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Lunar Occultations of Neglected Double Stars

Dear reader,

A series of stellar occultations of the Pleiades by the Moon is a good opportunity to resume observing lunar occultations. In the past, our goal was to determine the lunar limb profile through lunar occultations, but today this profile serves as a template for measuring double stars. The call for observations in this issue presents some interesting but neglected double stars, which will be occulted by the Moon. Furthermore, the accuracy of the Moon's path on the sky plane can also be improved by stellar occultations. Only with regular and numerous observations of lunar occultations can the deviation of the residuals O-C values be explained in the future.

Beyond Jupiter, interesting objects are still waiting to be measured by observers of stellar occultations. This time, we focus on (31824) Elatus.

The news reports provide an overview of the activities of the worldwide community of occultation observers. Software and hardware development are just as much a part of it as the discovery of asteroid satellites and the study of historical events. New observers join our field of activity, but there is also a farewell to a dedicated supporter.

We have been invited to join the European Symposium on Occultation Projects (ESOP) in Poznań, Poland, in August 2025. In addition to the exchange of experiences with participants in person and online, the conference offers the best opportunity to meet old friends and make new friends.

Oliver Klös
IOTA/ES, Public Relations

COVER

The waxing Moon on 2025 April 1 at 20:23 UT on its way to occult the Pleiades. The images was taken near Wiesbaden, Germany, with a Canon EOS 350D and a more than 30-years-old Danubia f6.3/400 mm lens. Single image at ISO 1600 with an exposure of 0.4 s. Picture editing with Gimp 3.0. (O. Klös)

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In this Issue:

Rules for Authors

In order to optimise the publishing process, certain rules for authors have been set up how to write an article for *JOA*. They can be found in "How to Write an Article for *JOA*" published in this *JOA* issue (2018-3) on page 13. They also can be found on our webpage at https://www.iota-es.de/how2write_joa.html .

CALL FOR OBSERVATIONS:

Lunar Occultations of Neglected Double Stars Brighter than 5 mag from the WDS

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ABSTRACT: A list of neglected double stars is presented on the webpage of the Washington Double Star Catalog. New measurements for the objects on this list are very welcome. This article presents double stars from this list whose primary components are brighter than 5 mag and which can be measured by observing total and grazing lunar occultations. Favourable observation possibilities for occultations in the months of May to December 2025 are presented in detail.

Introduction

The measurements of double stars by lunar occultations can help to determine the position angle and separation of even very close double stars. This is especially the case when several measurements of the same occultation are made from different locations.

The Washington Double Star Catalog (WDS) is the source for double star measurements [1]. Even in times of highly-precise data from ESA's *Gaia*, new observations of double star systems are still important. This is especially true for bright pairs that could not be measured by *Gaia*. The catalogue's website contains a list of binary stars whose observations have been neglected. Either the measurements have not yet been confirmed or the last measurement was more than 20 years ago.

Bright Double Stars

Table 1 presents stars from this list that can be occulted by the Moon and whose primary component has a magnitude brighter than 5 mag. Entries in the list that are labelled with the code 'OC*' (not a double star) from the XZ Doubles dataset [2] have been excluded. The secondary component should also be detectable by lunar occultations and is therefore brighter than 9 mag or unknown in one case.

Additionally, the list shows the next good opportunity for a measurement during a lunar occultation. For these events the Moon will be not more than 60% illuminated and the occultation should occur over inhabited areas. This means that the specified time of event does not necessarily indicate the next lunar occultation of this star. Observers should include these stars in their observation programme and check for additional occultations at their specific observation locations. Depending on the phase of the Moon, even pairs fainter than 5 mag may also be observable. Observers are encouraged to search the list of neglected double stars of the WDS [3] for suitable pairs themselves. Besides total lunar occultation observations, grazing occultations are particularly suitable for resolving close double stars. Observers at the edge of the occultation zones should pay attention to this.

XZ No.	Name Flamsteed No.	WDS Identifier	Comp A mag	Comp B mag	Spectral Class	J2000.0 Coordinates	Constellation (Open Cluster)	Best Upcoming Observation	Moon illum.	Observing Areas
19368	Spica, 67 Vir	13252-1110OCC 418Aa,Ab	1.3	4.5	B1III-	132511.58-110940.4	Vir	22.08.2031	21%	S. South America
19368		13252-1110OCC 418Aa,Ac	1.3	7.5	B1III-	132511.58-110940.4	Vir	22.08.2031	21%	S. South America
22017	Graffias, 8 Sco	16054-1948OCC9158Aa,Ab	2.9	4.1	B0.5V	160526.23-194819.4	Sco	09.01.2032	15%	SW. USA, Mexico
4911	Alcyone, 25 Tau	03475+2406OCC 251Aa,Ab	3	4.6	B7IIIe	034729.06+240618.8	Tau	23.06.2025	7%	S. Europe
21513		15378-2308OCC 857	3.4	8.9	K0III	153748.06-230829.5	Lib	20.10.2028	7%	E. Australia
26854	45 Sgr	19218-1819OCC 994	3.7	6.7	K0III	192150.83-181829.4	Sgr	28.11.2030	14%	NW. Australia
26843	44 Sgr	19217-1751OCC 543	4.2	6.7	F0III/IV	192140.38-175050.1	Sgr	28.11.2030	14%	Australia, New Zealand
4854	Maja, 20 Tau	03458+2422OCC 248Aa,Ab	4.4	5.4	B6.5III	034549.59+242204.3	Tau (Pleiades)	20.07.2025	24%	W. North America, Central America
3891	46 Ari	02564+1801OCC 901	4.5	8.1	F6V	025625.98+180125.1	Ari	20.08.2030	59%	E. Canada
5729	71 Tau	04263+1537OCC9089Aa,Ab	4.5	8	F0V	042620.74+153705.8	Tau (Hyades)	05.09.2034	54%	N. Europe
10368	Mekbuda, 43 Gem	07041+2034OCC 293Aa,Ab	4.5	4.5	F7-G3Ib	070406.54+203413.1	Gem	14.06.2029	4%	E. Canada
4831	Taygeta, 19 Tau	03452+2428OCC 235Aa,Ab	4.6	6.1	B6V	034512.48+242802.6	Tau (Pleiades)	20.07.2025	24%	E. USA, Central America
3666	38 Ari	02450+1227OCC 975	4.8	7.4	A7III-IV	024457.51+122645.5	Ari	20.07.2033	37%	Canada, N. USA
7791	136 Tau	05533+2737OCC 206	4.8	6.3	A0V+A0V	055319.64+273644.2	Tau	01.05.2025	17%	NW. USA, Canada
18651	26 Vir	12392-0800OCC 760Aa,Ab	4.8	8.8	K2III-b	123914.81-075943.8	Vir	13.12.2025	33%	NW. Canada, Alaska
5813		04306+1612OCC9092Aa,Ab	4.9	7.6	A6IV	043033.63+161138.5	Tau (Hyades)	25.02.2034	51%	NE. Europe
	75 Tau	04284+1622RCH 2	4.97		K2III	042826.37+162134.7	Tau (Hyades)	18.08.2033	40%	NW. Canada, Alaska

Table 1. Neglected double stars from the list of the Washington Double Star Catalog with primary components brighter than 5 mag. The table is sorted by magnitude.

Five Events for 2025

The following events for 2025 are picked from Table 1. The maps from GRAZPREP 5.07 [4] show the shadow of the Moon (yellow) at the time given in the caption. Southern graze limit lines are plotted in green and northern limit lines are in red. A marker is set where the Moon grazes the star at the given time and multiple occultations are observable from there. An additional world map presents the complete lines for these occultations (Figure 7).

- **2025 May 01: 136 Tauri**

There is a single observation under OCc 206 from 1934 August 6 in the WDS. W. M. Worssell measured a distance of 0.05 arcsec and magnitudes of 4.8 mag and 6.3 mag [5]. This double star has not yet been confirmed. The Moon is only 17% illuminated when it will occult the star on 2025 May 01 over the northwest of the USA and Canada (Figure 1).

- **2025 June 23: Alcyone (25 Tauri)**

The fainter component of Alcyone is at a position angle of 289 degrees and at a separation of 117 arcsec (2016). However, the brighter component could be double as well. R. Sandy and T. Webber observed a close double star with magnitudes 3.0 and 4.6 on 1972 July 7 [6]. A year earlier, there had already been a promising photoelectric measurement of the duplicity at the *McDonald Observatory*, Texas, USA in the near infrared [7]. The only 7% illuminated Moon will occult Alcyone on 2025 June 23. Observers in southern Europe should measure this occultation (Figure 2).

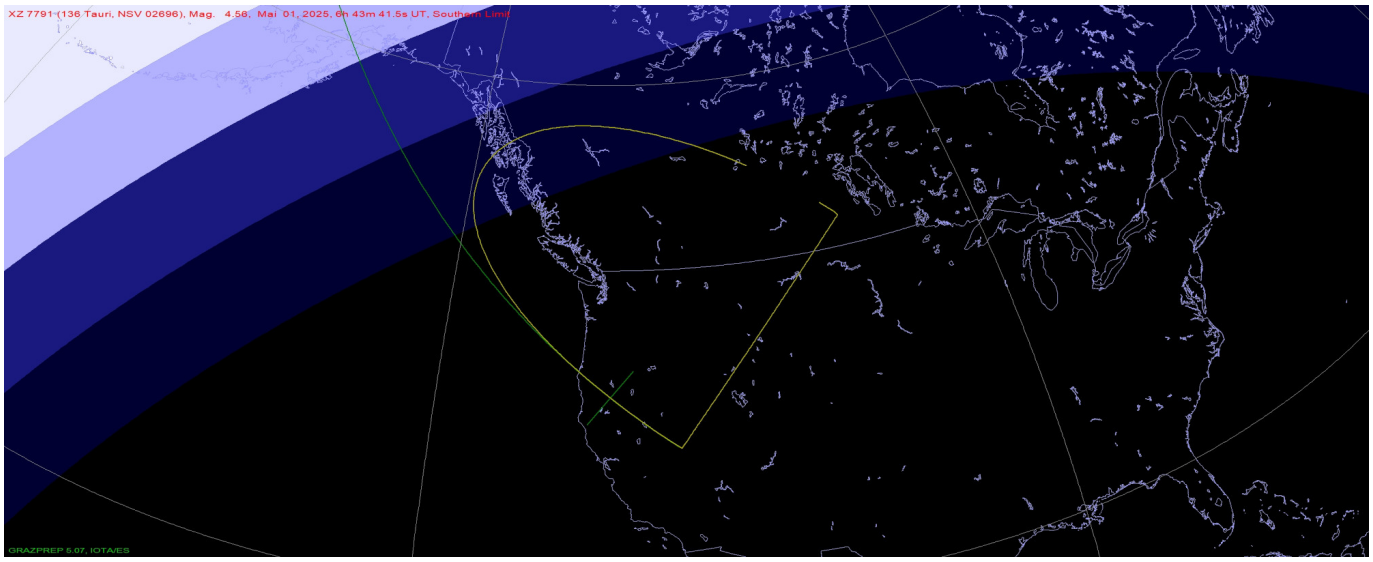

Figure 1. Southern limit bright limb graze of 136 Tauri on 2025 May 01, at 6h 43m 41.5s UT, crossing Oregon, California and Nevada. (GRAZPREP 5.07, E. Riedel)

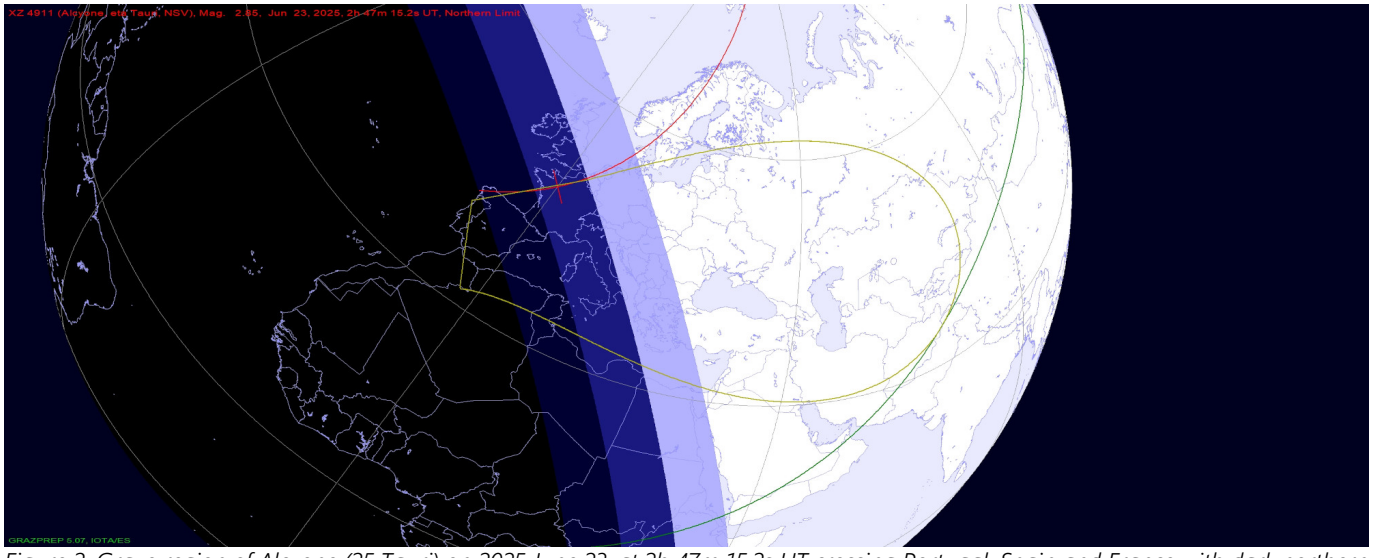

Figure 2. Graze region of Alcyone (25 Tauri) on 2025 June 23, at 2h 47m 15.2s UT crossing Portugal, Spain and France with dark northern limb and northern Africa with bright southern limb. (GRAZEREP 5.07, E. Riedel)

• 2025 July 20: Maja (20 Tauri)

The WDS shows a wide companion of 13.7 mag at a separation of 113 degrees and a position angle of 73 degrees (2011) for Maja, another member of the Pleiades. Eitter and E. Beavers separated the primary component into two stars at 4.4 mag and 5.4 mag on 1971 September 10. No information on separation and position angle is given in the WDS, but [8] gives a separation of 1.6 arcsec and a position angle of 69 degrees. This double star system should definitely be checked. There will be an opportunity to do so on 2025 July 20 in western and midwestern America and Central America (Figure 3). The Moon is only 24% illuminated.

