 0 | WS | ;
O+ | G. Abderhman et al | 19:28:08 | 19:38:04 | L120 | VIS | DZ | E 02 37 05.5 | N 33 57 29.2 | 750 | WS |
7.0 | 19:37:05.2 | 1.0 | 19:37:12.2 | 1.0 | NTP | 0.4 | 0.4 | A |
Standard PE applied. Observation with K. Mahmoud/T. Selimi. | ;
O+ | O. Bouazara et al | 19:33:18 | 19:38:03 | L120 | VIS | DZ | E 02 37 05.8 | N 33 57 29.7 | 750 | WS |
7.0 | 19:37:05.0 | 1.0 | 19:37:12.0 | 1.0 | NTP | 0.4 | 0.4 | A |
Standard PE applied. Observation with R. Hicham/B. Abdelhak. | ;
O- | Stefano Sposetti | 19:34:32 | 19:40:40 | M280 | VID | CH | E 09 01 26.5 | N 46 13 53.2 | 260 | WS | ;
O?2 | Pietro Baruffetti | 19:33:28 | 19:36:29 | M300 | VID | IT | E 10 07 56.7 | N 44 01 17.0 | 30 | WS |
9.73 | 19:34:28.02 | 0.22 | 19:34:37.75 | 0.18 | GPS++ | | | |
0.1 observed mag drop instead of 4.2 predicted. | ;
O+2 | Michele Bigi | 19:32:00 | 19:36:00 | M200 | VID | IT | E 10 08 19.0 | N 44 01 33.9 | 41 | WS |
10.41 | 19:34:27.76 | 0.16 | 19:34:38.17 | 0.41 | GPS++ | | | |
0.1 observed mag drop instead of 4.2 predicted. | ;
O+2 | Petr Zeleny | 19:31:16 | 19:37:07 | M254 | CCD | CZ | E 17 58 24.5 | N 49 27 47.9 | 338 | WS |
10.36 | 19:33:27.96 | 0.11 | 19:33:38.32 | 0.11 | GPS++ | | | |
0.2 observed mag drop instead of 4.2 predicted. | ;
O- | Peter Nosal | 19:33:23 | 19:36:37 | M250 | CCD | SK | E 19 17 49.3 | N 48 33 24.8 | 343 | WS | ;
```

(283) Emma 2020 Nov 24 131.1 x 131.1 km, PA 0.0°  
 Geocentric X -3923.2 Y 2495.0 km  
 Double : Sep 0.7000°, PA 105.0°

DAMIT #1859 2017-09-21

Sky Plane



find best fit

Center X 27.1  0.0 Centered on Shape model  
 Center Y 48.4  0.0

Major axis (km) 131.1  0.0 a/b=1.00  
 Minor axis (km) 131.1  0.0 dMag=0.00  
 Orientation 0.0  0.0 Motion 11.63km/s, X

Circular  Use assumed diameter  Include Miss events

Show:  Both  Primary  Secondary

Plot scale  normal  x 2  x 5

Plot scale

Quality of the fit Limits on size, but no shape

Form opacity

RMS fit 4.2 ± 13.8 km

1 (m)	Stefano Sposetti
2	Petr Zeleny
3	Michele Bigi
