Occultation Newsletter

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FROM THE PUBLISHER

For subscription purposes, this is the first issue of 1991. It is the third issue of Volume 5. Annual IOTA membership dues may be paid by check drawn on an American bank, money order, cash, or by charge to Visa or MasterCard. If you use Visa or MasterCard, include your account number, the expiration date, and your signature.

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ON 4 (2) through ON 4 (16), each	5.00

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Although they are available to IOTA members without charge, nonmembers must pay for these items:

Local circumstance (asteroidal appulse) predictions (entire current list for your location)	1.00
Graze limit and profile prediction (each graze)	1.50
Papers explaining the use of the predictions	2.50

Asteroidal occultation supplements will be available at extra cost: for South America through Ignacio Ferrin (Apartado 700; Merida 5101-A; Venezuela), for Europe through Roland Boninsegna (Rue de Mariembourg, 33; B-6381 DOURBES; Belgium) or IOTA/ES (see below), for southern Africa through M. D. Overbeek (Box 212; Edenvale 1610; Republic of South Africa), for Australia and New Zealand through Graham Blow (P.O. Box 2241; Wellington, New Zealand), and for Japan through Toshio Hirose (1-13 Shimomaruko 1-chome; Ota-ku, Tokyo 146, Japan). Supplements for all other areas will be available from Jim Stamm (117891 N. Joi Drive; Tucson, AZ 85737; U.S.A.) for 2.50

Observers from Europe and the British isles should join IOTA/ES, sending DM 40.-- to the account IOTA/ES; Bartold-Knaust Strasse 8; 3000 Hannover 91; Postgiro Hannover 555 829 - 303; bank-code-number (Bankleitzahl) 250 100 30.

IOTA NEWS

David W. Dunham

IOTA Meetings. There will be two meetings of IOTA this summer, the annual meeting in Texas, and a meeting in Puerto Vallarta just before the eclipse.

An IOTA meeting will be held on July 9th in conjunction with The Eclipse Edge expedition, at the Buganvilias Sheraton Resort in Puerto Vallarta, Mexico. We are planning to have lectures in the morning and a session on video observations in the afternoon. Since not all of the expedition members will be familiar with occultations or with IOTA, we want to include some introductory presentations. Our tentative plans are to have talks on an introduction to IOTA, a talk by Don Stockbauer on grazes and totals, a talk on IOTA/ES, and presentations on the status of the eclipse data reduction and on the progress made in reducing observations of asteroid occultations. In the afternoon, we will discuss video equipment and observing techniques, play tapes of video observations, and (probably) make copies of tapes. We have asked for a lecture hall with visual aids, which should include slide and viewgraph projectors, and video equipment. If you would like to be a speaker or have tapes or slides to show, please let Joan Dunham know before June 26.

The 9th annual meeting of IOTA will be held on Saturday, July 13th, at the Lunar and Planetary Institute; 3303 NASA Road 1; Houston, Texas (just east of the Johnson Spaceflight Center and about 35 miles southeast of downtown Houston). The meeting will start at 10 a.m. and will adjourn at 5 p.m., although informal discussions will likely last into the evening. More information can be obtained from Paul Maley; 11815 Lone Hickory Ct.; Houston, TX 77059; phone 713,488-6871. The (hopefully) just-observed total solar eclipse two days before will be a major subject of discussion. Also, status reports of IOTA's many observational, analysis, and software projects; and plans for future occultations and eclipses, will be presented. If you are interested in giving a presentation, please contact Mr. Maley. This will be IOTA's official meeting for 1991.

Zodiacal Variable Stars. David Herald has crossreferenced the XZ star catalog with the 4th edition of the variable star catalog, to produce tables of data on variability for stars in the XZ. The result is going to be sent to IOTA members in the near future.

Vesta, Myrrha, and Kleopatra. All three of the good 1991 January asteroidal occultations, which were the subject of special articles in the last two issues of ON, were rather well-observed. I will present results of these events at the Asteroids, Comets, and Meteorites conference in Flagstaff, AZ, in late June, so I do not want to dilute that presentation by giving details here. I will give the same presentation about these events at the two IOTA meetings mentioned above, and will publish preliminary outlines in the next issue. Many were clouded out for the Vesta event on January 3-4, but the event was extensively observed by visual, video, and photoelectric means in Michigan. Other useful observations were made in Ohio, and John Holtz observed one event near Pittsburgh, PA. Four valuable chords were obtained on the east side of Vesta by observers in Ontario, allowing a good elliptical fit to be made. The Myrrha event on January 13th was seen (some without optical aid) by many observers in the Tokyo area, although the path was expected to be farther south from the astrometry that was obtained. The Kleopatra path shifted south, so that the northern limit was near 0, and the southern limit at 0"2 S, on the map on p. 31 of the last issue. Although the path went over several large cities, only 8 observations were obtained, but they were well-distributed across the path. The preliminary analysis shows a remarkable cigar-like shape, 4 times as long as it is wide!

