Deliverable

H2020 COMPET-05-2015 project "Small Bodies: Near And Far (SBNAF)"

Topic: COMPET-05-2015 - Scientific exploitation of astrophysics, comets, and planetary data
Project Title: Small Bodies Near and Far (SBNAF)
Proposal No: 687378 - SBNAF - RIA
Duration: Apr 1, 2016 - Mar 31, 2019

WP	**WP 5**
Del. No	**D5.2**
Title	**Occultation candidates for 2017**
Lead Beneficiary	CSIC
Nature	Report
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WP5 Ground based observations

Objectives: WP5 has the main objective to execute observations from ground-based telescopes with the objective to acquire more data on the targets. One of this observation is the occultation of a star by an asteroid or TNO. On this particular point the main tasks are to coordinate observations and produce results on physical parameters of the asteroids and TNOs.

Description of deliverable D5.2
List with potential occultation candidates for 2017

Description of deliverable

During the last year 2016, a major data release from the GAIA mission was published (http://www.cosmos.esa.int/web/gaia/dr1). The coordinates and magnitudes of millions of stars with unprecedented precision were published in a public survey. This catalogue is extremely useful in our field for refining the occultations produced by asteroids and trans-Neptunian bodies (TNOs). The GAIA catalogue does not have positions and magnitudes of solar system bodies but has the positions of the to-be occulted stars with unprecedented precision. In this release, the astrometric precision of the position of a star (depends on magnitude) is 0.5 milli-arcsecond (*mas*) for a mag=6 star, 1.1 *mas* for a mag=9 star, 3 *mas* for a mag=12 star and 7 *mas* for a mag=15 star.

In a typical occultation of a star by a solar system body, the error in the determination of the shadow path on the surface of the Earth is determined by the error in the determination of the star position and the error in the determination of orbit of the solar system body. With the GAIA catalogue, the error in the star position is lowered to less than 10 *mas*, in most of the cases. For the main belt asteroids, 1 *mas* corresponds to 2 kilometres in error in the shadow path on the surface of the Earth. In the case of the TNOs, 1 *mas* corresponds to 30 km in error in the shadow path. Uncertainty of the shadow path is about 150 *mas* for a typical asteroid orbit and about 450 *mas* for a TNO orbit.

So, in conclusion, the predictions of the occultation of bright stars (magnitudes lower than 14) by an asteroid or TNOs is improved and now the shadow path can be determined with a few kilometres of error on the surface of the Earth. The main error is now the error in the determination of the orbit. To improve this source of error it is needed to conduct more astrometry for the asteroid and especially for the TNOs. A positive occultation is the ultimate way to diminish this error, as for that moment the asteroid/TNO has the exact position of the star.

One clear example is the one of the last occultation of a star by Pluto. The initial predictions - relying on ground-based measurements of the star - put the shadow centrality sweeping over mid-Europe (Fig. 1), but with uncertainties as large as 50 *mas*, equivalent to about 1500 km when projected onto Earth's surface. This situation, which was common to many occultation events before the Gaia data release, makes the task of choosing the telescopes that will look at the event much more difficult, with the risk of missing some relevant observations. Pluto subtends a mere 100 *mas* diameter on the sky while being one of the largest TNO.

The release of the star position by the Gaia project drastically improved that accuracy, down to a few *mas*, and corresponding to less than 100 km on ground. This release was combined with an improved Pluto orbit solution based on radio tracking of the New Horizons spacecraft that also reached an accuracy of ≈100 km. This placed the central path of the event over the Middle East and northern Africa, and triggered alerts in Israel, Morocco and the Canary islands (Fig. 2).

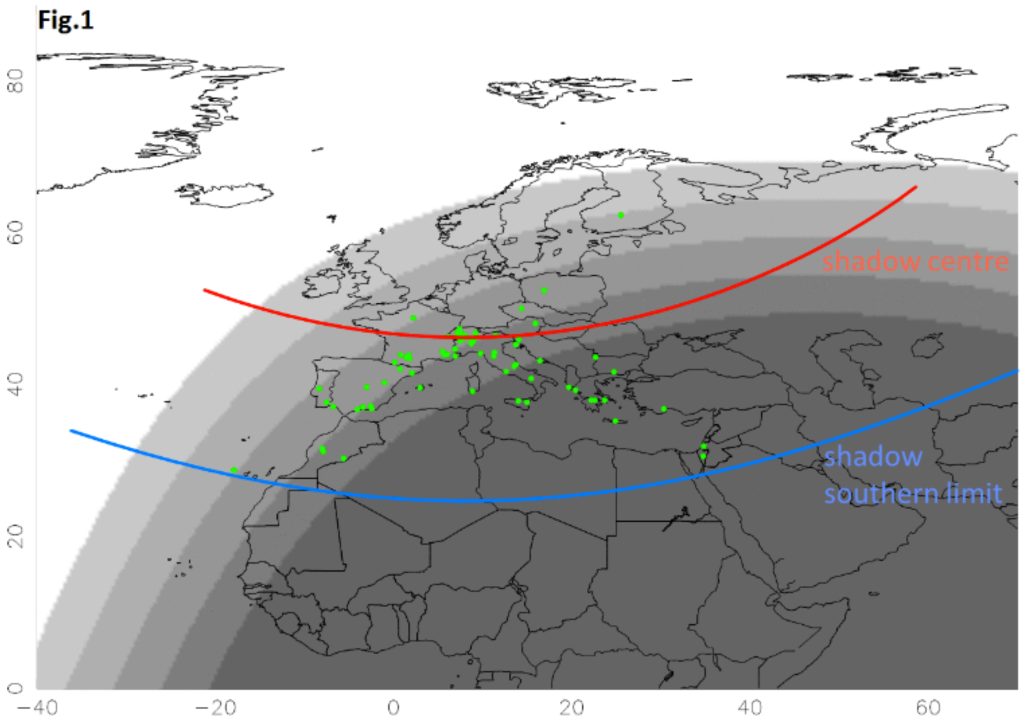


Figure 1: Early July 2016 prediction of Pluto occultation.