4	Pietro Baruffetti
5 (m)	Peter Nosal
6	O. Bouazara, R. Hicham et al
7	G. Abderhman, K. Mahmoud et al
8 (P)	Predicted

**Double star solution** [Help](#)

2 solutions  
 #1  #3  
 #2  #4

Sepn (masec) 700.0  0.0  
 PA of 2nd 105.0  0.0

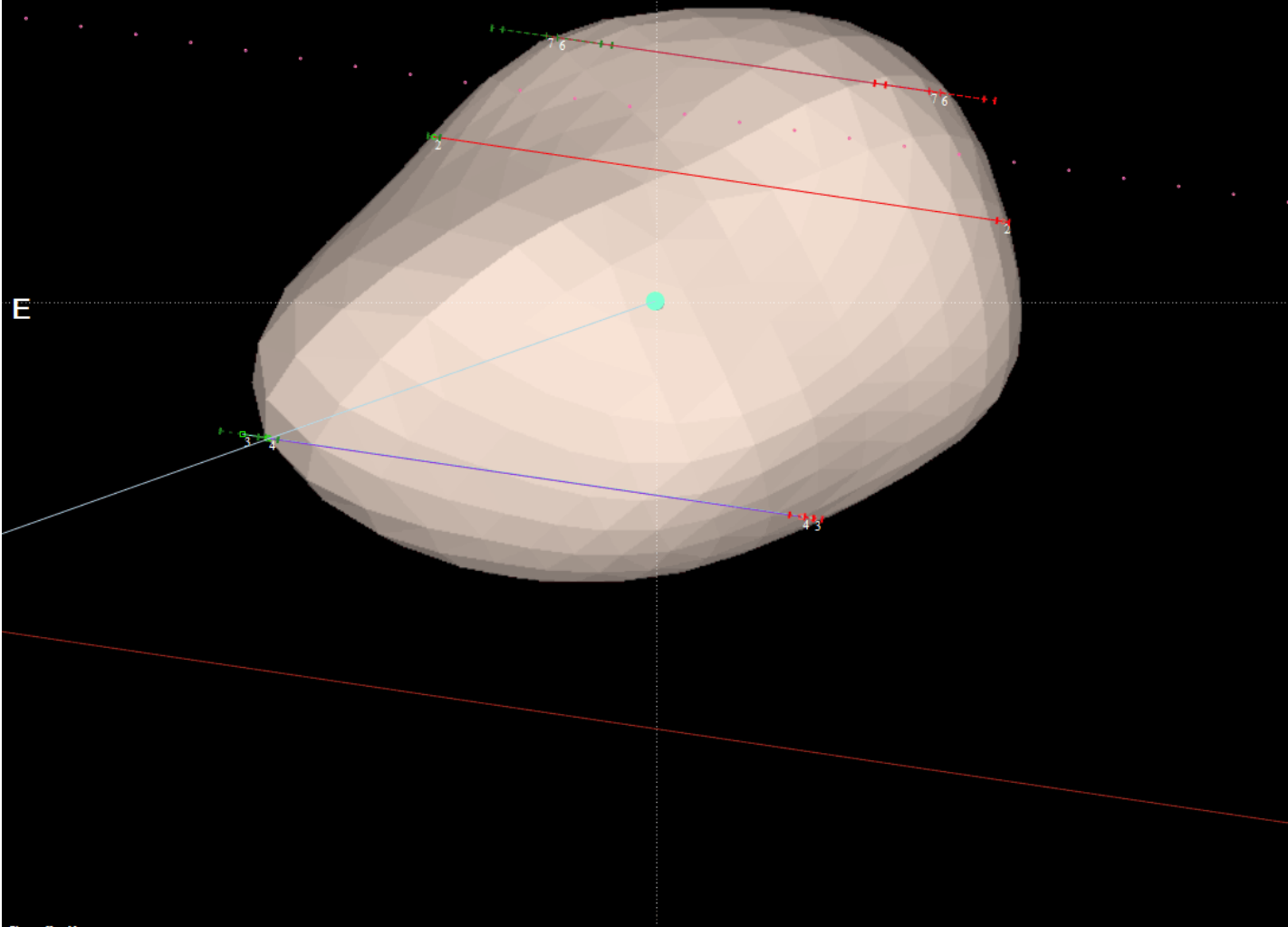
**Set offsets**

#1 (0.0,0.0)	#3 (0.0,0.0)
#2 (0.0,0.0)	#4 (0.0,0.0)

(283) Emma 2020 Nov 24 131.1 x 131.1 km. PA 0.0°  
 Geocentric X -3877.4 Y 2396.4 km  
 Double : Sep 0.7530". PA 109.6°

DAMIT #1859 2017-09-21

Sky Plane



Find best fit

Center X   0.0 Centered on Shape model  
 Center Y   0.0

Major axis (km)   0.0 a/b=1.00  
 Minor axis (km)   0.0 dMag=0.00  
 Orientation   0.0 Motion 11.63km/s, X

Circular  Use assumed diameter  Include Miss events

Show:  Both  Primary  Secondary

Plot scale  normal  x 2  x 5

Plot scale

Quality of the fit

Form opacity

- RMS fit 3.9 ± 12.5 km
- 1 (m) Stefano Sposetti
  - 2 Petr Zeleny
  - 3 Michele Bigi
  - 4 Pietro Baruffetti
  - 5 (m) Peter Nosal
  - 6 O. Bouazara, R Hicham et a
  - 7 G. Abderhman, K Mahmoud et
  - 8 (P) Predicted

**Double star solution** [Help](#)

2 solutions  #1  #3  #2  #4

Sepn (masec)   0.0  
 PA of 2nd   0.0

#1 (0.0,0.0)	#3 (0.0,0.0)
#2 (0.0,0.0)	#4 (0.0,0.0)





# Participative astronomy in Algeria according to observe stellar occultation by asteroids since 2019



تحت الرعاية السامية لوالي ولاية الأغواط  
Sous l'égide du Wali de Laghouat

مركز البحث في علم الفلك والفيزياء الفلكية والجيوفيزياء  
Centre de recherche en Astronomie, Astrophysique et Géophysique

بالتعاون مع :

مديرية التربية والرياضة لولاية الأغواط  
ديوان مؤسسات الشباب لولاية الأغواط  
رابطة الأنشطة العلمية والثقافية لولاية الأغواط  
جمعية سهيل لعلم الفلك - ولاية الأغواط

Direction de la jeunesse de la wilaya de Laghouat  
Office Des Etablissements de Jeunes de la Wilaya de Laghouat  
Ligue des activités scientifiques et culturelles de la wilaya de Laghouat  
Association Souhail d'Astronomie de Laghouat