• 2025 July 20: Taygeta (19 Tauri)

For Taygeta, the WDS lists two stars of 11 and 14 mag in addition to the primary component. However, observations by R. Sandy and H. Povenmire from 1969 August 6 and two measurements by A. Richichi from 1988 December 20 and 1989 September 19 show that the main component could be a close double star with 4.6 and 6.1 mag [9]. The Moon is 24% illuminated. The occultation can be observed from the eastern USA and Central America (Figure 4).

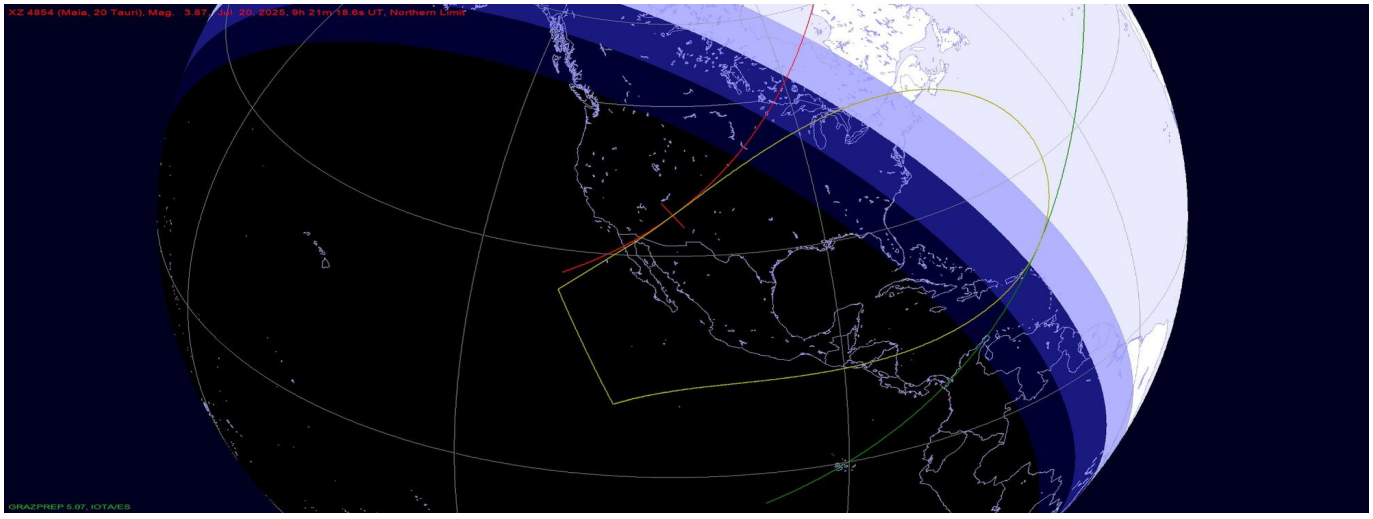

Figure 3. Graze region of Maia (20 Tauri) on 2025 July 20 at 9h 21m 18.6s UT crossing Mexico and the western and midwestern US with dark northern limb and Panama and Columbia with bright southern limb. (GRAZPREP 5.07, E. Riedel)

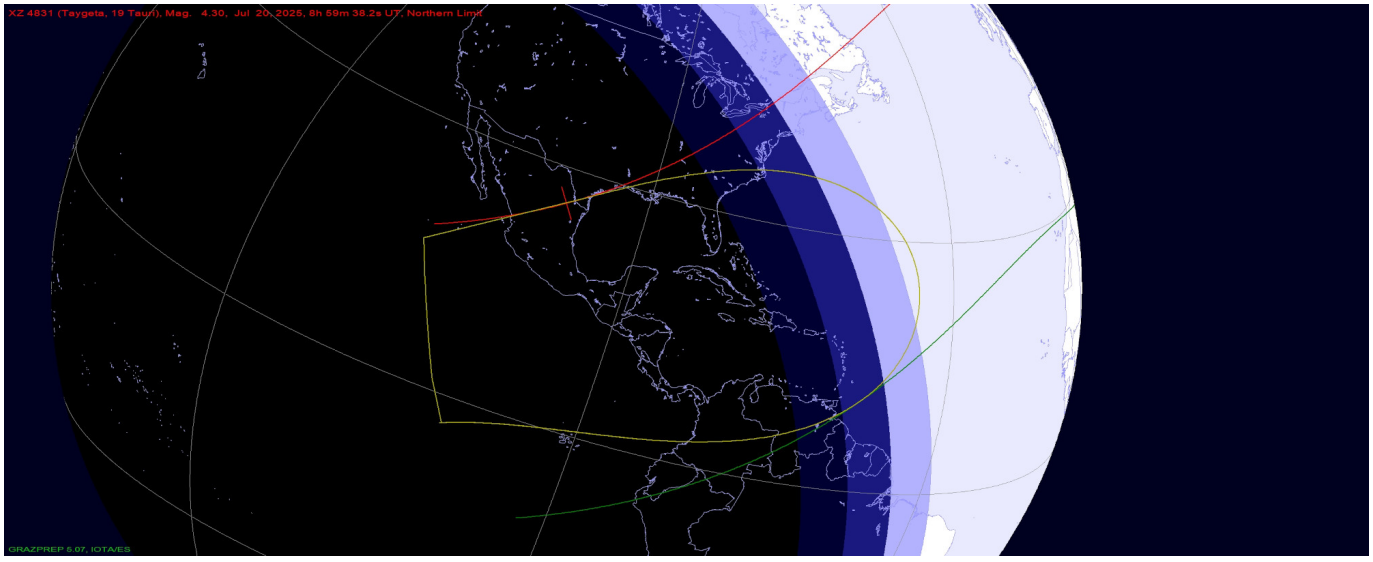

Figure 4. Graze region of Taygeta (19 Tauri) on 2025 July 20 at 8h 59m 38.2s UT crossing Mexico and the southern US with dark northern limb and Ecuador, Peru, Columbia and Venezuela with bright southern limb. (GRAZPREP 5.07, E. Riedel)

• 2025 December 13: 26 Virginis

The WDS lists four wide components from 4.8 mag to 10.6 mag for the multi-star system. R. Wilds and R. Sandy were able to resolve the main component on 1988 December 31 into two stars of 4.8 mag and 8.8 mag during an observation of a grazing occultation (Figure 5). The separation at this time was 0.1 arcsec and the position angle 214 degrees. [10], [11]. The upcoming occultation on 2025 December 13 can be observed in northwestern Canada and Alaska with a 33% illuminated Moon (Figure 6).

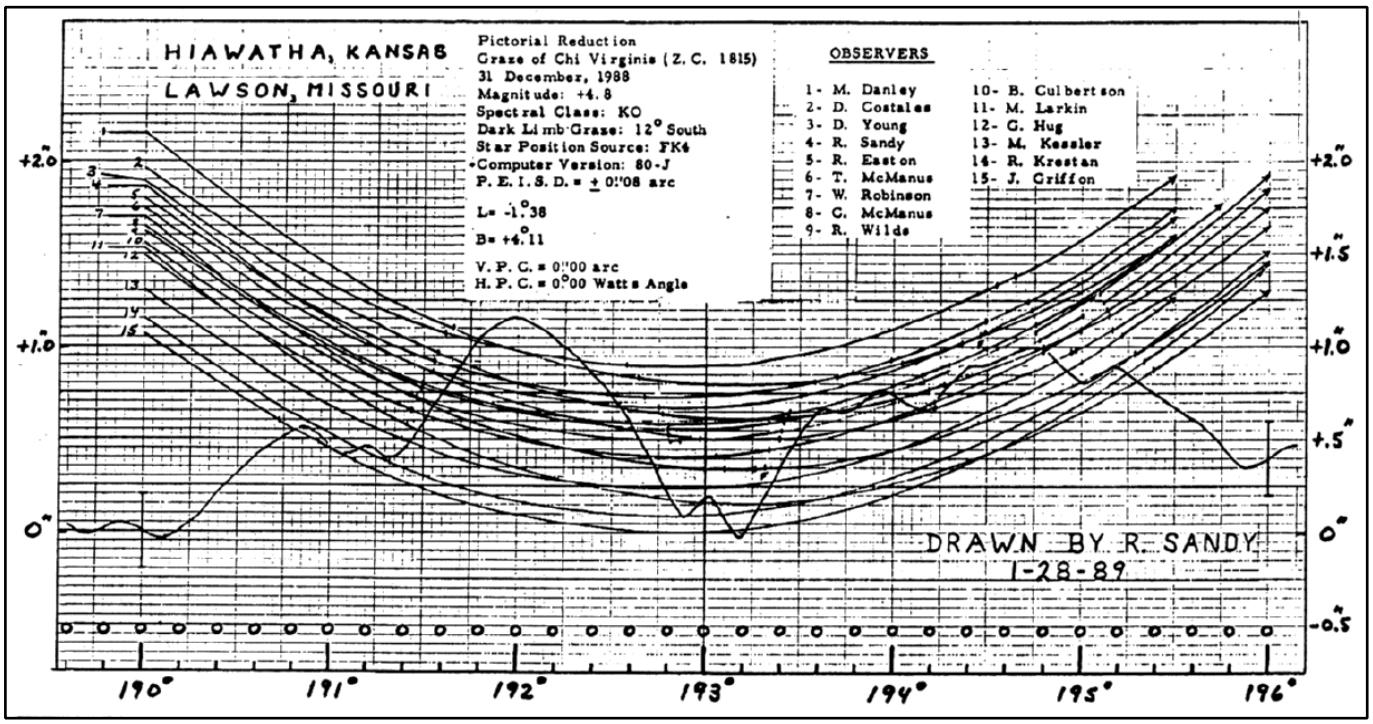

Figure 5. Grazing occultation of 26 Virginis recorded by 15 observers on 1988 December 31 drawn by Robert Sandy and published in Occultation Newsletter Vol. 4, No. 11. [11].

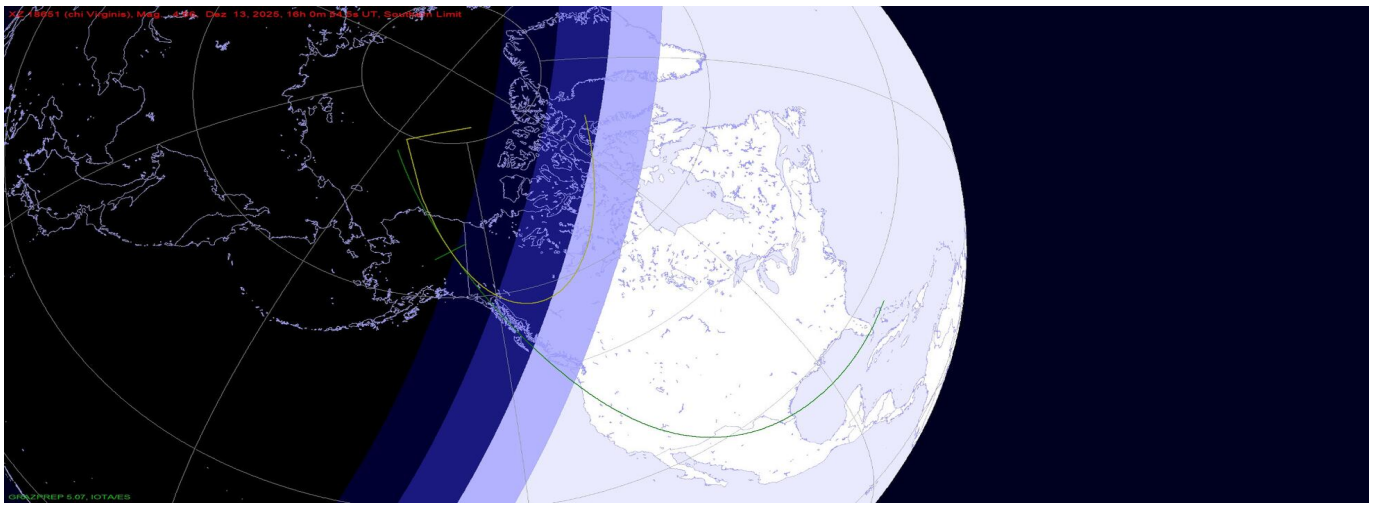

Figure 6. Southern limit dark limb graze of 26 Virginis on 2025 Dec 13 at 16h 0m 54.5s UT crossing Alaska and Northwest Territories. (GRAZPREP 5.07, E. Riedel)