Accurate predictions are the main difficulty for a successful campaign to observe an occultation produced by a main-belt asteroid or TNO.

In conclusion, using the software to produce the predictions of the future occultations, and using the GAIA catalogue we can identify the occultations by asteroids and TNOs during year 2017 with higher accuracy (compared to D5.1 Occultation candidates for 2016).

The following table of occultations of bright stars for the two geographical positions where we have a dense net of telescopes (Spain and Argentina) is produced with the GAIA catalogue. In the table we listed all asteroids larger than 50 km in diameter which produce occultations of stars brighter than mag 16, visible for these two locations.

For the case of TNOs, the selection is less restrictive, and only for TNOs larger than 400 km, as we can only select the occultations passing above the Earth's surface. As the event is getting closer in time, improvements in the prediction are done and we can discard or select the preferred one. This list is NOT definitive. For the TNOs, a similar list as for the MBAs is not useful, as the predictions change 1 month before the event. The error is usually larger than the Earth radii, and only a short time before the event we can refine the shadow path. Selected lists of events are shown at the end of this document.

Fig.2

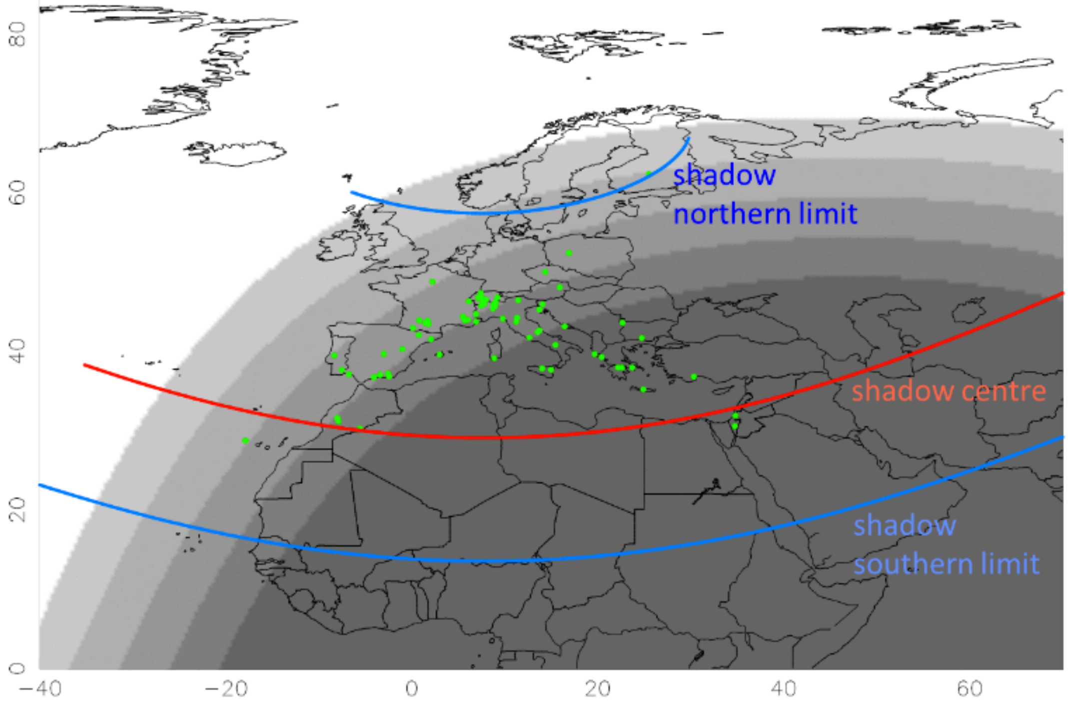


Fig. 2: Prediction using Gaia star position and New Horizons ephemeris

Asteroids

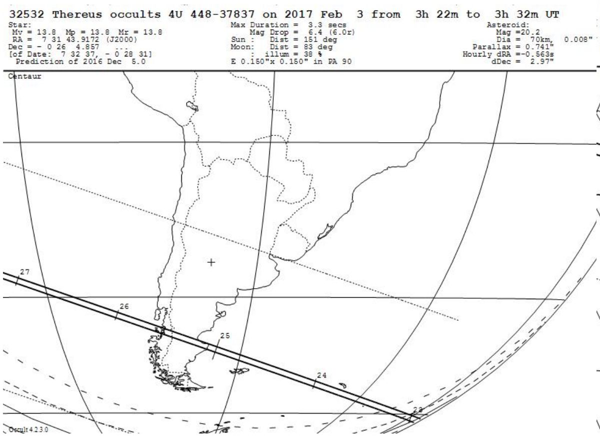
Granada

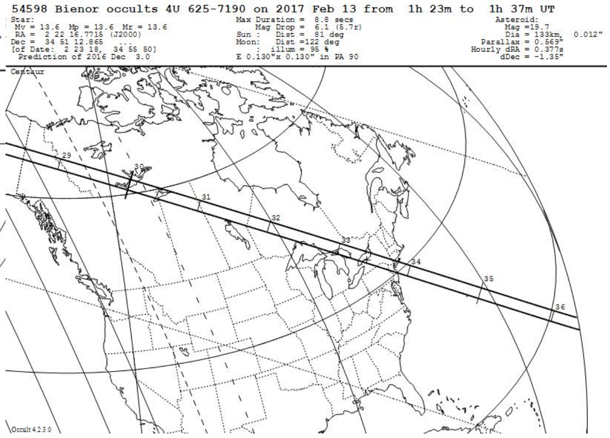
Date y m d	U.T. h m	Diameter km	Duration	Star mag	Mag Drop V	Star	asteroid	R.A. (J2000) h m s	Dec.(J2000) o ' "
2017 Jan 2	1 17.8	113	9.4s	13.2	0.26	2UCAC 31499589	683 Lanzia	8 43 17.801	- 0 45 16.03
2017 Feb 8	20 24.7	102	23.0s	10.8	2	2UCAC 40995969	135 Hertha	6 11 9.154	26 2 47.73
2017 Feb 9	23 9.5	102	15.2s	13	2	2UCAC 47053304	1093 Freda	5 41 32.938	44 59 41.13
2017 Feb 17	5 10.5	290	9.0s	11.4	0.02	2UCAC 27524178	3 Juno	18 15 52.328	-12 0 59.88
2017 Feb 26	18 39.3	168	4.0s	12.7	0.11	2UCAC 29029502	185 Eunike	1 27 5.372	- 7 54 55.90
2017 Feb 26	21 48.7	167	7.2s	12.6	0.5	2UCAC 32311226	194 Prokne	4 2 31.595	1 58 45.81
2017 Mar 8	2 9.0	135	16.5s	13.2	0.11	2UCAC 35570103	489 Comacina	8 18 38.221	10 35 25.17
2017 Mar 10	4 29.2	103	7.7s	12.8	0.09	2UCAC 21582491	37 Fides	17 0 56.641	-25 18 41.67
2017 Mar 25	20 56.2	104	3.3s	13.5	0.39	2UCAC 44095642	98 Ianthe	4 13 23.127	35 16 54.22
2017 Mar 25	23 43.3	118	8.1s	11.3	0.02	2UCAC 31508986	192 Nausikaa	11 40 2.722	- 0 52 2.18
2017 Apr 5	1 57.7	120	24.0s	13	0.09	2UCAC 25561635	596 Scheila	16 56 31.834	-16 47 50.28
2017 Apr 14	3 47.7	133	14.0s	11.2	0.02	2UCAC 23461311	40 Harmonia	18 28 7.000	-21 12 44.04