## الملتقى الوطني الثامن لرصد الإحتجابات الكويكبية

من 26 إلى 27 أكتوبر 2019

رصد إحتجاب النجم TYC 1816-01657-1

من طرف الكويكب 332 سيرى

بولاية الأغواط ليلة السبت 26 إلى الأحد 27 أكتوبر 2019  
على الساعة 03:25 بالتوقيت المحلي

### Huitième rencontre nationale sur les occultations astéroïdales du 26 au 27 Octobre 2019

Observation de l'occultation de l'étoile  
TYC 1816-01657-1 par l'astéroïde 332 Sîri  
à la wilaya de Laghouat la nuit  
du Samedi 26 au Dimanche 27 Octobre 2019  
à 03h25mn heure locale

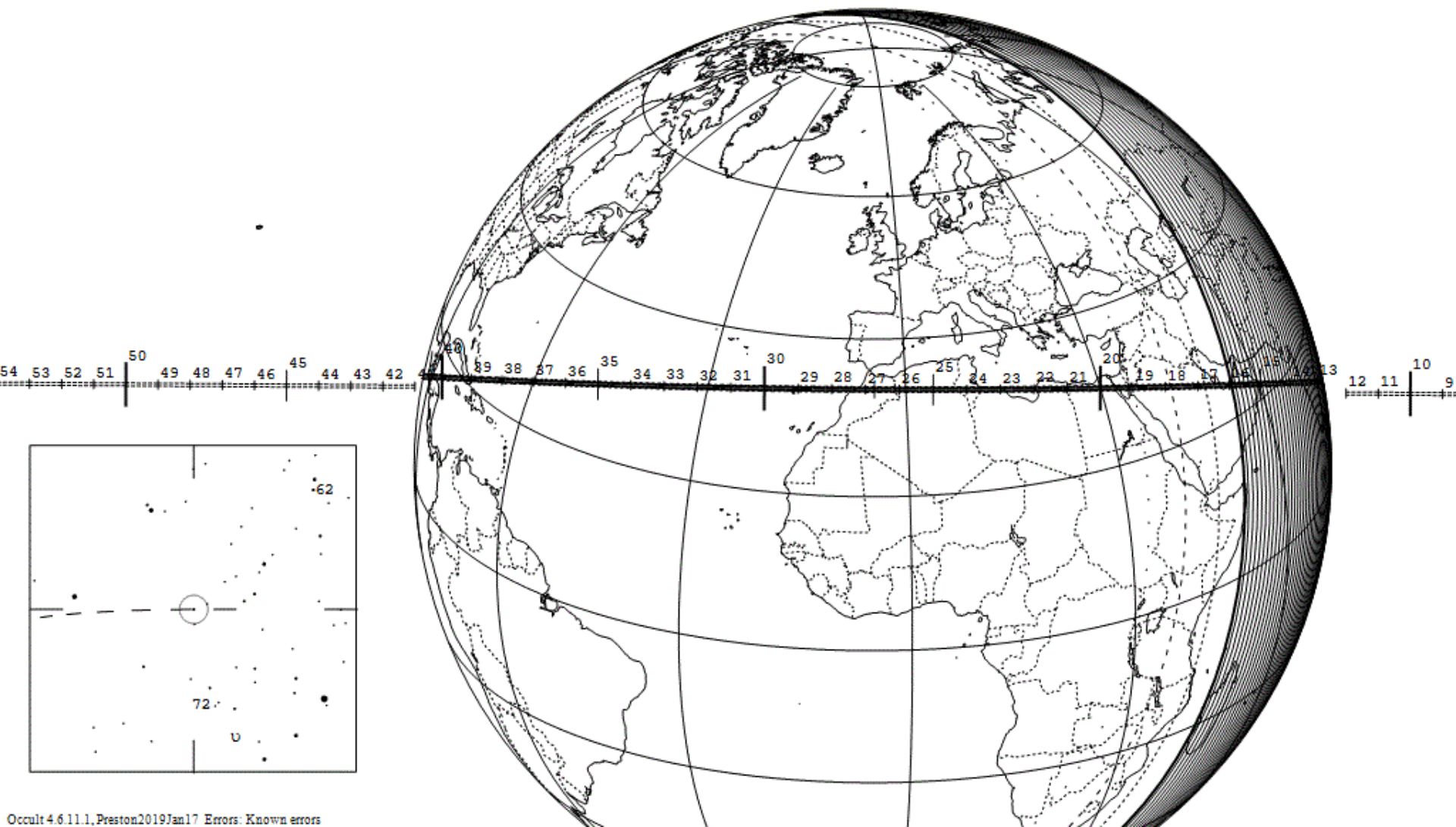
بمساهمة : Avec la participation de :

# 332 Siri occults TYC 1816-01657-1 on 2019 Oct 27 from 2h 13m to 2h 41m UT

Star:  
 Mag V = 8.8  
 RA = 4 27 11.8720 (BCRS)  
 Dec = 23 30 46.699  
 [of Date: 4 28 23, 23 33 20]  
 Prediction of 2019 Jul 21.0

Max Duration = 5.5 secs  
 Mag Drop = 5.2 (0.0r)  
 Sun : Dist = 145°  
 Moon: Dist = 129°  
 : illum = 2 %  
 E 0.026"x 0.013" in PA 79

Asteroid:  
 Mag = 14.0  
 Dia = 41km, 0.030"  
 Parallax = 4.695"  
 Hourly dRA = -1.435s  
 dDec = 0.14"





المركز القطري للبحوث الفلكية والجيوفيزيائية  
Centre de recherche en Astronomie, Astrophysique et Géophysique

الملتقى الوطني الثامن  
لرصد الإحتجابات الكوكبية  
من 26 إلى 27 أكتوبر 2019  
مركز احتجاب النجم 102-1  
TIC 1818-0165-1  
من 17 إلى 18 أكتوبر 2019  
الملتقى الوطني الثامن  
من 26 إلى 27 أكتوبر 2019  
على الساعة 03:25 بتوقيت المحلي

Huitième rencontre nationale  
sur les occultations astéroïdales  
du 26 au 27 Octobre 2019  
Observatoire du Centre de Recherche  
TIC 1818-0165-1 pour l'occultation 102-1  
du 17 au 18 Octobre 2019  
à 03h25 de l'heure locale

CRAG



2019/10/27 | 332 | Siri | TYC 1816-01657-1

asteroid measurement: at least 41 km

P+	prediction		02:25:15	02:25:15					E	03 00 00	N 33 15 41	0	WS	;
O+	K. Maamri et al				M150	VIS	DZ	E	03 00 10.8	N 33 29 38.0	875	WS		
	5.57	02:25:20.12	1	02:25:25.69	1	NTP	0.40	0.40	A					
	<i>Observation with H. Benmahiedine.</i> ;													
O+	A. Ghadi et al				M130	VIS	DZ	E	03 00 18.0	N 33 29 37.0	897	WS		