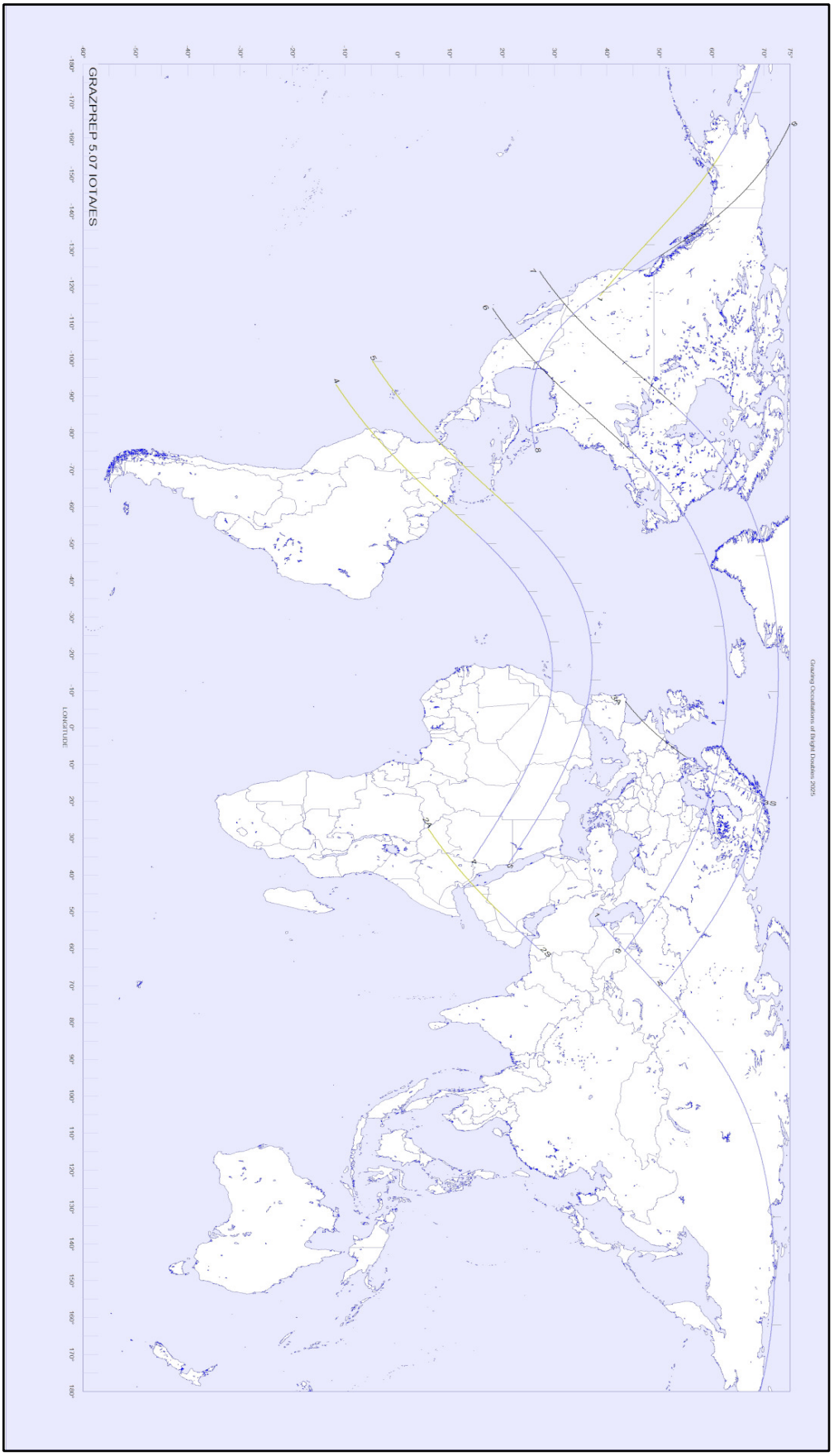

Figure 7. World map of the five bright double star occultations. The yellow parts of the graze limit lines indicate grazes on the bright limb, the black parts a graze on the dark limb. The blue parts of the graze limit lines are in daylight.

136 Tauri = Line 1
Alcyone = Lines 2 and 3
Taygeta = Lines 4 and 6
Maja = Lines 5 and 7
26 Virginis = Line 8

(GRAZPREP 5.07, E. Riedel)

Conclusion

Even when data releases from *Gaia* now provide highly-precise double star measurements, observations of these stars during total and grazing lunar occultations are still a rewarding task for occultation observers, especially for brighter stars. Measurements with several observation stations of the same occultation could resolve binary systems with high accuracy.

References

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[11] Sandy, R., The 1988 December 31 Graze of Chi Virginis, Occultation Newsletter, Vol. 4, No. 11, p. 258-259, https://www.iota-es.de/onheritage/ON_Vol04_No11.pdf

30 Years Ago – The 80-Characters Problem: Reporting by E-Mail

From *Occultation Newsletter* Vol. 6 No. 7:

LET'S REPORT OCCULTATION TIMINGS
BY E-MAIL

David W. Dunham

In ON 4 (5), p. 92 (August, 1987), I published an article, "Let's Report Occultation Timings on Diskettes", specifying an ASCII format that could be used for reporting occultation observations in files on IBM-compatible diskettes. During the last few years, many observers have gained access to electronic mail, so it would be convenient for many to send the relatively small lunar occultation observation files by e-mail. Until recently, there was no e-mail link to the International Lunar Occultation Centre (ILOC) in Tokyo. Also, for the time being, ILOC prefers that someone else collect the report messages, edit and process the files to exactly the format they need, and transmit the files to them periodically (once or twice a month). Toshio Hirose, of the Japanese Lunar Occultation Observers' Group, has agreed to collect the report messages. His Internet address is NBC00716@niftyserve.or.jp. Reporting observations by e-mail should speed the reduction process and save observers the expense of overseas postage, and thus should encourage more reporting of observations.

There is one problem with the ASCII format proposed for reporting on diskettes in 1987. That is the line length, set then at 80 characters, the same as IBM cards that had been used with mainframe computers for so many years before. Files with lines this long can be sent by e-mail only as attached (uuencoded) messages, which are difficult to create for some and not supported by many e-mail systems. Therefore, it would be better to create a 78-character-per-line format that can be sent as an ordinary e-mail message. The rest of this article is devoted to specifying such a format. For many items, the 80-character format can simply be truncated, but the crucial time lines have data in column 79, so simple truncation is not possible there. Toshio Hirose and ILOC have been provided with a PC computer program that I have written that will convert the e-mail format to the 80-character format that ILOC needs for their work. If you send diskettes to ILOC, you should continue to use the 80-character "old" format defined in 1987. Those

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Journal for Occultation Astronomy

Lunar Occultation Observations Former Developments – Current Situation – Future Prospects

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ABSTRACT: The article describes the current situation with lunar occultation observations and why they deserve a new interest by the observers and by the people to analyse them.

Introduction

In the early years of the IOTA the prediction, observation and analysis of lunar occultations were the IOTA's main concern. So, in 1988 about 13,000 such observations were made worldwide. This changed fundamentally.

Meanwhile, lunar occultations seemed to have lost their importance. However, there are some indications that lunar occultations are still important once again. Thus, observers are called to restart or to continue observing occultations by the Moon.

The Changes to Lunar Occultations over Decades

In the course of the decades, the observers' focus went to occultations by asteroids more and more. Even more accurate stellar positions and asteroid ephemerides made possible a quickly growing number of positive observations. Such stunning topics as double asteroids, asteroid moons and 3D shape models fascinated the occultation community, whereas lunar occultations seemed to have become uninteresting.

The former objectives of lunar occultation work were mainly to monitor the Earth's rotation, to improve the lunar ephemerides and to reconstruct the lunar limb profile [1], [2]. But these aims were achieved more precisely and more effectively by other methods, namely by laser distance measurements to laser reflectors on satellites in Earth orbit respectively on the lunar surface. Additional, extremely accurate stellar positions from the *Gaia* mission and highly detailed lunar limb profiles derived from the altitude measurements by the *Kaguya* space probe and the *Lunar Reconnaissance Orbiter* are available now. They made it irrelevant to refine these quantities with lunar occultations. And finally, unprecedented exact observer positions from GPS completed the set of astrometric quantities formerly employed in the occultation work.

So the number of lunar occultation observations decreased more and more. The data in Table 1 shows this impressively.

Some Statistics

The IOTA database containing all lunar occultation observations can be accessed via [3]. Furthermore, it forms the basis for the publication in VizieR [4].

The author has made a detailed statistic analysis for the years 1981 to 2024 based on the data in [3]. The results are given in Table 1.

In interpreting the numbers, it should be considered that, due to some reason, observations sometimes take several years until they arrive in the data base, for instance, because the observers report them so late. So, the numbers in the table have a preliminary character, especially for the most recent years. Therefore, observers are reminded to send in their observations at least once or twice a year to avoid forgetting about them.

Table 2 gives an overview of the number of expeditions to observe grazing occultations. It was derived by the author from [5] and shows the decrease of their number. For comparison, a few decades ago there were up to 80 graze expeditions worldwide each year.

The Situation Today

In the last three years, less than 1.000 total lunar occultations per year have been observed all around the world.

Also, the number of grazing occultation observations decreased dramatically. This is the more surprising as the highly-precise astrometric data and the highly-developed prediction programs *GRAZPREP* [6] and *Occult* provide very accurate predictions. From these the observers can easily find out where to locate in the landscape to see a maximal number of contacts between the star and the lunar limb.

This indeed leads to a few graze expeditions with many contacts for a single observer. While in the past, observed tracks with four or six contacts were often the rule, up to 16 or even more contacts can be achieved at a single station.

Year	Records	Occultation Phenomena					Timing Method				
		Disapp	Reapp	Blink	Flash	Graze	Stopw	Tape	Eye-Ear	Video	Other
		D	R	B	F	G	S	T	E	G	V
1981	9418	6703	2652	23	40	812	5068	1027	643	0	50
1982	13661	10055	3562	23	21	961	7536	1600	967	0	65
1983	11499	8261	3211	14	13	881	6326	1257	577	0	48
1984	9922	7038	2847	19	18	791	5643	988	820	0	78
1985	8793	5691	3060	22	20	1410	4298	1693	496	0	37
1986	8894	6148	2705	17	24	1098	4391	1671	599	0	47
1987	11083	7701	3343	16	23	1188	5695	1944	524	0	109
1988	13020	8075	4875	25	45	1830	7135	2564	556	0	38
1989	11776	7829	3910	21	16	1197	6398	1911	556	0	125
1990	11729	8439	3247	17	26	1576	6553	1922	293	0	169
1991	10987	7984	2968	18	17	1020	7355	1104	245	0	233
1992	9292	6644	2627	5	16	951	5499	1112	186	0	259
1993	9679	7494	2158	17	10	1083	5835	1144	175	0	199
1994	8105	6111	1945	29	20	937	4732	883	125	0	151
1995	11275	8197	3036	18	24	1579	6397	1326	119	0	389
1996	8463	6585	1853	8	17	689	5163	832	112	0	131
1997	8664	6067	2577	13	7	844	5356	822	114	1	376
1998	8167	6090	2031	18	28	988	4833	980	97	0	452
1999	8109	5794	2280	10	25	886	4246	789	118	4	930
2000	9534	6655	2852	17	10	1772	4207	1211	140	0	1563
2001	7989	6187	1776	10	16	1015	4047	596	90	0	1536
2002	6875	4715	2131	19	10	1091	3951	421	25	127	962
2003	6400	4446	1933	11	10	1060	2973	454	33	4	1194
2004	5207	3675	1516	7	9	636	1889	378	52	124	1276
2005	4819	3152	1631	21	15	778	1151	305	33	75	1454
2006	4726	3141	1539	26	20	1216	1376	430	35	76	2335
2007	5132	3561	1557	8	6	1102	1040	259	8	634	2600
2008	4394	3292	1094	4	4	656	994	189	1	1510	1128
2009	5329	3707	1594	11	17	845	590	228	16	3801	120
2010	3686	2665	1012	9	0	685	343	168	7	2765	18
2011	3781	2735	1035	7	4	548	517	216	2	2708	18
2012	3395	2170	1216	8	1	328	336	170	1	2592	268
2013	2746	1669	1062	8	7	482	273	146	3	2164	131
2014	3913	3024	884	2	3	461	503	41	5	2649	686
2015	2963	2206	746	6	5	434	287	115	3	2484	29
2016	3055	2318	712	15	10	482	382	66	10	2420	111
2017	2974	2073	854	27	20	896	319	118	23	2319	98
2018	2294	1790	492	2	10	609	327	91	10	1804	35
2019	1767	1491	274	2	0	241	462	0	7	1282	13
2020	1592	1245	321	8	18	363	417	1	14	1108	33
2021	1142	917	222	1	2	242	340	5	14	773	10
2022	932	773	159	0	0	54	211	11	16	664	28
2023	658	617	41	0	0	2	234	0	14	398	12
2024	190	156	34	0	0	0	82	0	1	94	13
Total	288029	205286	81574	562	607	36719	135710	31188	7885	32580	19557

Table 1. Statistic of lunar occultation observations from 1981 to 2024.

Legend:
Occultation Phenomena:
Disapp = Disappearance
Reapp = Reappearance
Blink = Momentary Disapp.
Flash = Momentary Reapp.
Graze = Contact during grazing occultation

Method of Timing and Recording:
Stopw = Visual with stopwatch
Tape = Visual with tape recorder
Eye-Ear = Visual with eye & ear
Video = Video with time insertion
Other = Video with other time linkings

Year	Number
2017	33
2018	31
2019	20
2020	14
2021	19
2022	17
2023	16
2024	10

Table 2. Number of graze expeditions from 2017 to 2024.

Meaning of the Reduction and of the Residuals

For the right understanding of the matter, the author finds it worthwhile giving the following explanations once again.

As is well known, the final result of an occultation observation is the time for the moment when the star was observed to disappear or reappear at the lunar limb.

The first step of the subsequent analysis is to compute a so-called reduction. It reduces the complex relationship between the positions of the Moon, the star, the lunar limb and the observer to one single quantity, describing the summary error in the whole system. That way, the so-called residuals allow us to compare observations made at different times and at different places concerning different stars.

The residual O-C (observed minus computed) is the essential result of the reduction. It is the computed distance of the star to the lunar limb just at the moment of the time reported by the observer. Usually, the O-C is given as an angle expressed in arc seconds (") or milliarcseconds (mas). In the reductions by the program Occult the O-C is given additionally as the according time equivalent expressed in seconds (sec).

Theoretically, the residual should be exactly zero because the star is just at the lunar limb at the moment of the occultation. Indeed, the O-C is mostly somewhat different from zero. This is because the residual is the summary error of all components playing a role in the particular occultation: The lunar ephemerides, the lunar limb, the star's position, the observer's position, the earth's axis orientation and the timing itself.

Furthermore, there is a special challenge in linking all these highly accurate quantities to each other to form a consistent system.

Finally, the algorithm for the reduction and the program to perform it have an influence. Thus, the timing is only one aspect.