2017 Apr 18	5 18.3	114	14.1s	15.4	1.3	2UCAC 18767548	2797 Teucer	18 36 12.780	-31 1 50.99
2017 Apr 24	19 7.9	152	3.9s	12.1	2.2	2UCAC 43234232	361 Bononia	5 3 23.429	32 48 54.07
2017 Apr 24	21 53.5	183	22.3s	11	0.1	2UCAC 27101850	409 Aspasia	11 48 11.772	-13 5 16.90
2017 May 19	22 26.5	125	10.0s	10.6	0.02	2UCAC 24136108	27 Euterpe	16 16 32.699	-19 57 57.63
2017 May 23	1 22.5	113	7.1s	14.5	1.4	2UCAC 28402341	2920 Automedon	17 43 19.869	- 9 58 27.82
2017 May 24	23 32.0	290	39.5s	10.1	0.17	2UCAC 29903899	3 Juno	19 7 1.378	- 5 31 57.83
2017 May 26	21 11.7	132	3.9s	13.5	0.29	2UCAC 38969404	200 Dynamene	8 18 54.131	20 1 39.62
2017 Jun 13	21 8.8	200	8.1s	11.3	0.02	2UCAC 36298666	9 Metis	10 52 37.773	12 35 36.03
2017 Jun 20	4 9.8	135	4.5s	13.3	1.4	2UCAC 37829064	276 Adelheid	1 39 28.089	17 3 13.74
2017 Jun 24	21 22.9	140	7.9s	14.1	0.31	2UCAC 32039215	150 Nuwa	11 47 58.308	0 48 44.70
2017 Jul 6	19 58.0	131	9.1s	14.6	0.9	2UCAC 23909068	1143 Odysseus	17 11 46.316	-20 27 45.69
2017 Jul 29	4 2.0	208	5.7s	13	0.15	2UCAC 37665643	85 Io	5 17 3.600	16 43 5.07
2017 Jul 30	21 3.4	132	19.9s	12.2	0.05	2UCAC 22540180	476 Hedwig	18 18 6.318	-23 4 37.95
2017 Aug 3	5 15.2	141	3.6s	13.3	0.13	2UCAC 39272823	145 Adeona	5 32 0.453	21 8 10.35
2017 Aug 22	3 7.8	208	6.9s	12.7	0.36	2UCAC 37320772	85 Io	5 52 24.729	15 48 18.95
2017 Sep 7	3 24.2	184	7.6s	12.4	2.2	2UCAC 38944165	334 Chicago	6 21 20.092	20 2 39.27
2017 Sep 19	5 15.9	185	8.3s	9.9	0.34	2UCAC 38403302	8 Flora	6 15 42.656	18 31 12.12
2017 Sep 30	18 34.3	138	15.1s	11.2	0.16	2UCAC 36221261	712 Boliviana	22 53 23.393	12 24 28.81
2017 Oct 10	0 47.2	554	32.1s	8.3	0.02	2UCAC 24507345	2 Pallas	3 17 34.534	-18 34 15.38
2017 Oct 23	3 57.0	147	14.6s	11.3	0.09	2UCAC 39962304	111 Ate	2 30 52.383	23 23 0.24
2017 Oct 27	4 45.9	109	5.7s	12.5	0.09	2UCAC 32862707	57 Mnemosyne	8 23 56.477	3 3 46.36
2017 Oct 27	21 29.2	175	51.6s	10	0.02	2UCAC 35677523	89 Julia	22 17 6.443	10 41 2.76
2017 Nov 9	6 25.3	107	6.8s	13.9	0.34	2UCAC 38794121	410 Chloris	9 29 53.328	19 40 38.14
2017 Dec 1	1 5.8	185	53.8s	9	0.04	2UCAC 38242961	8 Flora	7 20 50.004	18 24 1.76
2017 Dec 3	3 30.4	135	10.9s	13	0.6	2UCAC 43600795	466 Tisiphone	6 27 54.945	33 33 11.22
2017 Dec 3	19 39.6	147	11.2s	11.1	1.9	2UCAC 43237300	388 Charybdis	5 19 4.714	32 31 1.24
2017 Dec 4	1 9.7	132	18.6s	8.8	0	2UCAC 39632993	20 Massalia	5 55 9.443	22 21 37.19
2017 Dec 10	5 2.2	154	5.2s	14.2	0.31	2UCAC 28554388	212 Medea	12 57 31.640	- 9 14 57.67
2017 Dec 11	20 18.5	253	64.5s	8	0.01	2UCAC 37299218	7 Iris	1 53 7.519	15 57 23.83
2017 Dec 29	1 10.4	121	8.8s	11.1	0.19	2UCAC 38931808	92 Undina	5 36 52.335	20 4 27.67
2017 Dec 31	21 35.7	132	18.7s	8.8	0.01	2UCAC 39625500	20 Massalia	5 26 49.897	22 1 45.04
2018 Jan 1	3 32.1	132	18.8s	8.8	0	2UCAC 39625438	20 Massalia	5 26 35.977	22 1 33.21