	5.61	02:25:19.77	1	02:25:25.38	1	NTP	0.40	0.40	A					
	<i>Observation A. Bouchareb.</i> ;													
O+	O. Bouazara et al				M130	VIS	DZ	E	03 02 36.0	N 33 26 46.7	848	WS		
	4.58	02:25:20.95	1	02:25:25.53	1	NTP	0.40	0.40	A					
	<i>Observation with H. Rayane.</i> ;													
O+	Djounai Baba Aissa		02:22:06	02:27:16	M203	VID	DZ	E	03 08 33.8	N 33 18 54.1	795	WS		
	5.28	02:25:17.42	0.04	02:25:22.70	0.04	GPS++								
O+	R. Aider et al				M114	VIS	DZ	E	03 08 35.4	N 33 18 55.3	795	WS		
	5.09	02:25:17.47	1	02:25:22.56	1	NTP	0.40	0.40	A					
	<i>Observation with S. Belhanachi/Y. Hocine.</i> ;													
O-	N Bouhoume Ali et al		02:24:01	02:26:03	M114	VIS	DZ	E	03 20 28.0	N 33 09 27.0	743	WS		
	<i>Observation with B. Benaoumeur.</i> ;													

**Antenna Place** : 3 teams - 3 telescopes - 6 persons  
Souhail Association of Astronomy (Laghouat)  
**One positive Observation**

**Nili Place** : 4 teams - 4 telescopes - 8 persons  
Horizon Djurdjura Association (Tizi Ouzou)  
and Sirius Association of Amateur Astronomers (Bejaia)  
**Two positive Observations**

**North road connection of Hassi Delaâ 7 kilometers north of Bellil** :  
3 teams - 3 telescopes - 3 persons  
Algiers Observatory (CRAAG)  
and El-Idrissi Association of Astronomy from Bousmail (Tipaza)  
**Two positive Observations**

**Youth Hostel of Bellil** :  
1 team - 1 telescope - 1 personne  
Algiers Observatory (CRAAG)  
**Technical problems**

**First road connection 6 kilometers south of Bellil** :  
2 teams - 2 telescopes - 3 persons  
Callisto Astronomy Club of Algiers  
and Al-birûni Astronomy Club of Algiers  
**One positive observation without measure**

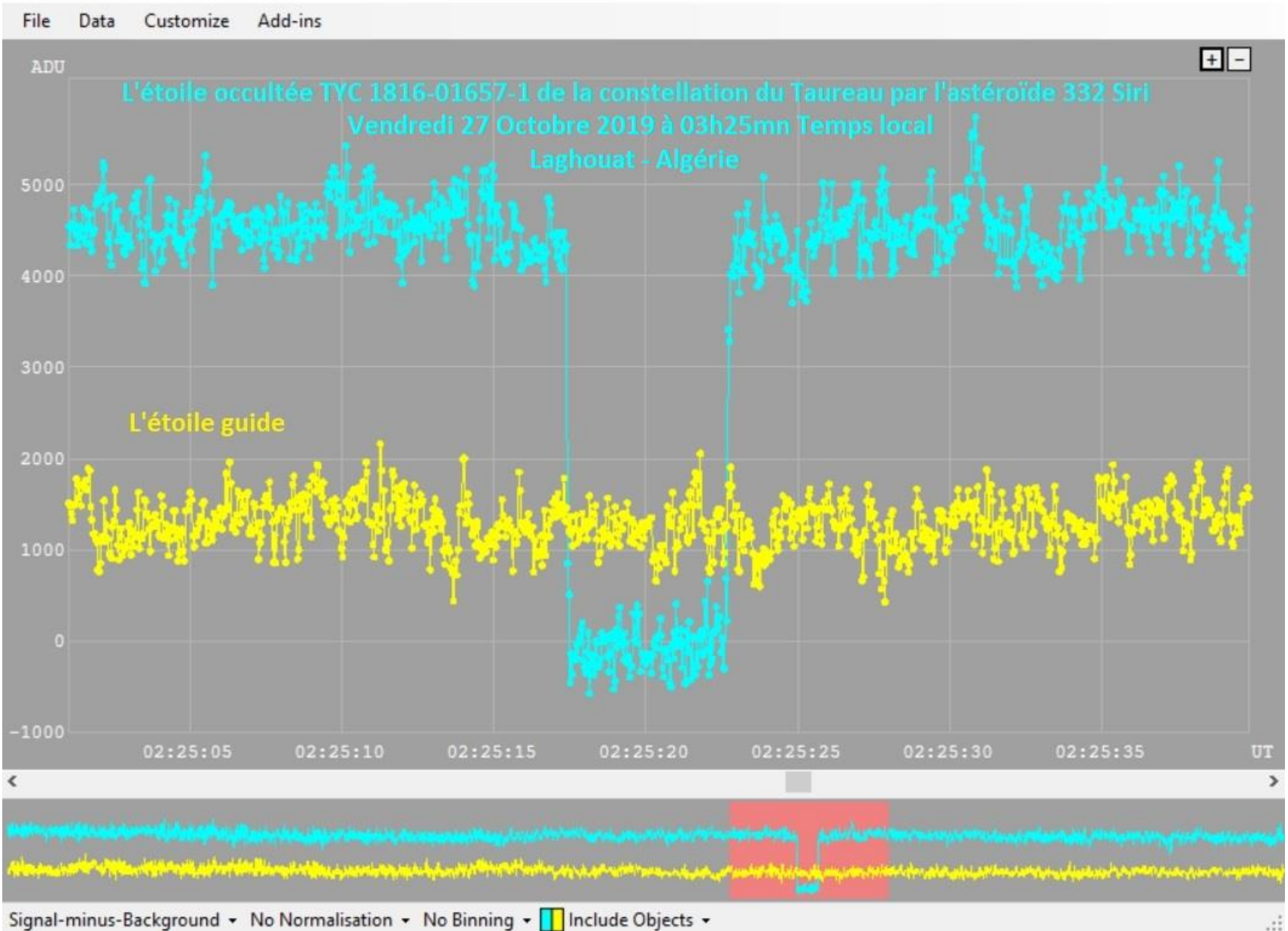
**South road connection of Hassi Delaâ 13 kilometers south of Bellil** :  
4 teams - 4 telescopes - 8 persons  
Blida Scientific Association of Astronomy  
and Al-Asturlabi Association of Astronomy of Bou Saada (Msila)  
**One positive observation without measure**

**Tilrhemt** :  
4 teams - 4 telescopes - 6 persons  