Therefore, a great value of the O-C in seconds does not necessarily mean that the timing is in error by just this value, even if that expression could imply this. In other words, the residual is not primary intended to confirm the timing quality. Unfortunately, the meaning of the O-C is sometimes misunderstood by some observers. Nowadays, the O-C values lie within the range [-100 mas ... +100 mas] typically.

Occasionally the O-C can be a little larger, mainly caused by poor star positions or wrong star identification. The latter may be the case with close double or even multiple stars when it is difficult to distinguish which component was actually occulted [7].

Surprising Results Concerning Accuracy

Dave Herald and Dave Gault offered an interesting idea in their article in [8].

They assumed that all involved important astrometric quantities (lunar ephemerides, stellar positions, lunar limb data and observers positions) are sufficiently accurate now. So, the residual of a lunar occulation observation should mainly depend on the timing accuracy. Henceforth, they stated that lunar occultation observations could serve as a tool to check the reliability of the whole timing process utilised by the observer. Therefore, they included an output feature for the *Occult* program showing possible timing errors from the residuals. They call it 'clock correction'. It is simply the time equivalent expressed in seconds for the residual originally expressed in milliarcseconds.

Recently, two independent groups detected a systematic pattern in the residuals and their time equivalents as computed by *Occult*. The residuals O-C for total occultation disappearances are typically in the order of -0.04" whereas the value for reappearances is +0.07".

The averages of the corresponding time equivalents are +0.12 seconds and +0.19 seconds. That would imply that the occultations occurred by this amount too late!

This surprising result was first published by the IOTA/EA section at their meeting in August 2024 [9].

Dietmar Büttner found just the same result two years ago in his not yet published analysis. See Figures 1 and 2. Both sources confirm each other concerning the magnitude of order as well as the sign of the derived error. The author used the reduction data for the about 3,400 recent observations given in [10] and the criteria for selecting the observations to analyse which are given in [8]. Only video observations were considered for the above figures. However, a separate analysis for visual observations only indicated the same tendency but with a somewhat higher scatter.

Another independent indication for problems with the accuracy of up-to-date lunar occultation results arises from the grazing occultation reductions performed by Mitsuru Soma. He derives typical corrections from each graze expedition in the range ±0.08" and sometimes even a bit larger [5].

For comparison:

In past decades, these shifts from grazes were in the range of ±1". And a typical residual for total lunar occultations amounted up to ±1.5" just 20 or 30 years ago.

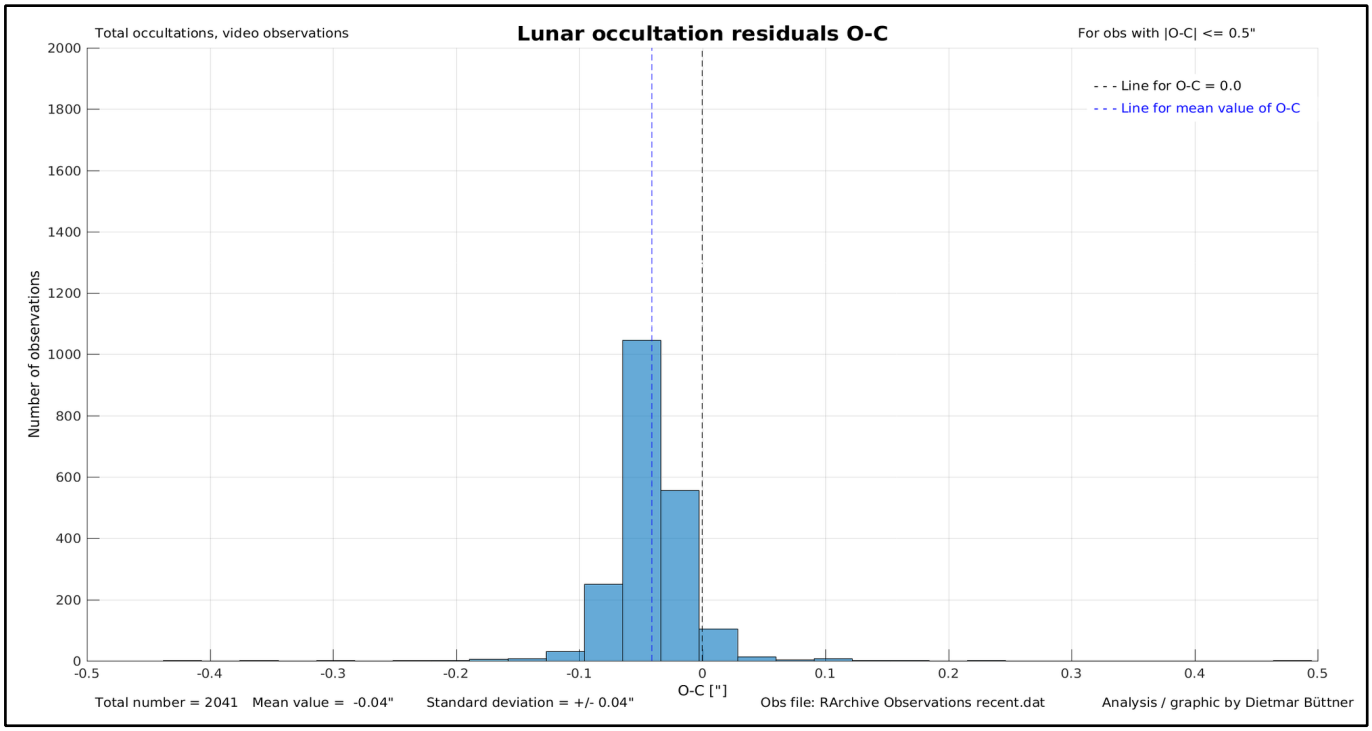

Figure 1. Histogram of the residuals for 2041 recent disappearance observations. The residuals O-C were computed by Occult and published in [10]. They are expressed as angle in arc seconds.

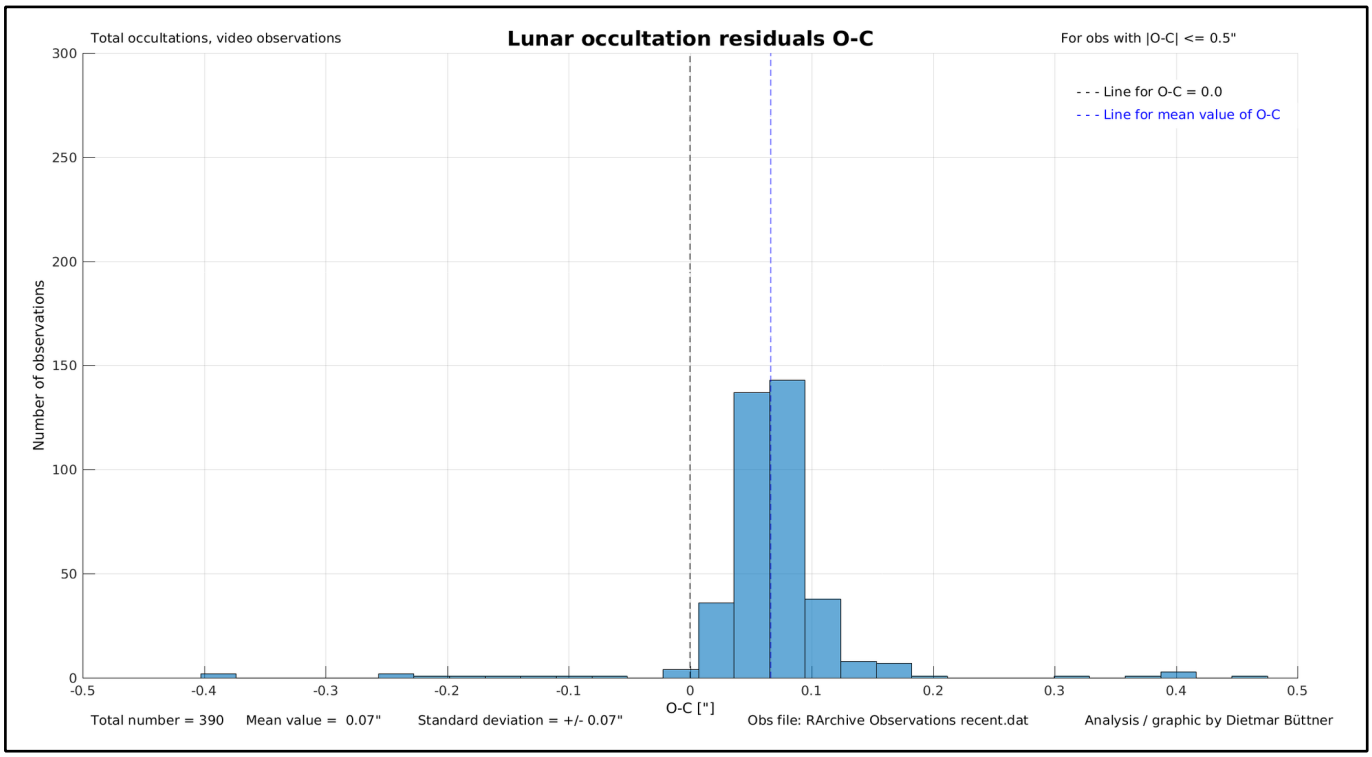

Figure 2. Histogram of the residuals for 390 recent reappearance observations. Same source and method as in Figure 1.

Discussion

Thus, as seen from the residuals, the accuracy is much higher today, namely in the order of a factor of 10 to 20. Nevertheless, the data clearly indicate that the residuals are much greater than expected under the conditions of highly accurate astrometric basic data. Namely, the current results could be an indication for systematic errors along the Moons' path for total occultations and perpendicular to it for grazing occultations.

Probably, the reasons for these systematic errors lie in the interplay of all quantities together. In the last months, there was an expansive discussion on the PLANOCCULT list on the accuracy and reliability of asteroidal occultation predictions. It reflected clearly the rather complex kind of the matter. This holds for lunar occultations too. With an even higher accuracy, things become more and more complex. So, there are new questions to deal with.

On the other hand, there is no doubt in the accuracy of the basic data each on his own. And, of course, there is no doubt about the algorithms employed by Dave Herald and Mitsuru Soma considering their extraordinary expertise over many decades.

Altogether, the unexpected 'large' residuals and shift data indicate possible further causes of errors in the whole process. These need to be investigated.

Summary: The Need for More Observations

To perform such investigations there is a new need for more lunar occultation observations. This holds for total as well as for grazing occultations.

The only way to find out the cause of the deviations described above is to evaluate real observations. Although there are already nearly 500,000 observations in the IOTA data base [4], actual observations are needed. This allows us to evaluate the observations over a longer span of time and to investigate how the deviations develop with time.

A final remark on visual observations:

As it can be seen from Table 1, even in the era of video cameras, visual observations amounted to about a quarter or even to a third of all observations. So, they can't be simply ignored. Of course, observations with the highest possible timing accuracy are desired. Otherwise, even a number of reliable visual observations could be helpful. As shown above, even observations with cameras resulted in unexpected large residuals. Thus, the somewhat less accurate visual observations could help to solve the mystery.

And especially grazing occultations are much less sensitive to any timing errors as total occultations are.

Observations can be replaced by observations only. The necessary evaluations have a clear statistic character. Therefore, as much as possible observations are needed. Unfortunately, it turned out in the past, that it is more and more difficult to recruit new observers. Thus, even visual observations should be appreciated with, of course, considering their possible lower accuracy.

For further general explanations see [11].

Acknowledgements

At this point, the author wants to express his thanks to Jan Manek who acted as European regional collector for lunar occultations from 2008 to 2024 until the author took over this role.

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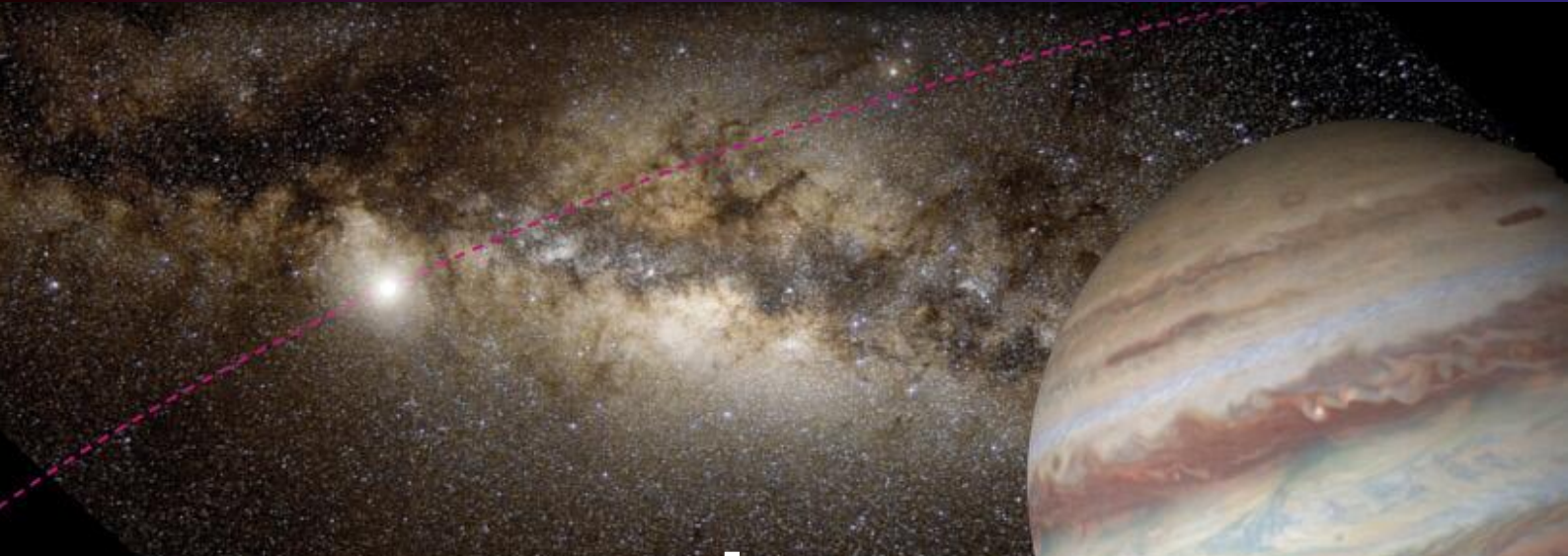

Beyond Jupiter

The World of Distant Minor Planets

Since the downgrading of Pluto in 2006 by the IAU, the planet Neptune marks the end of the zone of planets. Beyond Neptune, the world of icy large and small bodies, with and without an atmosphere (called Trans-Neptunian Objects or TNOs) starts. This zone between Jupiter and Neptune is also host to mysterious objects, namely the Centaurs and the Neptune Trojans. All of these groups are summarised as "distant minor planets". Occultation observers investigate these members of our solar system, without ever using a spacecraft. The sheer number of these minor planets is huge. As of 2025 March 17, the *Minor Planet Center* listed 1873 Centaurs and 3603 TNOs.