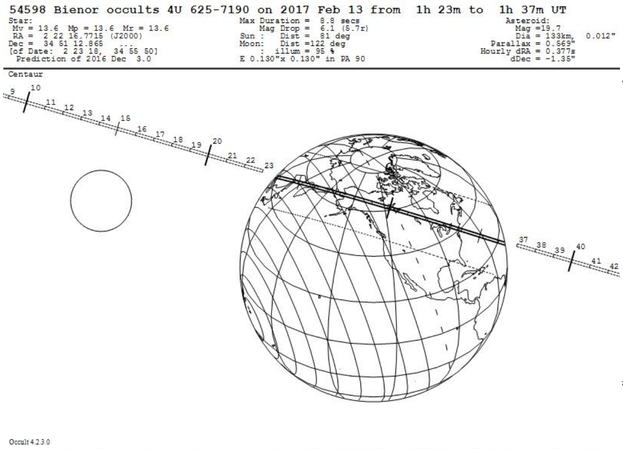
Cordoba	Argentina								
Date y m d	U.T. h m	Diameter km	Duration	Star mag	Mag Drop V	Star	Asteroid	R.A. (J2000) h m s	Dec.(J2000) o ' "
2016 Dec 28	1 50.6	62	6.3s	12.4	0.9	504-44021	417 Suevia	7 47 49.538	10 43 12.11
2017 Jan 18	7 52.4	114	3.0s	10.3	4	324-86063	127 Johanna	16 40 34.691	-25 14 56.42
2017 Jan 22	1 2.9	64	6.7s	12.5	0.7	490-49523	792 Metcalfia	8 40 42.278	7 56 52.91
2017 Jan 28	23 51.7	64	7.3s	12.6	0.5	495-46553	342 Endymion	7 47 48.643	8 53 27.30
2017 Feb 5	8 22.7	81	2.4s	13.3	1.6	320-118751	160 Una	17 26 38.982	-26 0 56.82
2017 Feb 7	9 23.2	52	1.2s	11.8	4.7	328-185549	1332 Marconia	19 7 15.711	-24 28 49.46
2017 Feb 8	9 2.4	53	1.7s	12.8	3.4	341-94721	743 Eugenisis	17 19 11.832	-21 59 56.43
2017 Feb 12	9 22.2	109	4.6s	13.3	1.4	391-69618	164 Eva	16 42 57.494	-11 52 57.37
2017 Feb 23	5 37.6	128	8.3s	13.4	1.8	431-42671	225 Henrietta	7 56 53.396	- 3 56 49.64
2017 Feb 26	7 50.9	67	21.3s	12.4	0.7	366-65379	55 Pandora	14 29 11.157	-16 56 7.54
2017 Feb 27	1 3.2	104	11.0s	11.1	1.2	544-44332	739 Mandeville	8 0 7.158	18 41 48.73
2017 Mar 5	3 1.6	52	12.9s	13.4	2.1	565-31833	846 Lipperta	6 44 8.403	22 51 34.55
2017 Mar 14	6 48.9	54	3.0s	13.7	3	331-129827	1074 Beljawskya	18 5 21.130	-23 55 19.82
2017 Apr 3	1 20.4	55	7.3s	11.9	0.26	276-78348	115 Thyra	15 17 27.873	-34 58 4.99
2017 Apr 18	9 14.1	89	5.6s	12.9	3.1	355-192879	414 Liriope	20 8 32.086	-19 4 44.47
2017 Apr 26	6 59.4	75	3.3s	11.2	0.16	459-107495	25 Phocaea	19 56 39.732	1 45 53.09
2017 Apr 27	23 47.0	52	2.0s	13.7	2.5	560-41143	846 Lipperta	7 24 14.828	21 50 41.38
2017 Apr 27	23 49.8	142	15.2s	11.3	0.09	311-78922	93 Minerva	15 12 3.657	-27 52 43.04
2017 May 1	23 15.3	66	8.0s	13.6	1.7	484-49207	874 Rotraut	10 3 56.989	6 41 19.61
2017 May 3	7 0.2	82	6.0s	13.3	1.1	409-128722	205 Martha	20 11 5.292	- 8 13 15.17
2017 May 6	2 22.0	97	7.6s	13.4	0.9	434-58373	528 Rezia	13 34 2.397	- 3 14 13.22
2017 May 13	24 1.8	85	5.9s	10.5	3.9	260-70604	501 Urhixidur	14 15 36.974	-38 0 7.30