El-Rassed (Aami Essaid) Association of Astronomy (Ghardaia)  
and ISSERGHI Astronomy Club of El-Atteuf (Ghardaia)  
League of Scientific Activities of Bordj Bou Arreridj  
**Negative Observation**

© 2018 Google  
Image © 2019 Maxar Technologies  
Image © 2019 Maxar Technologies  
Image © 2019 CNES / Airbus

Google earth

Date des images satellite : 30/7/2019 33°15'39.92"N 3°14'08.79"E élév. 770 m altitude 56.73 km







Sous l'égide du Wali de Laghouat

Centre de Recherche en Astronomie, Astrophysique et Géophysique  
Direction de la jeunesse et des sports de la wilaya de Laghouat  
Association Souhail d'Astronomie de la wilaya de Laghouat

organisent :

# 9<sup>ème</sup> Rencontre Nationale sur les occultations astéroïdales du 22 au 25 Octobre 2020 Observation de l'occultation de l'étoile HIP 5315 par l'astéroïde 1171 Rusthawelia à la wilaya de Laghouat la nuit du Samedi 24 Octobre 2020 à 21h32mn heure locale

en collaboration avec :

Office des Établissements des Jeunes de la Wilaya de Laghouat  
Institut National pour la Formation des Fonctionnaires du Secteur  
de l'Éducation de la wilaya de Laghouat  
Ligue scientifique et technique des jeunes de la wilaya de Laghouat  
Centre d'Excellence Tamiz pour la Formation, les langues  
et les services de consultation de la wilaya de Laghouat



Avec la participation de :

Office des Etablissements des Jeunes de la wilaya de Borj Bou Arreridj / Office des Etablissements des Jeunes de la wilaya de Mila  
Ligue des activités scientifiques et techniques des jeunes de la Wilaya de Tizi Ouzou / Ligue des jeunes scientifiques amateurs d'Alger  
Ligue des activités scientifiques et techniques des jeunes de la Wilaya de Sétif / Ligue des activités scientifiques et techniques des jeunes de la Wilaya de Médéa  
Ligue des activités scientifiques et techniques des jeunes de la Wilaya de Ghardaïa / Ligue des activités scientifiques et techniques des jeunes de la Wilaya de Tindouf  