In the coming years, JOA wants to portray a member of this world in every issue; needless to say not all of them will get an article here. The table shows you where to find the objects presented in former JOA issues. (KG)

In this Issue:

(31824) Elatus

Konrad Guhl · IOTA/ES · Berlin · Germany · kguhl@astw.de

ABSTRACT: Since 2016, the JOA regularly publishes portraits of objects beyond Jupiter's orbit. This short communication on the Centaur (31824) Elatus tells the story of its discovery, the meaning behind its name and the nature of its orbit. The sizes and physical properties are derived from data published up to 2020.

No.	Name	Author	Link to Issue
944	Hidalgo	Oliver Klös	JOA 1 2019
2060	Chiron	Mike Kretlow	JOA 2 2020
5145	Pholus	Konrad Guhl	JOA 2 2016
5335	Damocles	Oliver Klös	JOA 2 2023
7066	Nessus	Konrad Guhl	JOA 1 2024
8405	Asbolus	Oliver Klös	JOA 3 2016
10370	Hylonome	Konrad Guhl	JOA 3 2021
10199	Chariklo	Mike Kretlow	JOA 1 2017
15760	Albion	Nikolai Wünsche	JOA 4 2019
15810	Awran	Konrad Guhl	JOA 4 2021
20000	Varuna	Andre Knöfel	JOA 2 2017
28728	Ixion	Nikolai Wünsche	JOA 2 2018
32532	Thereus	Konrad Guhl	JOA 1 2023
38628	Huya	Christian Weber	JOA 2 2021
47171	Lempo	Oliver Klös	JOA 4 2020
50000	Quaoar	Mike Kretlow	JOA 1 2020
53311	Deucalion	Konrad Guhl	JOA 2 2024
54598	Bienor	Konrad Guhl	JOA 3 2018

No.	Name	Author	Link to Issue
55576	Amycus	Konrad Guhl	JOA 1 2021
58534	Logos & Zoe	Konrad Guhl	JOA 4 2023
60558	Echeclus	Oliver Klös	JOA 4 2017
65489	Ceto and Phorcys	Konrad Guhl	JOA 1 2025
90377	Sedna	Mike Kretlow	JOA 3 2020
90482	Orcus	Konrad Guhl	JOA 3 2017
120347	Salacia	Andrea Guhl	JOA 4 2016
134340	Pluto	Andre Knöfel	JOA 2 2019
136108	Haumea	Mike Kretlow	JOA 3 2019
136199	Eris	Andre Knöfel	JOA 1 2018
136472	Makemake	Christoph Bittner	JOA 4 2018
174567	Varda	Christian Weber	JOA 2 2022
208996	2003 AZ_8	Sven Andersson	JOA 3 2022
341520	Mors-Somnus	Konrad Guhl	JOA 4 2022
471143	Dziewanna	Wojciech Burzyński	JOA 3 2024
486958	Arrokoth	Julia Perła	JOA 3 2023
-	2004 XR_{190}	Carles Schnabel	JOA 1 2022
541132	Leleākūhonua	Konrad Guhl	JOA 4 2024

The Discovery

The object was discovered on 1999 October 29 at *Mount Lemmon Observatory* in Arizona, United States of America and received the preliminary designation, 1999 UG_5 [1]. The discovery is a product of the Catalina Sky Survey (CSS). The CSS searches for near-Earth objects. The three CSS telescopes are located in the Santa Catalina Mountains just north of Tucson, Arizona and are managed by the *Steward Observatory* of the University of Arizona. Permanent number (31824) was assigned on 2001 November 30 [2]. The object was named on 2003 June 14 for the Centaur Elatus [3].

Figure 1. Elatus' death. (Artist's impression made for JOA by Enzo Trenkner.)

The Name

Elatus is one of the lesser-known centaurs. There are only two incidents in mythology: He fought with burning trees as weapons and he was killed by a poisoned arrow from Hercules. So, we don't have any ancient sculptures, pictures or mosaics depicting Elatus. Figure 1 shows an impression of the death of Elatus by the comic artist Enzo Trenkner: Hercules/Heracles shoots an arrow at the Centaur, which passes through Elatus' arm into Chiron's knee.

The Orbit

The orbit, of eccentricity 0.384, is inclined to the ecliptic by 5.25°. With a semi-major axis of 11.81 au, the distance from the Sun varies between 7.3 au and 16.3 au (Ref. JPL 31). The complete orbit is contained within that of Uranus. The orbital period is approximately 40.3 years. So, the object is a typical member of the Centaur class.

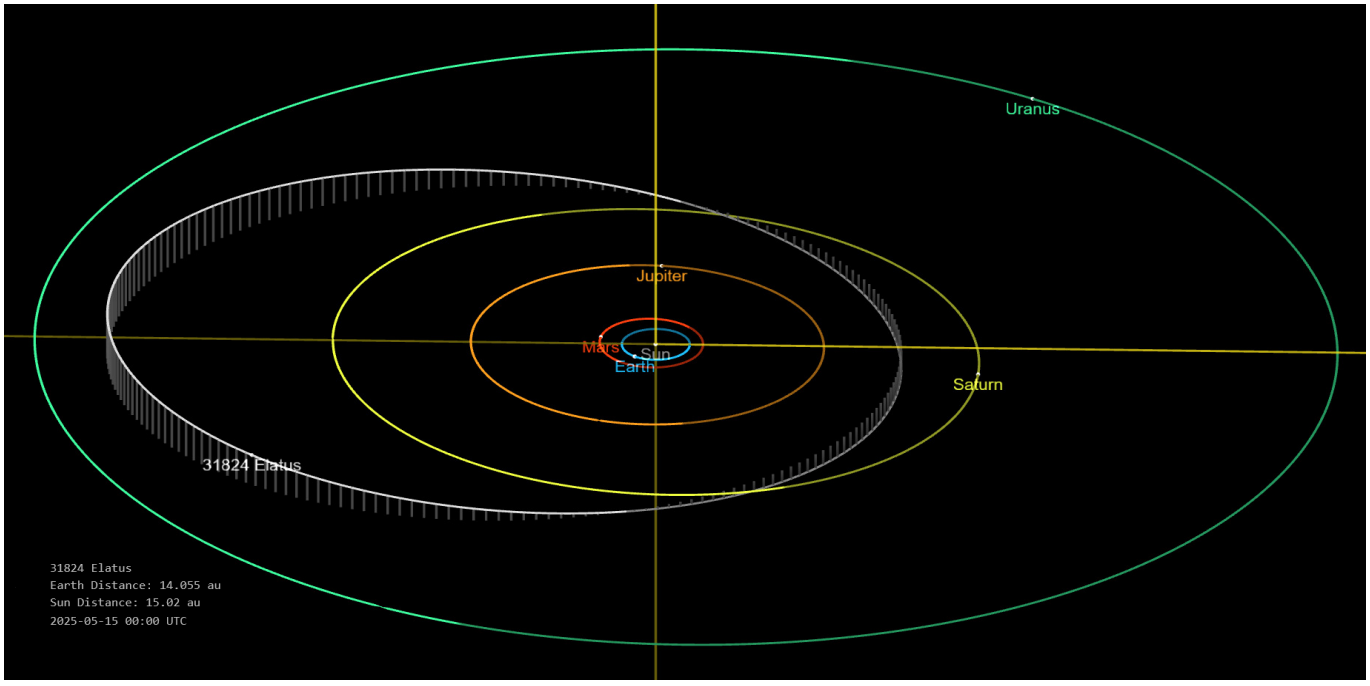

Figure 2. Orbit diagram and position of (31824) Elatus on 2025 May 15.
(Source: NASA/JPL Small-body database lookup, https://ssd.jpl.nasa.gov/tools/sbdb_lookup.html#/?sstr=31824)

Physical Characteristics

In [4] published in 2001, the authors report R-band observations taken with the Calar Alto 1.52 m and the La Palma 3.5 m TNG telescopes. They report a brightness of H_V= 10.42 ± 0.02. They found the planet to be extremely red (B − V = 0.95 ± 0.13, V − R = 0.63 ± 0.07 and R − I = 0.60 ± 0.09). In this paper, different rotation periods and possible outburst activity are discussed to explain the lightcurve. In reference [5], the photometric values differ slightly: B − V = 0.88 ± 0.18, V − R = 0.60 ± 0.08 and R − I = 0.72 ± 0.13. Again, these results place (31824) Elatus in the group of the reddest-known bodies in the Solar System. In reference [6] the taxonomic classification is given as RR (very red) and the absolute magnitudes, H_R and H_V were 10.06 ± 0.09 and 10.61 ± 0.07 respectively. The calculated diameter based on photometric data is 47 ± 2 km [5]. In [6], the authors re-analysed *Spitzer Space Telescope* data and report a rotation period of 13.41 ± 0.04 h and a diameter of 49.8 +10.4/-9.8 km. In 2009, (31824) Elatus was observed with the *Hubble Space Telescope*, an unresolved image from which is shown in Figure 3.

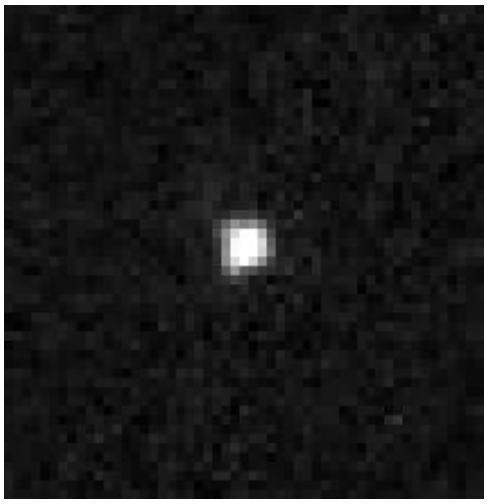

Figure 3. Hubble Space Telescope image of (31824) Elatus, taken on 2009 September 29. Credit: HST

Future Occultations

With the current orbital elements, an occultation of a 10th magnitude star in the constellation of Libra has been predicted for 2026. Figure 4 shows the prediction from *Occult*. Given a diameter of approximately 50 km, the occultation path will be narrow and we shall have to wait until 2026 when new astrometry should make accurate predictions possible ahead of the possible event.

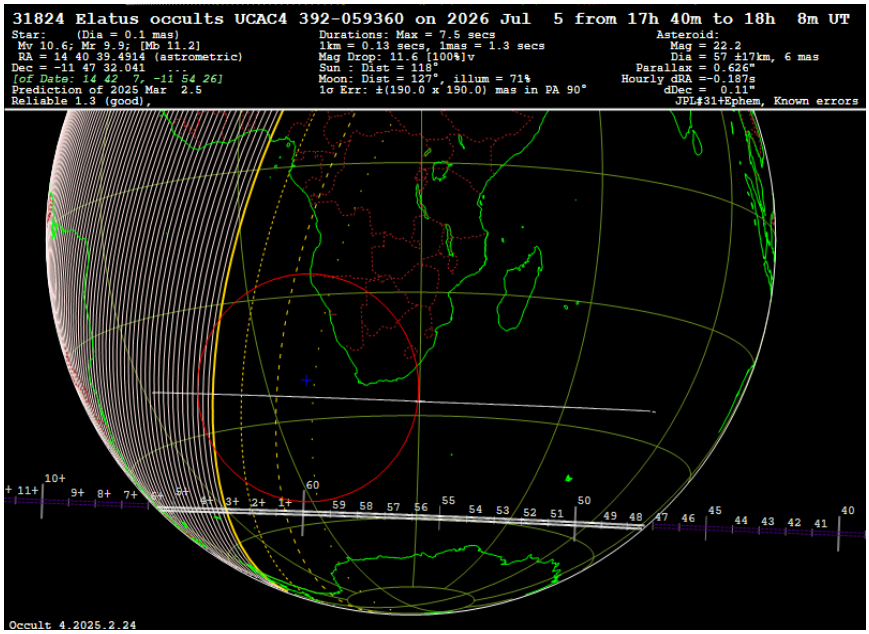

Figure 4. Path map of the possible occultation on 2026 July 5. Occult V4.2025.2.24

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News

Catalogue of the Historical Observations of Solar Eclipses from Europe and Middle East

Marek Zawilski, member of the Polish Society of Amateur Astronomers, Łódź Division, is a long-time amateur astronomer and observer of occultation phenomena.

In about 40 years, he has collected and cataloged historical observations of eclipses and occultations, which he has presented in numerous publications and at meetings and conferences.