2017 May 15	8 42.7	53	4.3s	12.7	1.9	348-76805	828 Lindemannia	15 31 53.795	-20 27 55.52
2017 May 25	10 9.2	150	6.0s	12.5	1.2	483-139173	95 Arethusa	22 52 31.884	6 35 36.20
2017 May 28	7 56.0	54	3.3s	13.1	4	334-97527	21900 Orus	17 16 41.247	-23 14 47.63
2017 Jun 4	8 43.1	114	10.0s	12	0.8	283-157453	127 Johanna	18 4 1.890	-33 31 13.16
2017 Jun 9	4 41.5	76	4.4s	13.4	3.8	272-81438	7119 Hiera	15 52 25.302	-35 40 34.41
2017 Jun 20	9 1.2	66	7.2s	11.1	0.19	250-161998	101 Helena	18 19 33.701	-40 10 4.70
2017 Jun 23	4 24.5	127	12.6s	11.6	1.1	262-187115	602 Marianna	19 49 44.377	-37 46 34.41
2017 Jun 25	0 33.2	81	8.0s	11.4	0.24	290-140351	133 Cyrene	17 56 28.953	-32 6 56.98
2017 Jul 1	2 26.8	103	10.3s	10.9	3.8	373-64953	36 Atalante	12 34 23.596	-15 32 56.14
2017 Jul 4	4 3.9	56	3.5s	13.5	3.8	314-239372	5209 1989 CW1	19 44 2.835	-27 15 25.94
2017 Jul 8	0 27.7	57	6.5s	12.4	1.4	373-88812	527 Euryanthe	17 27 19.730	-15 29 12.65
2017 Jul 8	22 54.5	66	7.6s	11.3	0.12	253-149377	101 Helena	17 58 26.881	-39 31 5.42
2017 Jul 13	0 57.8	51	4.8s	12.4	0.42	311-176454	347 Pariana	18 12 29.234	-27 55 16.24
2017 Jul 13	3 14.8	87	10.5s	13.2	0.8	306-101645	210 Isabella	16 56 19.888	-28 49 21.99
2017 Jul 14	5 17.4	66	8.1s	10.4	1	255-138824	101 Helena	17 53 21.999	-39 6 46.17
2017 Jul 16	5 28.0	51	5.1s	12.5	0.34	310-171512	347 Pariana	18 9 41.698	-28 6 17.29
2017 Jul 26	8 50.7	89	7.9s	11.2	0.7	381-161327	639 Latona	20 19 2.037	-13 59 59.94
2017 Jul 30	0 40.3	59	5.2s	13.2	1	434-98172	256 Walpurga	19 29 11.704	- 3 23 37.10
2017 Aug 1	0 27.6	229	32.9s	10.6	0.07	272-105586	324 Bamberga	17 32 50.463	-35 37 39.68
2017 Aug 6	4 35.6	53	3.2s	12.7	4.7	422-109885	5285 Krethon	19 8 5.336	- 5 38 50.90
2017 Aug 13	1 25.3	97	3.7s	11.4	4.1	402-55488	528 Rezia	13 46 49.785	- 9 47 22.96
2017 Aug 27	3 43.5	113	11.6s	12.2	0.42	355-198935	545 Messalina	21 18 59.629	-19 11 4.58
2017 Aug 28	4 59.0	61	5.8s	11.7	1.7	372-176260	382 Dodona	21 0 5.073	-15 46 45.60