Association Sirius des astronomes amateurs de Bejaïa / Association Scientifique et Astronomique de Blida  
Association scientifique et culturelle Imssi Nihkitane de Tamanrasset / Association Scientifique Horizon Djurdjura de Tizi Ouzou  
Association Jeunesse Innovatrice de la wilaya d'Alger / Association d'Astronomie Sirius de Constantine  
Association Scientifique et Astronomique El-Bouzdjani de Médéa / Association Scientifique et Astronomique Enadim Elhaqib de Mostaganem  
Association ASTROLABE des astronomes amateurs Bou Saïda - M'sila / Association d'Astronomie El-Batani d'Oran  
Association culturelle et scientifique El-Manar - Meliana - Ain Defla / Association culturelle ANGHAM EL-HAYAT - El-Guerrara - Ghardaïa  
Association culturelle ESSALAM - Bounoura - Ghardaïa / Association d'astronomie et des techniques spatiales El-Ottb - Berriane - Ghardaïa  
Association Culturelle Ibn El Haithem avec le parc culturel Ahaggar de la wilaya déléguée de In Salah

Club d'Astronomie et les sciences amusantes NASSA HAGGAR - Tamanrasset / Club d'Astronomie Al-Biruni de la maison des Jeunes d'El-Mouradia - Alger  
Club d'Astronomie Callisto du centre culturel El-Marsa - Alger / Club d'Astronomie Al-Shirazi du Centre des Loisirs Scientifiques de la wilaya de Mila  
Club d'Astronomie Isserghi du centre culturel El-Attaf - Ghardaïa / Club d'Astronomie Amnir - Beni Isguen - Ghardaïa  
Club d'Astronomie Ammi Said - Ghardaïa

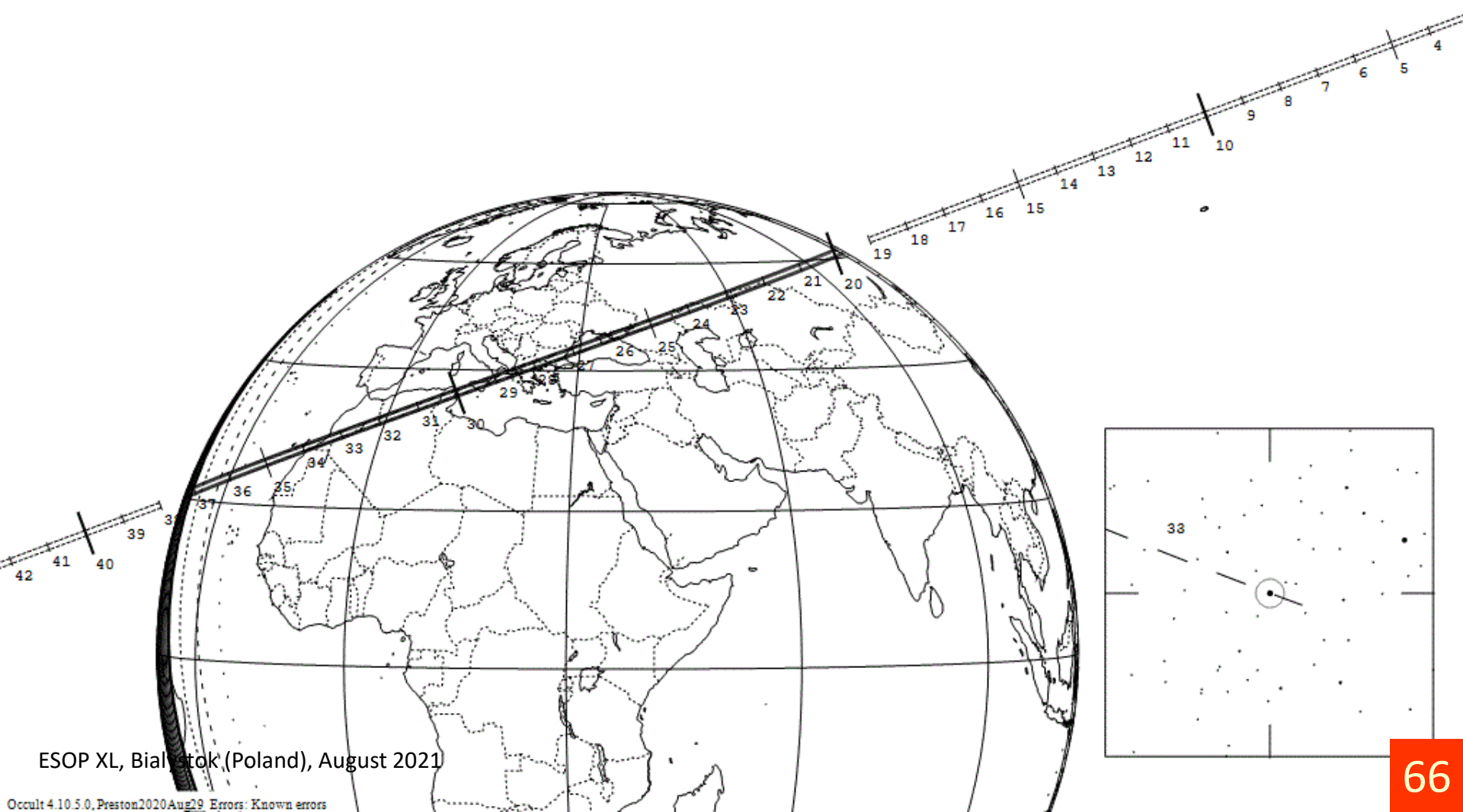
# 1171 Rusthawelia occults HIP 5315 on 2020 Oct 24 from 20h 20m to 20h 37m UT

Star: Dia = 1mas  
Mag V = 6.2  
RA = 1 7 59.8627 (astrometric)  
Dec = 1 59 25.944  
[of Date: 1 9 4, 2 6 5]  
Prediction of 2020 Aug 29.0

Max Duration = 8.1 secs  
Mag Drop = 7.3 (0.0r)  
Sun : Dist = 164°  
Moon: Dist = 59°  
: illum = 63 %  
E 0.042"x 0.018" in PA 69

Asteroid: (in DAMIT)  
Mag = 13.4  
Dia = 73 ±4km, 0.062"  
Parallax = 5.329"  
Hourly dRA = -1.727s  
dDec = -9.68"

Expect fades - star dia.