In March 2025, he announced a new online version of the catalogue of historical observations of solar eclipses:

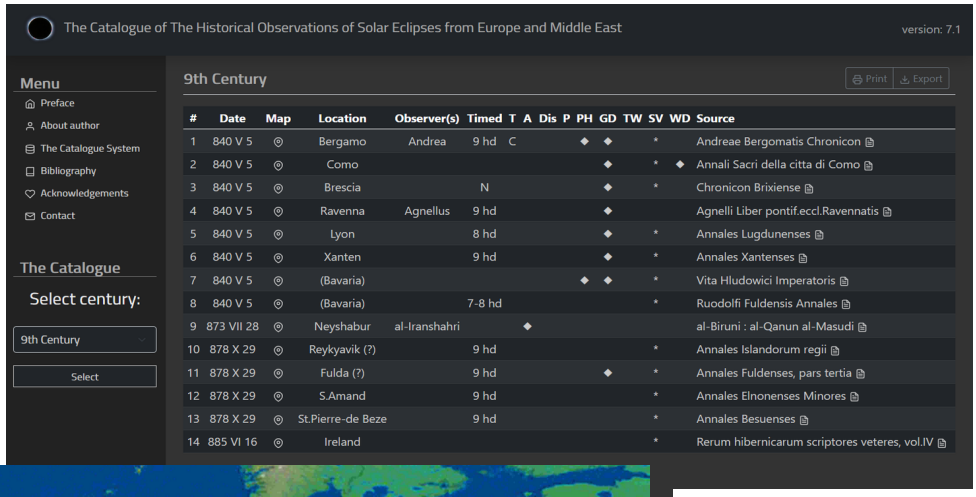
http://www.solareclipses.pl/

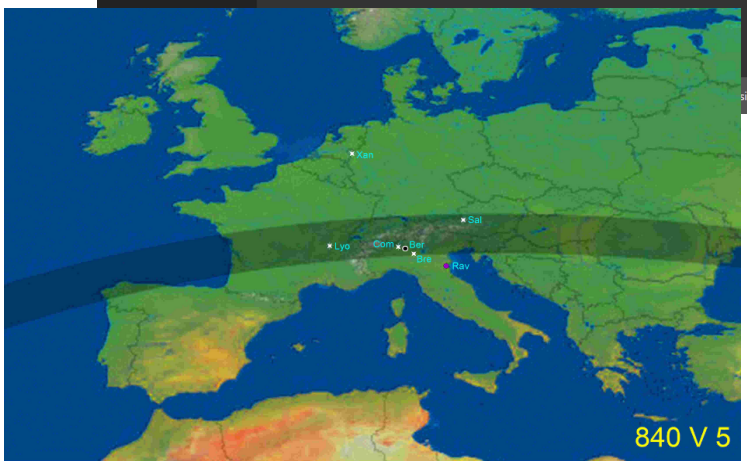
The use of the database is easy. First select the century, then click on the icon next to the date. A map of the eclipse path will appear with the observation locations and their three-letter abbreviations marked.

A click on the icon next to the name of the source file will open the original text and its English translation. It should be noted, that up to the 18th century, source texts are available in the database. For later observations only references to literature are given due to the amount of data.

Marek Zawilski will extend the catalogue in the future and welcomes any remarks about his work.

(O. Klös)





Screenshots of the catalogue of the historical observations of solar eclipses from Europe and Middle East with eclipse path map and source text.

840 V 5

Vita Hludowici Imperatoris
Auctore astronomo

Qua in tempore deliquium solis contigit, tertia die Letaniae maioris, insolitum. In tantum enim lucis recessu tenebrae praevaluerunt, ut nihil a noctis veritate differe videretur. Stellarum namque ratus ordo ita cernebatur, ut nullum sidus hebetudinem lucis solaris pateretur; quiu potius luna, quae se ei adversam praebuerat, paulatim Orientem petendo primum corniculatim illi lumen a parte Occidentali restituerat, in morem sui, quando prima vel secunda cernitur, et sic per augmenta totam venustatem tota rota solis reciperet.

Life of Emperor Louis
by an author called the astronomer

At that time an unusual eclipse of the sun occurred on the 3rd day of the Greater Litany. Namely, darkness so prevailed with the receding of the light that, in truth, it seemed to fifer not at all from night. The determined order of the stars was perceived such that no star seemed to suffer from the extinguishing of the sun's light except perhaps the moon, which lay opposite the sun. But as the moon moved gradually to the east, a little horn of light was restored to the sun's western parts, as in the case when it is seen at first or second light. Thus little by little the whole circle got back its total beauty.

Bavaria, GERMANY

COMMENTS

This is surely the description made by the eyewitness of the event.
Unfortunately, the place of the observation is unknown.

s.ca 840

MGH SS, II

Newton p.339-400 (incomplete)

News

More Discoveries of Binary Asteroids with Occultation Technique

Dave Herald announced on the mailing lists in March 2025 that the number of discoveries of binary asteroids is still rising.

Until 2025 March 13, there were 14 discoveries in 2025 announced in CBETs. Five based on occultation observations were announced between Feb 21 and Mar 12 (Figures 1-5). The occultation observation of (1626) Sadeya was a confirmation of a photometric light curve discovery (CBETs 4893, 5524).

Table 1 lists eleven binary asteroids discoveries by occultation observations until 2025 March 13. Observers all over the world are encouraged to keep an eye on upcoming stellar occultations by these minor planets.

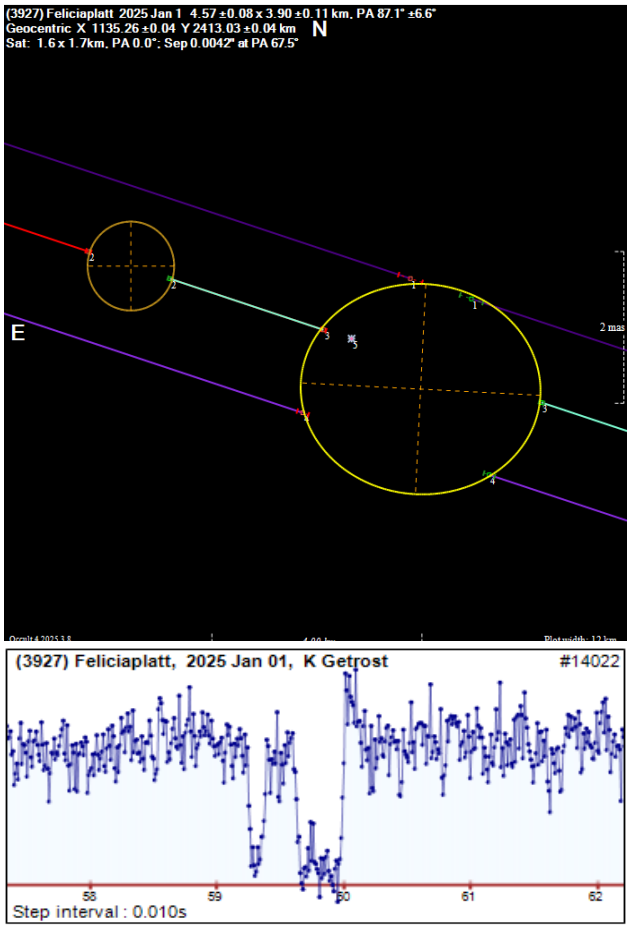


Figure 1. 2025 Jan 01: Profile of (3927) Feliciaplatt and its satellite recorded with a double station by Roger Venable (chords 1, 4) and Kai Getrost (chords 2, 3) who detected the satellite. (CBET 5511)

All plots and light curves are from *Occult V4.2025.3.8*. Access to the 50 most recent CBETs is available here:

http://www.cbat.eps.harvard.edu/cbet/RecentCBETs.html

(O. Klös)

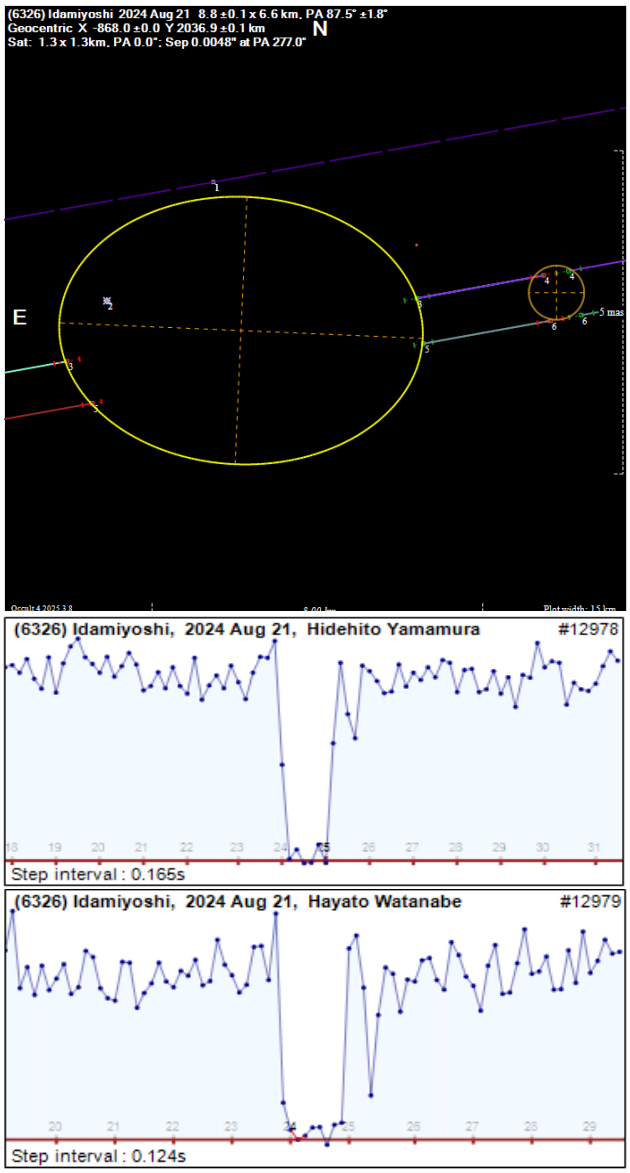


Figure 2. 2024 Aug 21: Binary asteroid (6326) Idamiyoshi measured by Hidehito Yamamura (chord 3, 4) and Hayato Watanabe (chord 5, 6). Norihiro Manago recorded a miss on chord 1. (CBET 5512)

News

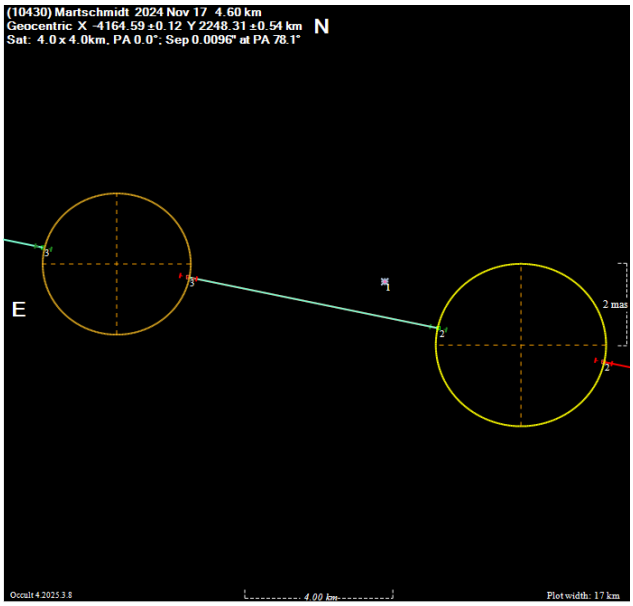


Figure 3. 2024 Nov 14: Single chord observation by Richard Nolthenius of binary asteroid (19430) Martschmidt. (CBET 5506)

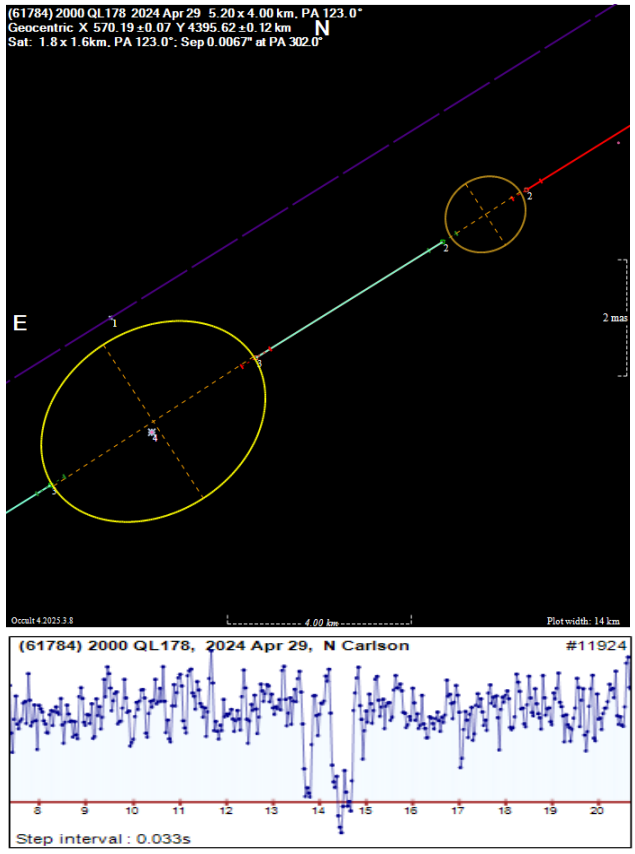
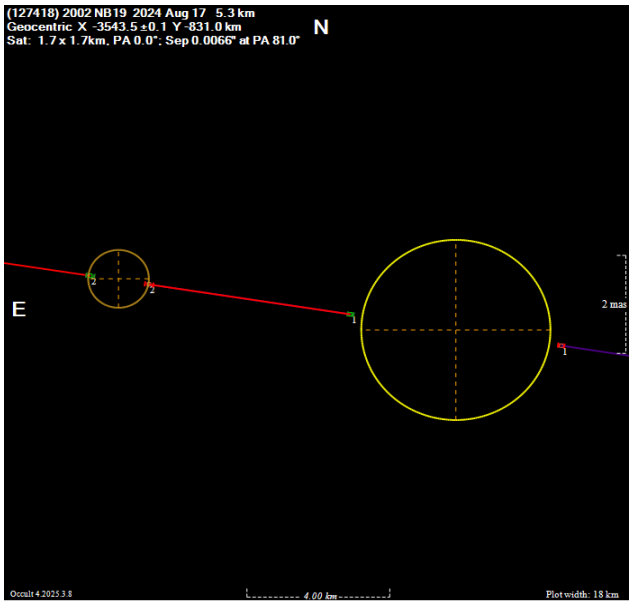


Figure 4. 2024 Apr 29: Norman Carlson's detection of the satellite of (61784) 2000 QL_{178}. Jerry Bardecker recorded a miss. (CBET 5522)



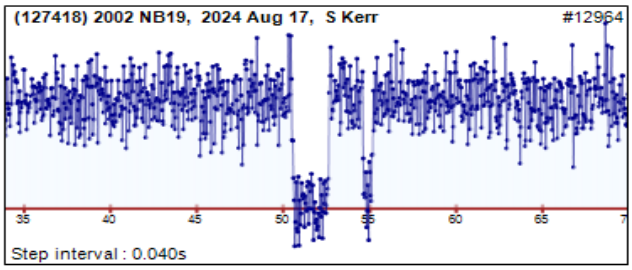


Figure 5. 2024 Aug 17: Single chord observation by Steve Kerr of binary asteroid (127418) 2002 NB_{19}. (CBET 5521)

Asteroid Number	Nominal Dia. (km)	Satellite Dia. (km)	Sep. of Centres (radii of main)
3927	4	1.5	~ 2.7
4337	19	12	~ 4.9
5232	12	8	~ 5.5
5457	21	2	> 1.8
6326	6.9	1.3	> 2.2
10424	6.5	2.1	~ 2.0
10430	5.7	4	~ 3.8
61784	5.2	1.8	~ 3.3
100624	16	4	~ 3.2
127418	5.3	1.7	~ 3.6
172376	5.7	3.3	~ 5.4

Table 1. Binary asteroids discovered by occultation observations. The satellites of asteroids (5457) and (6326) have been unlikely near their greatest elongation at the time of the measurements. (Data compiled by Dave Herald)

News

MADAMO Award for the Discovery of the (4337) Arecibo Companion

The IOTA Board of Directors is awarding Dave Gault and Peter Nosworthy the *W. J. Merline Award for Discovery of an Asteroid Moon by Occultation* (MADAMO award) for their discovery on 2021 May 19 of the companion to (4337) Arecibo.