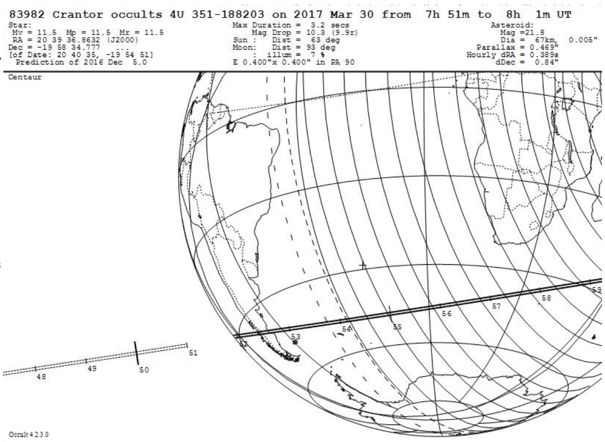
2017 Sep 4	4 13.2	120	9.4s	10.4	2.7	316-244298	508 Princetonia	22 50 25.447	-26 55 40.58
2017 Sep 10	23 26.6	67	3.6s	13.1	4.5	421-69810	15440 1998 WX4	17 6 20.159	- 5 51 42.22
2017 Sep 15	6 33.4	61	11.4s	12.3	1.5	371-180438	382 Dodona	20 50 54.778	-15 54 41.18
2017 Sep 17	2 56.8	71	7.5s	11.9	1.1	477-130680	1240 Centenaria	23 19 49.702	5 14 37.92
2017 Sep 17	8 42.0	100	4.5s	11.8	1.7	542-24030	114 Kassandra	6 15 9.250	18 23 33.37
2017 Sep 19	23 37.1	83	2.7s	12.5	1.5	408-63582	97 Klotho	15 32 41.827	- 8 27 26.97
2017 Sep 24	2 37.3	114	4.4s	12.2	1.8	301-107729	596 Scheila	16 59 54.156	-29 55 9.72
2017 Sep 28	23 1.5	112	12.7s	12.2	1.7	441-125036	506 Marion	21 48 4.459	- 1 59 36.05
2017 Sep 29	22 34.3	54	3.4s	13.7	2.8	328-162839	2043 Ortutay	18 32 12.508	-24 35 54.17
2017 Oct 1	1 54.6	120	6.0s	11.4	0.11	323-159618	40 Harmonia	18 19 44.584	-25 28 34.37
2017 Oct 5	2 35.7	129	19.3s	11.2	0.9	392-124486	419 Aurelia	20 55 0.595	-11 40 9.23
2017 Oct 10	3 25.6	63	5.4s	12	0.24	524-2665	224 Oceana	1 33 19.990	14 47 42.59
2017 Oct 27	4 46.5	60	4.3s	13.3	1.4	435-4504	850 Altona	3 27 31.231	- 3 9 58.06
2017 Oct 29	4 59.7	50	6.9s	11.4	0.16	483-808	186 Celuta	0 30 41.918	6 25 4.82
2017 Nov 2	22 54.3	229	7.4s	11.2	0.22	323-202603	324 Bamberga	19 6 25.858	-25 30 29.05
2017 Nov 3	7 4.7	61	4.4s	10.3	4.3	459-2711	638 Moira	2 6 52.040	1 40 43.65
2017 Nov 14	7 32.3	65	6.7s	11.6	2.9	555-19386	976 Benjamina	5 46 27.415	20 59 38.13
2017 Nov 16	0 10.1	59	2.1s	9.4	6.9	343-199603	820 Adriana	20 23 8.709	-21 34 59.20
2017 Nov 20	5 25.0	163	14.9s	12.6	0.7	472-41853	444 Gyptis	9 18 24.109	4 12 59.55
2017 Nov 24	1 37.6	52	2.1s	12.6	1.1	347-189980	537 Pauly	21 51 34.795	-20 44 44.70
2017 Nov 24	23 14.5	104	2.5s	12.6	2.2	309-218731	481 Emita	18 28 0.578	-28 21 5.15
2017 Nov 29	3 18.3	129	9.7s	12.5	0.42	513-17042	56 Melete	5 55 44.994	12 32 57.95
2017 Dec 11	8 53.9	100	11.5s	11.7	0.15	528-31923	114 Kassandra	6 43 14.034	15 29 12.48
2017 Dec 14	23 47.0	81	1.9s	13	0.7	344-191380	133 Cyrene	20 3 11.979	-21 19 32.16
2017 Dec 24	2 7.4	52	4.1s	12.7	0.9	537-23595	1197 Rhodesia	6 12 35.227	17 15 18.56
2017 Dec 25	7 42.0	165	5.6s	12.8	1	434-59512	386 Siegena	14 12 34.503	- 3 15 41.78
2017 Dec 27	5 25.6	80	6.4s	12.4	0.7	552-20231	464 Megaira	5 54 50.203	20 18 32.28