William David Dunham was born on January 9th, a little earlier than expected, at 5 pounds 14 ounces. William was my father's father's name (The W. in my name is for Waring, not William). He remains very healthy and brings us much joy, but does mean that we have less time to work on occultations.

Next issue. In addition to William, we have been preoccupied with taking care of the problems associated with withdrawal of most of the U. S. Naval Observatory's support for occultation work; see the next article. So most of my contributions intended for this issue, such as descriptions of the new 80L version of the XZ star catalog and planetary occultation table formats (not covered last time) and notes about special events, will have to wait until the next issue, which is planned for early August. Try to have your contributions for that issue in by July 25. Information about the July 8th Pleiades passage in Mexico will be distributed separately to those whom I know will be in Mexico that morning.

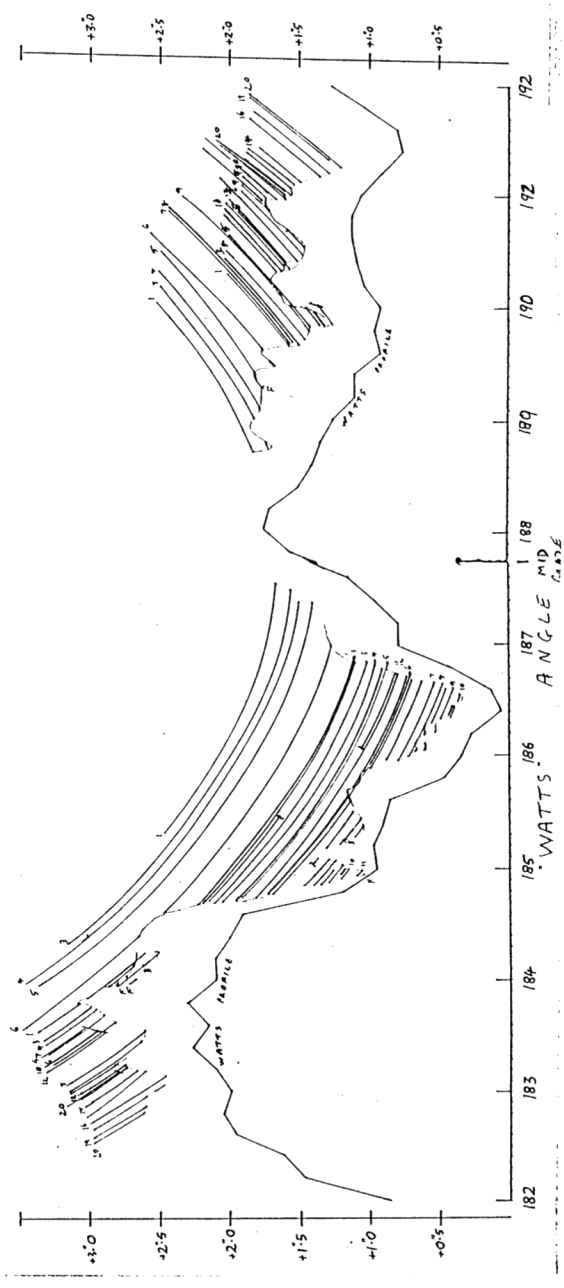
GRAZE OF ANTARES

David Herald

We observed a grazing occultation of Antares near Mangoplan, N.S.W. on 1990 February 18. Conditions were fantastic, and 18 observers recorded 183 definite timings. As far as I am aware, this is the most successful southern hemisphere graze ever. We had observers from Sydney, Wollongong, Canberra, Albury, and Melbourne. We had to rearrange the site location some 12 hours before the event because of the weather -- to a location about 200 km away. One observer blew up the engine on his car getting there.

The reduction provided shows a systematic shift between the reduced data of the two companions. This is most noticeable near Watts angle 187 deg. I have analyzed the systematic shift to get an improvement in the position angle and separation of Antares. From the orbital elements in the Fourth Catalog of Orbits of Visual Binary Stars, I get (for epoch 1990.2) PA = 273.99, separation = 2.70. From an analysis of the relative shifts of the profile for the primary and secondary, I get PA = 275.5 +/- 0.4, and separation = 23.80 +/- 0.10.

[Ed - While this shift can easily be seen in the profile David Herald has sent, it cannot be seen when the profile is reduced to fit in the ON.]



USNO ENDS OCCULTATION PREDICTION SERVICE

David W. Dunham

The U. S. Naval Observatory has been reducing its support for some of its older scientific programs as new ones have been added. As a part of these changes, it is terminating virtually all support of occultation work. Marie Lukac, who has done an outstanding job computing and distributing the detailed USNO total (lunar) occultation predictions to observers throughout the world for many years, will no longer provide this service. She will soon send a final notice announcing this to everyone on her active mailing list. Because of this, prediction requests that Mrs. Lukac has received since January have not been processed; she has just handed them over to me.