The first confirmation of this satellite was done by observers Richard Nolthenius and Kirk Bender in a following occultation on 2021 June 9. The original and the confirming observations are described in the Minor Planet Bulletin 49-1, January 2022:

https://ui.adsabs.harvard.edu/abs/2022MPBu...49 ...3G/abstract

Final, and decisive, confirmation was made by the teams who analysed the *Gaia* data for (4337) Arecibo, providing a completely independent analysis of the asteroid's duplicity. Their results "Asteroid (4337) Arecibo: Two ice-rich bodies forming a binary", published as a letter in the journal Astronomy and Astrophysics. The paper can be accessed as a html or a pdf via the arXiv link:

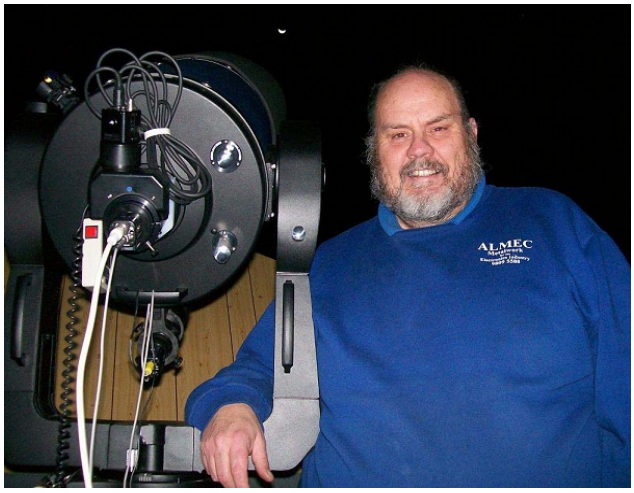
https://arxiv.org/abs/2503.13375

The Board also thanks Dave Herald for his assistance, preparing the CBET that announced the discovery, assisting in preparation of the MPB article, and advocating for the observers with the prize evaluation team.

For those who are unfamiliar with the MADAMO award, it is described in the web page accessible via this link:

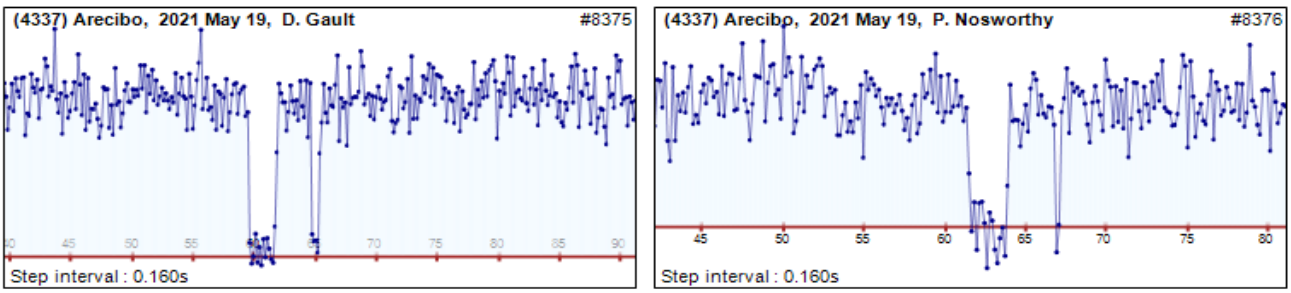
https://pauldmaley.com/merline/

(J. Dunham)



Dave Gault

Peter Nosworthy



Lightcurves of binary asteroid (4337) Arecibo by Dave Gault (left) and Peter Nosworthy on 2021 May 19.
An extended report with recorded videos and animations of the lightcurves is here: https://hazelbrookobservatory.com/4337arecibo

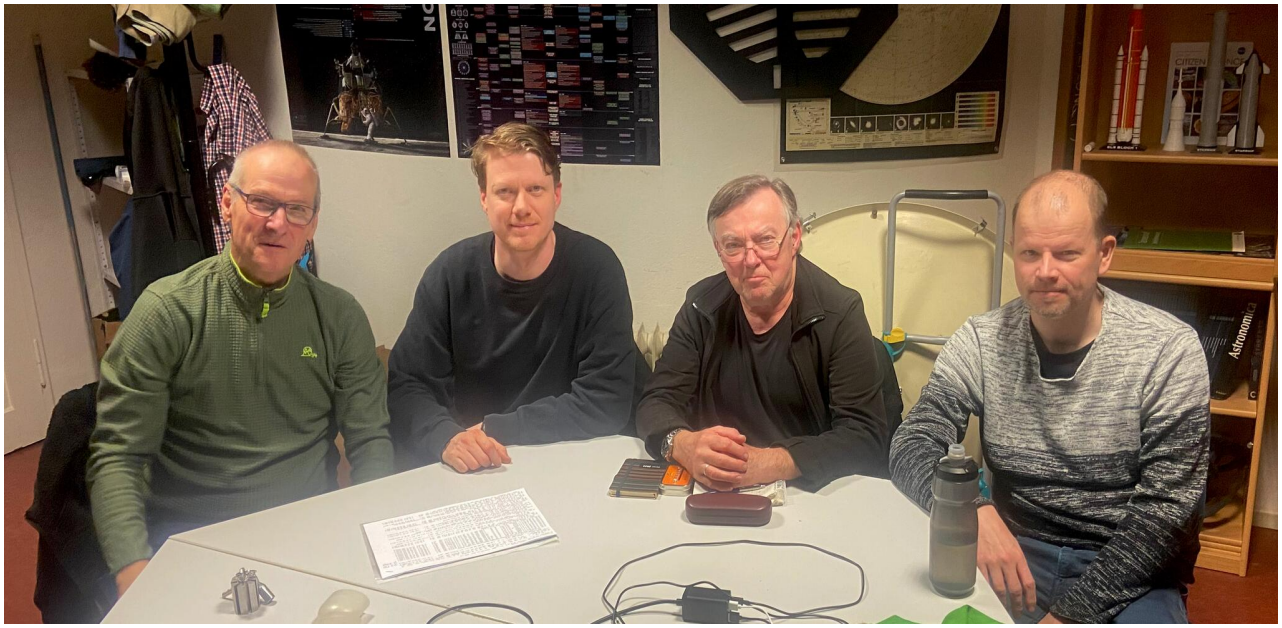
News

Stellar Occultation Working Group Founded at Archenhold Observatory

Following a call from Konrad Guhl (IOTA/ES), eight people have come together in the vicinity of the *Archenhold Observatory* in Berlin, Germany, to observe stellar occultations. Now they are discussing software, learning and practising with cameras and telescopes.

The planned observations of lunar occultations and occultations by minor planets will revitalise a tradition of the observatory, which has been carrying out such observations for almost 100 years.

(K. Guhl)



Four members of the new stellar occultation working group: Jörg Scholz, Christoph Zielke, Hans-Jürgen Blaschke and Lars Meissner (left to right) (Photo: K. Guhl)

A New Webpage for the Journal of Double Star Observations

The latest issue of the Journal of Double Star Observations can be downloaded on a new webpage:

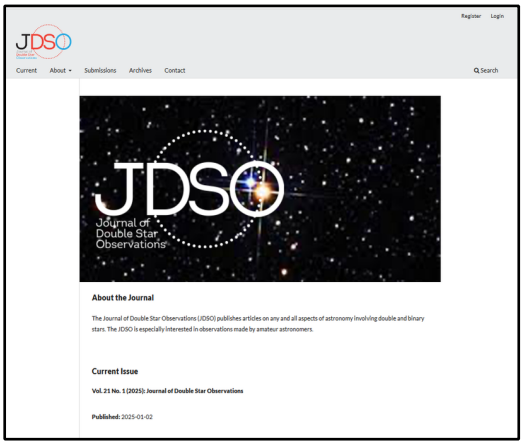
https://doublestarsjournal.org

The webpage has a new design. It is still possible to download a specific article or a complete issue.

To add all past issues to the new archive is a work in progress. All issues of volume 20 and earlier are still available on the former link:

http://www.jdso.org

(O. Klös)



News

IOTA OpenVTI – Timing Insertion for Analogue Cameras

Ted Blank has announced a new version of the IOTA VTI on the IOTAoccultations mailing list on 2025 March 20.

Due to a discontinued chip production which was essential for the IOTA VTI, the time inserter was not available for some time.

The new version is Arduino-based and supports NTSC and PAL formats. Tests of the new device confirmed the same accuracy in timing as the IOTA VTI. The overlay characters have not been changed so the data recorded with the IOTA Open VTI can be analysed using *PyMovie* or *LIMOVIE* as before.

Power supply is provided by either 12V DC or via a USB A-B cable on 5V USB power. The new VTI requires an external GPS antenna which is included in the package.

After power up the device waits for the timestamp display initial character change from "G" (GPS time without leap seconds applied) to "U" (UTC with appropriate leap seconds applied), which may take up to 15 minutes for the GPS almanac to download. Timestamps in "G" mode are accurate, but current leap seconds offset have to applied manually during analysis.

In addition, the IOTA analogue occultation recording starter kit will be available again soon. This set includes a RunCam Night Eagle 3 analogue camera.

IOTA OpenVTI with connections for power and video. The connector for the GPS antenna is on the backside.

For prices and shipping costs go to:

https://occultations.org/iota-openvti-description-and-ordering-page/

(O. Klös)

DTVI+CAM 430 – Now Available for the US Market

The digital camera DTVI+CAM 430 has now the permission to be marketed in the USA.

Anyone interested in this special occultation camera should have a look at the user manual in English:

https://dvticam.com/static/usermanual/5.8.1/DVTI_User_Manual_EN_v5.8.1b.pdf

A video in English language about recording an occultation with this camera can be found here:

https://dvticam.com/static/videos/dvti_recording_an_occultation.mp4

(O. Klös)

News

ADV-Player Becomes DVTI Video Tools

The DVTI+CAM team presents a new software – *DVTI Video Tools*. The new application will replace the *ADV Player* (see JOA 2024-04, p. 35).

The software will view, annotate, edit and export Astronomical Digital Video (ADV) files. With this application, the user can view ADV files and their meta data, export them as ADV, SER, FITS series and MP4 and can add annotations like text, arrows, circles etc.

The first version is now ready for download:

https://dvticam.com/support

A video tutorial in English gives detailed instruction for the use of the features of *DVTI Video Tools*:

https://dvticam.com/static/videos/dvti_video_tools.mp4

Please check for future updates of the video. Some brand new features like the export to AVI (important for the use with *LIMOVIE*) or the repair of corrupted ADV files will be explained later.

Future versions of the software may include the following features:

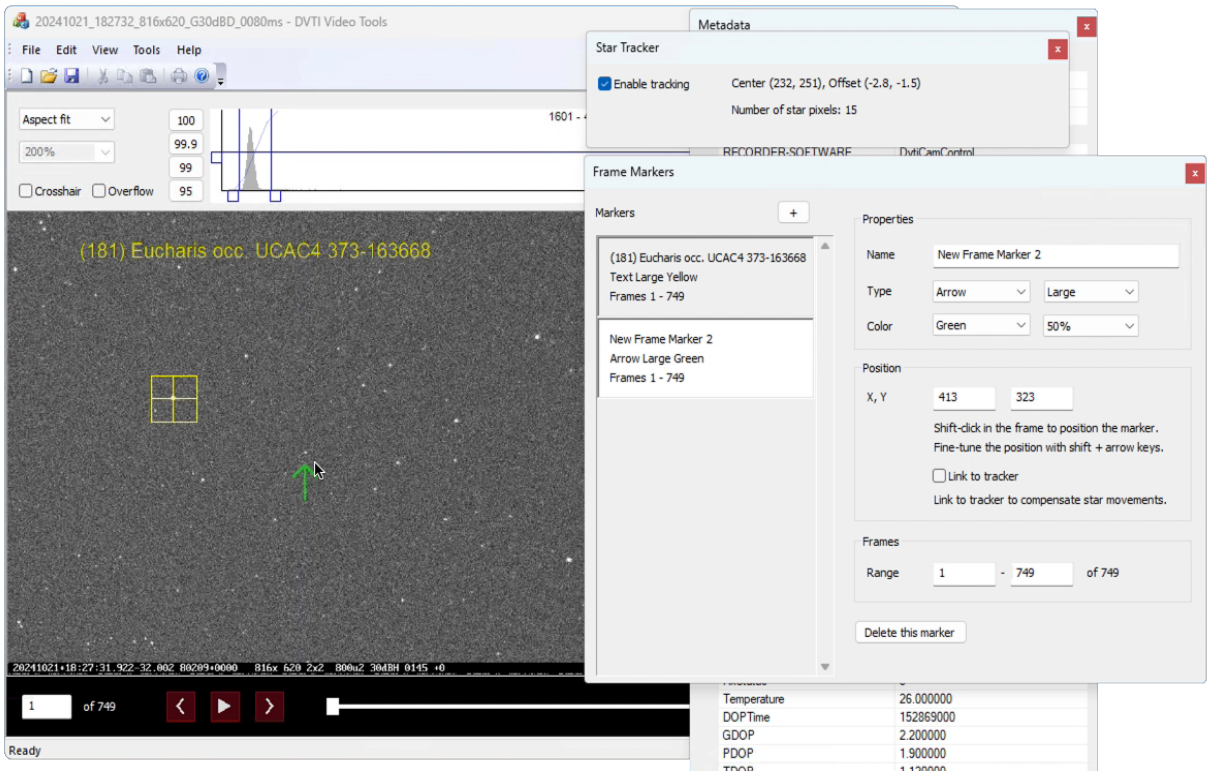
- Editing of metadata
- Integration of plate solving
- Stacking of frames in post-production

The DVTI+CAM team, Andreas Schweizer and Stefan Meister, ask the users to give feeback and to report any bugs to the forum. Requests for additional features are welcome.

https://groups.io/g/d-vti-cam/messages

A version for *Linux* is in the final stage of testing and is now available. Check the DVTI+CAM support page.