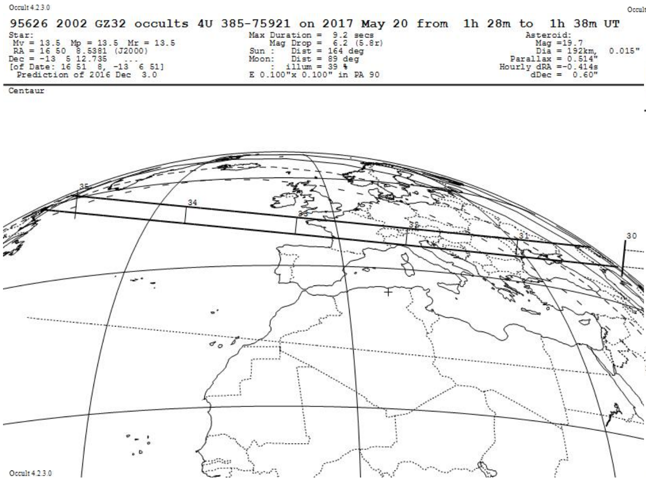
TNOs

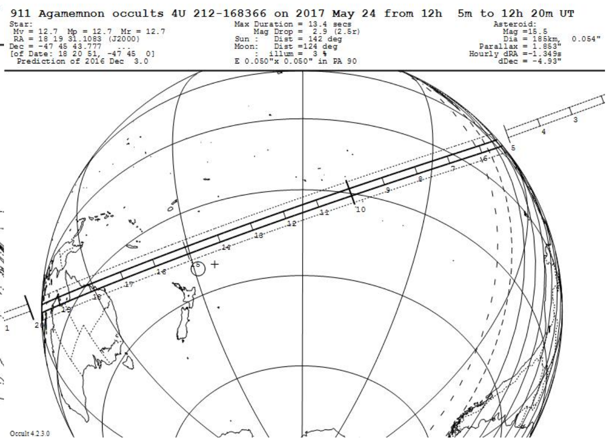

32532 Thereus occults 4U 448-37837 on 2017 Feb 3 from 3h 22m to 3h 32m UT
Star:
Mv = 13.8 Mp = 13.8 Mr = 13.8
RA = 7 31 43.9172 (J2000)
Dec = - 0 26 4.857 ...
[of Date: 7 32 37, - 0 28 31]
Prediction of 2016 Dec 5.0
Max Duration = 3.3 secs
Mag Drop = 6.4 (6.0r)
Sun : Dist = 151 deg
Moon: Dist = 83 deg
: illum = 38 %
E 0.150"x 0.150" in PA 90
Asteroid:
Mag =20.2
Dia = 70km, 0.008"
Parallax = 0.741"
Hourly dRA =-0.563s
dDec = 2.97"
Centaur
Occult 4.2.3.0


54598 Bienor occults 4U 625-7190 on 2017 Feb 13 from 1h 23m to 1h 37m UT
Star:
Mv = 13.6 Mp = 13.6 Mr = 13.6
RA = 2 22 16.7715 (J2000)
Dec = 34 51 12.865 ...
[of Date: 2 23 18, 34 55 50]
Prediction of 2016 Dec 3.0
Max Duration = 8.8 secs
Mag Drop = 6.1 (5.7r)
Sun : Dist = 81 deg
Moon: Dist =122 deg
: illum = 95 %
E 0.130"x 0.130" in PA 90
Asteroid:
Mag =19.7
Dia = 133km, 0.012"
Parallax = 0.569"
Hourly dRA = 0.377s
dDec = -1.35"
Centaur
Occult 4.2.3.0


54598 Bienor occults 4U 625-7190 on 2017 Feb 13 from 1h 23m to 1h 37m UT
Star:
Mv = 13.6 Mp = 13.6 Mr = 13.6
RA = 2 22 16.7715 (J2000)
Dec = 34 51 12.865 ...
[of Date: 2 23 18, 34 55 50]
Prediction of 2016 Dec 3.0
Max Duration = 8.8 secs
Mag Drop = 6.1 (5.7r)
Sun : Dist = 81 deg
Moon: Dist =122 deg
: illum = 95 %
E 0.130"x 0.130" in PA 90
Asteroid:
Mag =19.7
Dia = 133km, 0.012"
Parallax = 0.569"
Hourly dRA = 0.377s
dDec = -1.35"
Centaur
Occult 4.2.3.0


83982 Crantor occults 4U 351-188203 on 2017 Mar 30 from 7h 51m to 8h 1m UT
Star:
Mv = 11.5 Mp = 11.5 Mr = 11.5
RA = 20 39 36.8632 (J2000)
Dec = -19 58 34.777 ...
[of Date: 20 40 35, -19 54 51]
Prediction of 2016 Dec 5.0
Max Duration = 3.2 secs
Mag Drop = 10.3 (9.9r)
Sun : Dist = 63 deg
Moon: Dist = 93 deg
: illum = 7 %
E 0.400"x 0.400" in PA 90
Asteroid:
Mag =21.8
Dia = 67km, 0.005"
Parallax = 0.469"
Hourly dRA = 0.389s
dDec = 0.84"
Centaur
Occult 4.2.3.0


95626 2002 GZ32 occults 4U 385-75921 on 2017 May 20 from 1h 28m to 1h 38m UT
Star:
Mv = 13.5 Mp = 13.5 Mr = 13.5
RA = 16 50 8.5381 (J2000)
Dec = -13 5 12.735 ...
[of Date: 16 51 8, -13 6 51]
Prediction of 2016 Dec 3.0
Max Duration = 9.2 secs
Mag Drop = 6.2 (5.8r)
Sun : Dist = 164 deg
Moon: Dist = 89 deg
: illum = 39 %
E 0.100"x 0.100" in PA 90
Asteroid:
Mag =19.7
Dia = 192km, 0.015"
Parallax = 0.514"
Hourly dRA =-0.414s
dDec = 0.60"
Centaur
Occult 4.2.3.0