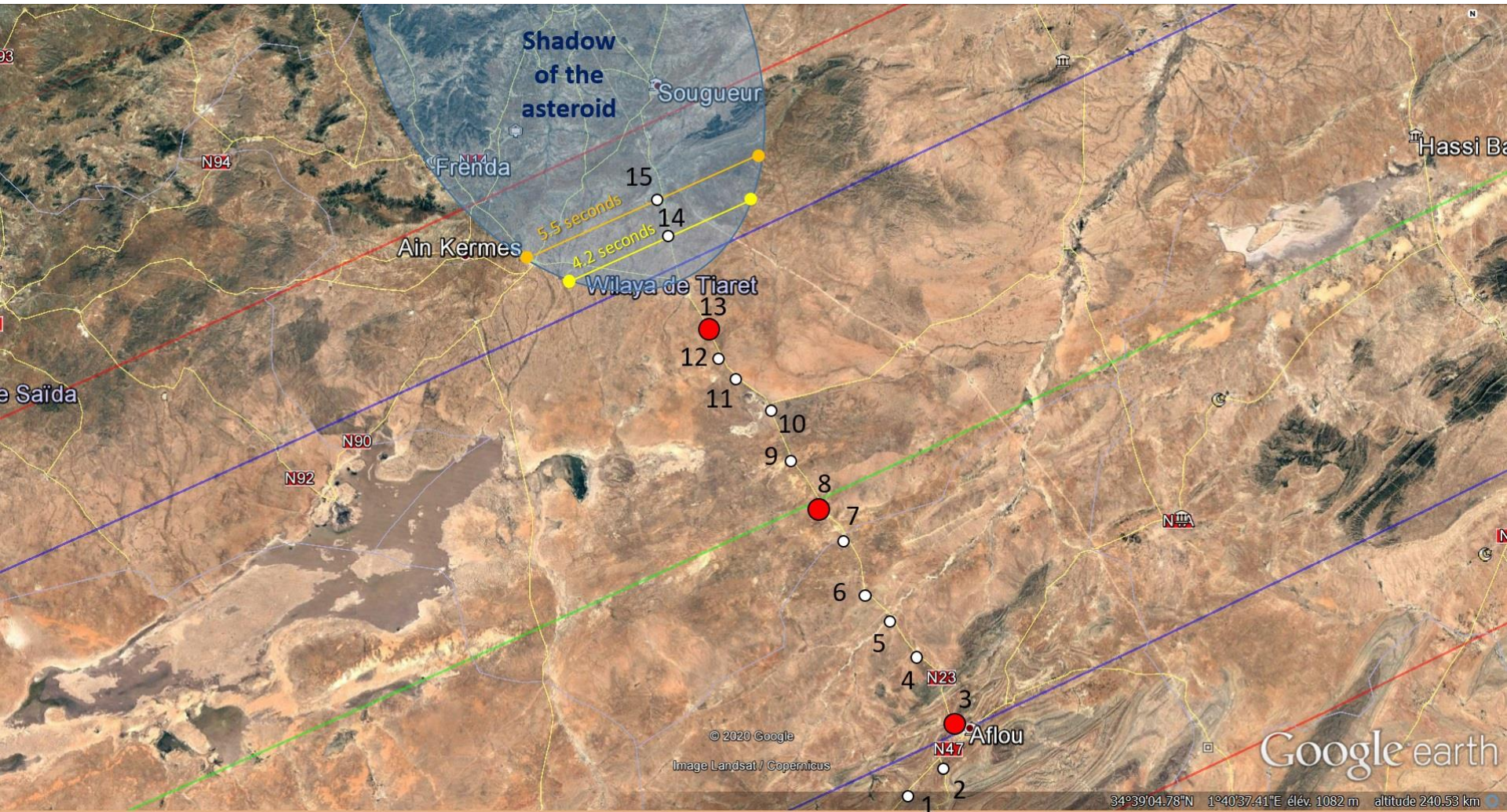


ESOP XL, Białystok (Poland), August 2021



ESOP XL, Bialystok (Poland), August 2021



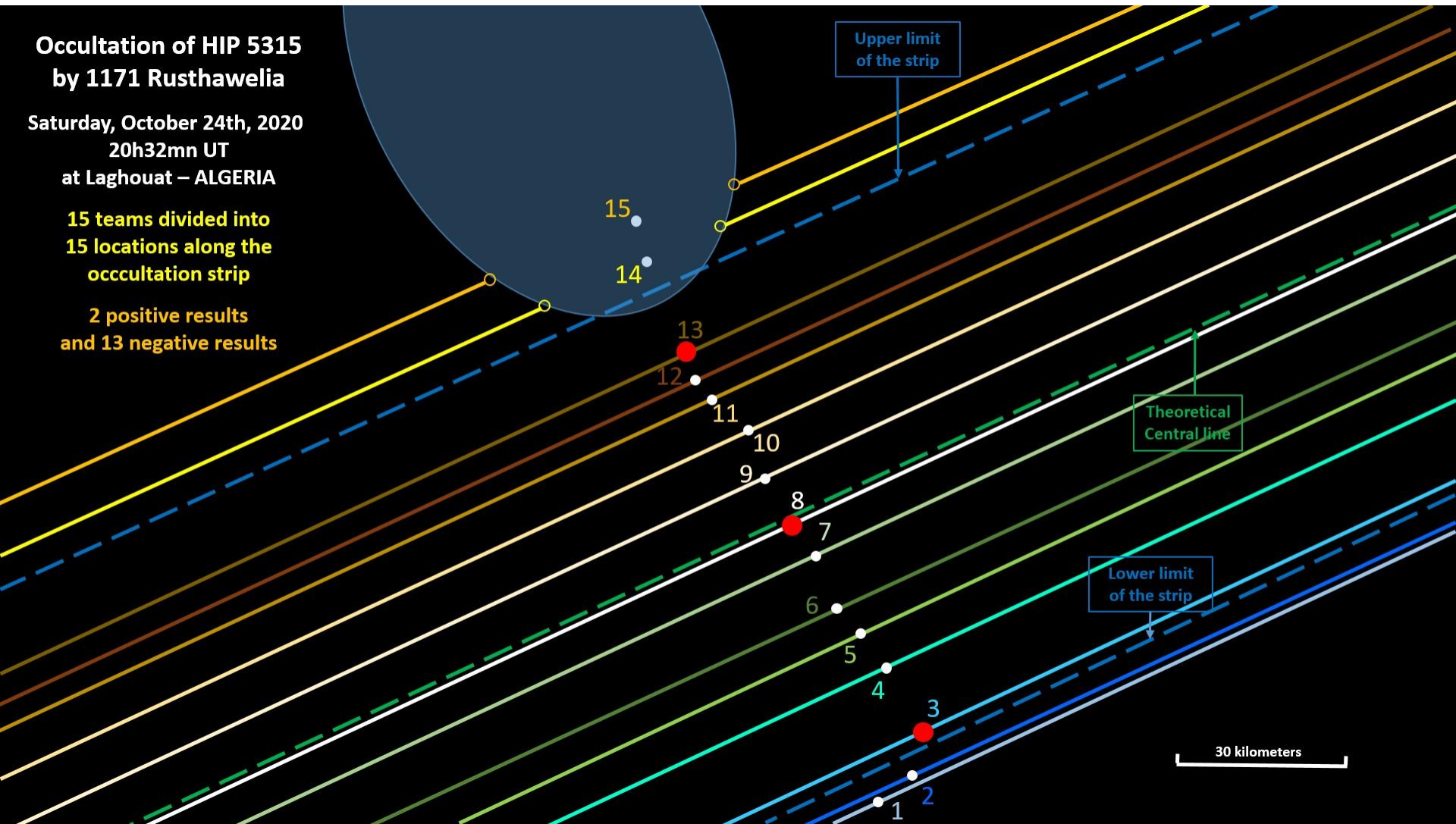


# Occultation of HIP 5315 by 1171 Rusthawelia

Saturday, October 24th, 2020  
20h32mn UT  
at Laghouat – ALGERIA

15 teams divided into  
15 locations along the  
occultation strip

2 positive results  
and 13 negative results



# Summary

We are interesting to study more stellar occultation by asteroids and specially NEA (Near-Earth Asteroids) and TNO (TransNeptunian Objets).

Now, at Algiers Observatory, there are two of us each preparing a PhD thesis on occultations. I am more interested by NEOs, while my colleague is more interested by Trojans.

We intend in the near future to expand the team by recruiting a third one to develop this discipline in Algeria.

In parallel, we develop the Algerian Occultation Amateurs Astronomers Network to observe firstly more easy stellar occultations by asteroids visually which follows the works of Participative Astronomy in Algeria.

Finally, we wish to create a relationship with other partners around the world and especially from IOTA in order to develop this research in Algeria.

# Thank you for your attention!