(O. Klös)



Screenshot of DVTI Video Tools.

News

Solar-Powered Observatory Records Its First Occultation

A positive measurement of the occultation by asteroid (947) Monterosa with a duration of 0.46 s was accomplished on 2025 March 19 with the solar-powered observatory *Solarstromsternwarte* in Oberreith, Germany (Figure 1). This was the first asteroidal occultation recorded from this site.

Initiated by Martin Gutekunst (IOTA/ES), Peter Gilge is a new observer of stellar occultations. He is a member of the association 'Astronomy in the Chiemgau' and has joined the European section of IOTA. He was supported by Gregor Krannich, member of IOTA/ES and one of the SODIS Coordinators of Germany, during the observation.

Thomas Hilger, the 1st chairman of the association 'Astronomy in the Chiemgau', joined the team for the observation. The *Solarstromsternwarte* houses a 60 cm Newtonian on a fork mount (Figure 2). Details about the telescope and its unique power supply can be found on the webpage of the association (in German):

https://www.astronomie-im-chiemgau.de/

The day after the observation, Gregor Krannich familiarised Peter with the installation of software and helped him to evaluate the observation (Figure 3). He reported that the first successfully observed occultation had aroused so much enthusiasm in Peter and Thomas that both will continue to observe occultations.

A new team with a powerful telescope is now ready to observe stellar occultations in the south of Germany.

(O. Klös)

Figure 1. The large solar panel array of the Solarstromsternwarte in Oberreith, Germany. In the middle of the roof is the opening for the telescope visible. (Photo: Astronomie im Chiemgau e.V.)

Figure 2. The 60 cm Newtonian on the fork mount inside the spacious Solarstromsternwarte.
(Photo: Astronomie im Chiemgau e.V.)

Figure 3. Lightcurve of the positive observation of the occultation by (947) Monterosa on 2025 Mar 19.
More details: https://sodis.iota-es.de/review/review/?u=7885

News

Lightcurves of Occultations Updated on VizieR

Dave Herald annnounced an update of the light curve database at VizieR on 2025 February 1 on the mailing lists.

He gave the following instructions to view the light curves:

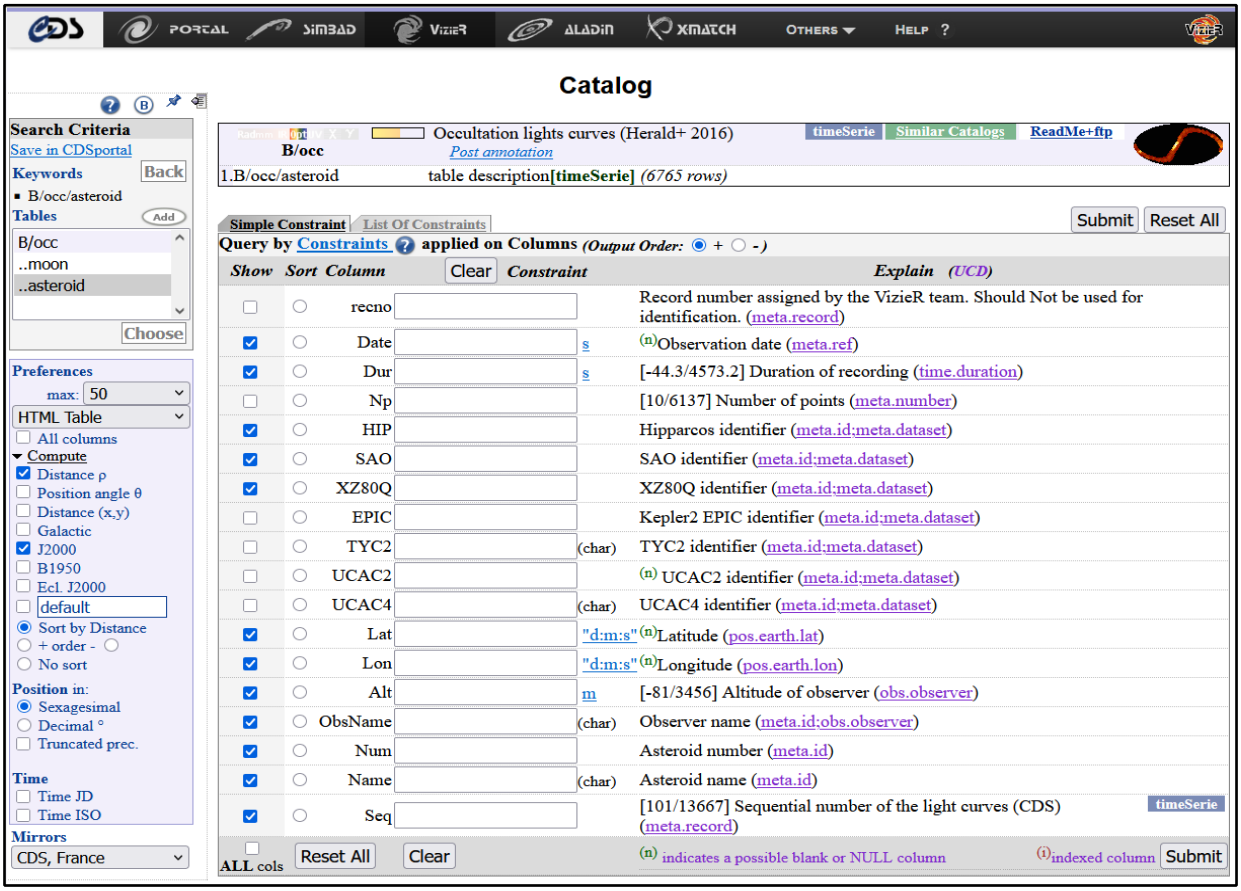
- Go to https://vizier.cds.unistra.fr/viz-bin/VizieR
- At the top left box, specify: **B/occ/asteroid**
- On the form that appears, select either the lunar or the asteroids file

- Assuming asteroids:
  There are heaps of fields you can select to find events. Easiest way to find your events is to use the Name field (near the bottom of the list), and enter some or all of your family name with an asterisk as the first and last character in the field. E.g. *Smith*

- In the list that then appears, to display an event, click the link on the end of a line of interest. This will open a plot with some controls.

All light curves should be submitted for archival. As part of the submission process, the light curves are reviewed before uploading to VizieR. In a few rare situations, there may be a delay in uploading the light curve to VizieR due to publication guidelines. Observers need not worry about this aspect as it will be handled during the review process. If observers have questions about the archival of their specific light curve(s), they should contact Dave Herald.

(O. Klös)



Screenshot of the catalogue webpage for occultation light curves from asteroids at VizieR. Under Search Criteria choose '..moon' for the catalogue of light curves from lunar occultations.

Invitation to ESOP XLIV
Poznań, Poland, 23 - 24 August 2025

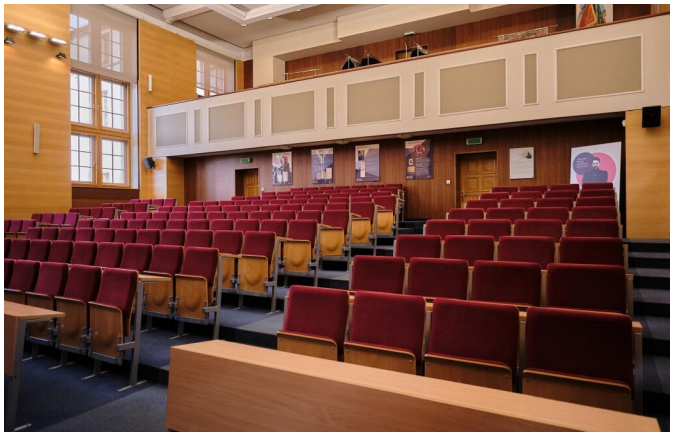
Four years after meeting in Białystok, the European Symposium on Occultation Projects (ESOP) comes back to Poland. This time we will welcome symposium participants in Poznań, Poland's fifth largest city, located in the Midwest part of the country. It can be reached by international E30 highway and fast trains from Berlin and Warsaw (around 300 km distance to both), but also by plane, via Poznan Ławica international airport.

Poznań is home to one of the top Polish universities: Adam Mickiewicz University (AMU), with a strong research centre of minor bodies of the solar system, the Astronomical Observatory Institute (AOI), being the organiser of the ESOP meeting.

Participants will have the opportunity to see the Institute's research instruments, both historic and modern ones. The conference venue will be a spacious lecture auditorium in the main building of AMU, "Collegium Minus", located close to the city centre. Meeting co-organiser is the Polish Amateur Astronomers Society, Białystok Branch.

As a traditional part of ESOP, after the conference additional trips will be offered, both in the historic city centre and the surroundings, with its beautiful lakes, gardens and castles. Trips are planned to visit *Chalin Observatory* and Center for Natural Education located in Sieraków Landscape Park, and to Kórnik with its castle and tree garden. Poznań must-see is a meteorite crater reserve within the city limits (Morasko Meteorite Nature Reserve), with recent 300-kg meteorite finds.

Details and registration here:
https://esop44.iota-es.de/



Lecture auditorium in "Collegium Minus"
(Photo: Władysław Gardasz)

On behalf of the Organising Committee we invite the whole community interested in occultation phenomena to join the 44th ESOP symposium. We will be glad to see you in Poznań in person, but an on-line participation via Zoom will also be offered.

Anna Marciniak
Adam Mickiewicz University

Wojciech Burzyński
Polish Amateur Astronomers Society

Journal for Occultation Astronomy

Sonja Itting-Enke

1930 – 2024

Sonja Itting-Enke in her element: with guests at the telescope, here at the reopening of her 'Cuno Hoffmeister Memorial Observatory' in 2018. (Photo: Miriam Hutterer)

On 11 December 2024, the dedicated Namibian amateur astronomer Sonja Itting-Enke closed her eyes forever at the age of 94. The recipient of the VdS (Vereinigung der Sternfreunde) medal was the driving force behind the spread of astronomy in Namibia.

Her activities date back to before the last appearance of Halley's Comet in 1986, when she took over the preparations and organisation in the country for the VdS-Halley-Watch campaign and thus gave 45 stargazers the opportunity to observe it.

She tirelessly organised events for the Namibia Scientific Society in Windhoek to disseminate astronomical knowledge. Her 'Star Globe', a 3-metre globe made of wire with coordinates and all the constellations, is famous for providing spatial orientation under the starry sky. Countless tourist guides were thus familiarised with the constellations and celestial mechanics and were able to pass this knowledge on to tourists and locals. Astronomy students from UNAM, the University of Namibia in Windhoek, were also able to supplement their theory with live observations.

When stargazers from Germany visited Namibia, she was always happy to help and offered accommodation in her house, which was built around the *Cuno Hoffmeister Memorial Observatory*. It was always important to her that visitors, if possible, gave a lecture on an astronomical topic at the Namibia Scientific Society.

If the IOTA/ES organised an observation campaign for a stellar occultation, she arranged necessary things as a Namibian member and was thus also able to support the professional astronomers. Observation campaigns for occultations such as by Pluto and Chariklo werde supported either logistically or by active observation with her 14 inch telescope. And she was always a contact centre for IOTA members if they need help.

All this commitment was honoured by the VdS in 2008 at the Bochum autumn conference with the award of the VdS Medal; the applause of those present confirmed the choice of the committee.

Anyone who has experienced Sonja and her tireless energy will never forget her.

Michael Mushardt
Wolfgang Beisker
IOTA/ES

Journal for Occultation Astronomy

IOTA's Mission

The International Occultation Timing Association, Inc was established to encourage and facilitate the observation of occultations and eclipses It provides predictions for grazing occultations of stars by the Moon and predictions for occultations of stars by asteroids and planets, information on observing equipment and techniques, and reports to the members of observations made.

The Journal for Occultation Astronomy (JOA) is published on behalf of IOTA, IOTA/ES and RASNZ and for the worldwide occultation astronomy community.

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IOTA maintains the following web sites for your information and rapid notification of events:

www.occultations.org
www.iota-es.de
www.occultations.org.nz

These sites contain information about the organisation known as IOTA and provide information about joining.

The main page of occultations.org provides links to IOTA's major technical sites, as well as to the major IOTA sections, including those in Europe, East Asia, Middle East, Australia/New Zealand, and South America.

The technical sites hold definitions and information about all issues of occultation methods. It contains also results for all different phenomena. Occultations by the Moon, by planets, asteroids and TNOs are presented. Solar eclipses as a special kind of occultation can be found there as well results of other timely phenomena such as mutual events of satellites and lunar meteor impact flashes.

IOTA and IOTA/ES have an on-line archive of all issues of Occultation Newsletter, IOTA'S predecessor to JOA.

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