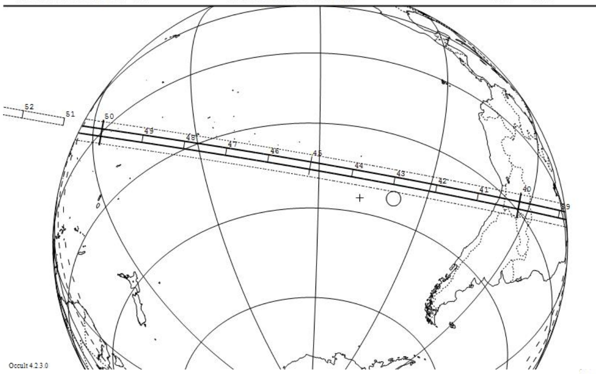

911 Agamemnon occults 4U 212-168366 on 2017 May 24 from 12h 5m to 12h 20m UT
Star:
Mv = 12.7 Mp = 12.7 Mr = 12.7
RA = 18 19 31.1083 (J2000)
Dec = -47 45 43.777 ...
[of Date: 18 20 51, -47 45 0]
Prediction of 2016 Dec 3.0
Max Duration = 13.4 secs
Mag Drop = 2.9 (2.5r)
Sun : Dist = 142 deg
Moon: Dist =124 deg
: illum = 3 %
E 0.050"x 0.050" in PA 90
Asteroid:
Mag =15.5
Dia = 185km, 0.054"
Parallax = 1.853"
Hourly dRA =-1.349s
dDec = -4.93"
Occult 4.2.3.0

911 Agamemnon occults 4U 210-163240 on 2017 Jun 27 from 7h 39m to 7h 51m UT

Star:
Mv = 13.8 Mp = 13.8 Mr = 13.8
RA = 17 56 33.0373 (J2000)
Dec = -48 0 17.410 ...
[of Date: 17 57 54, -48 0 14]
Prediction of 2016 Dec 3.0

Max Duration = 10.7 secs
Mag Drop = 1.7 (1.4r)
Sun : Dist = 155 deg
Moon: Dist =125 deg
: illum = 14 %
E 0.053"x 0.054" in PA 90

Asteroid:
Mag =15.3
Dia = 185km, 0.055"
Parallax = 1.898"
Hourly dRA =-1.813s
dDec = 3.24"

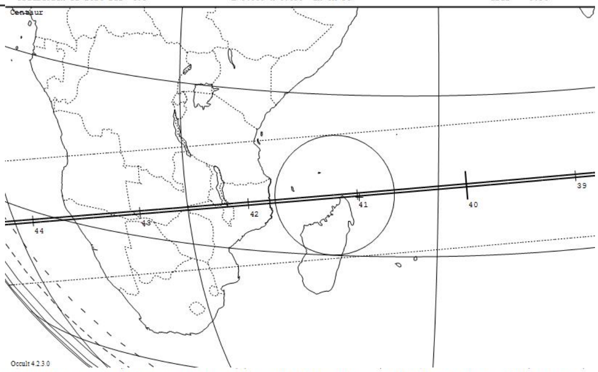


250112 2002 KY14 occults 4U 523-18843 on 2017 Dec 28 from 19h 36m to 19h 45m UT

Star:
Mv = 11.1 Mp = 11.1 Mr = 11.1
RA = 5 55 59.3500 (J2000)
Dec = 14 27 25.499 ...
[of Date: 5 57 1, 14 27 23]
Prediction of 2016 Dec 5.0

Max Duration = 1.7 secs
Mag Drop = 9.5 (9.1r)
Sun : Dist = 168 deg
Moon: Dist = 51 deg
: illum = 75 %
E 0.090"x 0.090" in PA 90

Asteroid:
Mag =20.6
Dia = 38km, 0.005"
Parallax = 0.769"
Hourly dRA =-0.665s
dDec = -0.84"

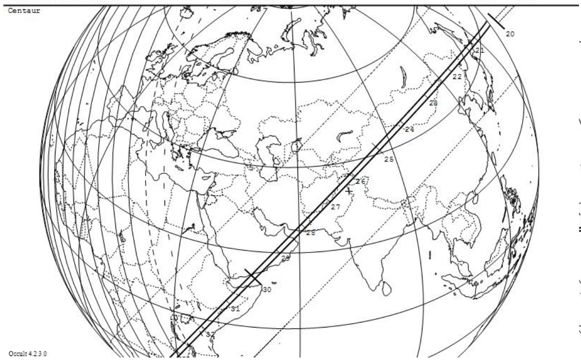


54598 Bienor occults 4U 643-11336 on 2017 Dec 29 from 16h 20m to 16h 34m UT

Star:
Mv = 12.8 Mp = 12.8 Mr = 12.8
RA = 2 49 15.5345 (J2000)
Dec = 38 29 52.276 ...
[of Date: 2 50 24, 38 34 20]
Prediction of 2016 Dec 3.0

Max Duration = 8.9 secs
Mag Drop = 6.7 (6.3r)
Sun : Dist = 130 deg
Moon: Dist = 26 deg
: illum = 83 %
E 0.130"x 0.130" in PA 90

Asteroid:
Mag =19.5
Dia = 133km, 0.013"
Parallax = 0.610"
Hourly dRA =-0.300s
dDec = -3.76"



250112 2002 KY14 occults 4U 534-12126 on 2017 Feb 3 from 19h 55m to 20h 19m UT

Star:
Mv = 13.3 Mp = 13.3 Mr = 13.3
RA = 5 12 42.8262 (J2000)
Dec = 16 41 43.263 ...
[of Date: 5 13 43, 16 42 43]
Prediction of 2016 Dec 5.0

Max Duration = 4.3 secs
Mag Drop = 7.4 (7.0r)
Sun : Dist = 123 deg
Moon: Dist = 38 deg
: illum = 46 %
E 0.092"x 0.090" in PA 90

Asteroid:
Mag =20.7
Dia = 38km, 0.005"
Parallax = 0.777"
Hourly dRA =-0.268s
dDec = -0.32"