An additional change is that the USNO is shifting computation support to distributed computing and will discontinue use of the IBM 4341 some time in 1992. Computations will be migrated onto a network of project-oriented computers. Since all of the occultation software can currently run only on the mainframe computer, I am trying to transport it to other computers. This is difficult. The computer programs were written mostly by Tom Van Flandern ten to twenty years ago, and are optimized for old FORTRAN compilers that are no longer supported.

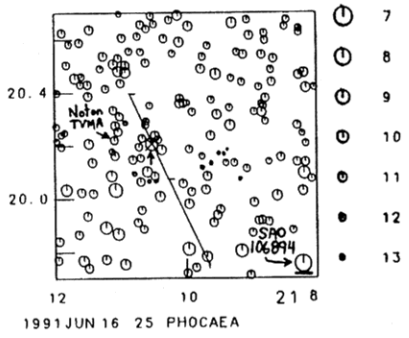
The solar physics division at Goddard Space Flight Center (GSFC), which is interested in IOTA's activities mainly for solar diameter results from our analyses of solar eclipse Bailey's bead timings, has given me an account on an IBM 3081 computer at GSFC. Their allocation on this computer is very limited, not enough to make the extensive computer runs to generate the annual datasets needed for total and grazing occultation predictions, but it should be sufficient for update prediction runs. I have completed most of the work needed to move the main datasets and programs from USNO to GSFC, with much help from Wayne Warren at the Astronomical Data Center, and should soon be able to make update runs there. The first priority has been to get operating at all away from USNO. On about June 10, I will process all of the requests that Mrs. Lukac has received since January.

Hans Bode and other members of IOTA/ES in Hannover, Germany, have offered to help, including translation of the USNO FORTRAN programs into modern VS77 FORTRAN that can be run on different mainframe computers (such as VAXes) as well as on PC's with sufficient hard disk storage (probably about 80 Mbytes) to include all of the datasets needed (the Watts limb correction file is by far the largest, taking about 43 Mbytes). This will be very useful, since the programs might be run in many different places, hopefully eventually in each country with strong programs to observe lunar occultations.

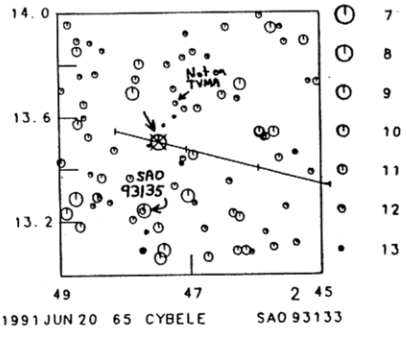
The International Lunar Occultation Centre (ILOC) in Tokyo hopes to be one of the first places to run the programs. Following a letter that I sent to them explaining the situation, they are in the process of trying to get support to run the programs and distribute predictions worldwide, taking over the work that was performed at USNO before February. They hope to distribute the main predictions of total occultations for 1992, probably printing the predictions from a magnetic tape containing the print files that I will generate, and generating the predictions themselves for 1993.

Observers should also be aware that, at some time in the future, they may need to provide reimbursement for the cost of mailing the predictions. There is a possiblity of funding support for mailings for the next year. If that cannot be provided, observers requesting updated total occultation predictions will need to reimburse IOTA for the cost to mail them.

Also, P and L catalog predictions may not be available for 1992, partly because there might not be time to generate the datasets needed for those predictions, and partly because the current series of Pleiades passages ends in the Southern Hemisphere early in 1992.



1991 JUN 16 25 PHOCAEA



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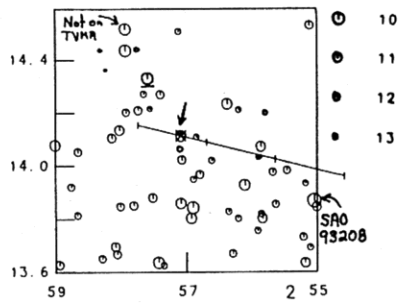

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ECLIPSE NEWS

David W. Dunham

Only plans for this July 11th total solar eclipse limit observations, and grazes during the Pleiades passage on July 8th, are given here.

Northern Limit of July 11th solar eclipse. Alan Fiala, U. S. Naval Observatory, Washington, DC 20390, telephone 202,653-1742, plans to observe near the northern limit on the southeast coast of Maui. The detailed calculations show that sites a mile inside (south of) the actual northern limit are accessible. Contact him if you wish to avoid the crowds and expense on Hawaii Island.

Villa Insurgentes, Baja California, is also at the northern limit. With the stringent travel restrictions, it will probably be necessary to be there the night before the eclipse. Derald Nye, 10385 E. Observatory Dr., Tucson, AZ 85747-9789, telephone 602,762-5504 (home) or 799-4654 (weekdays), plans to observe near there, but only if at least one other person will join him. I hope that someone already planning to observe from Baja will take him up on that offer; that location has the highest probability of any of the accessible limit sites for clear sky.

North of Mazatlan, Mexico. At least one member of the expedition to Mazatlan organized by Paul Maley plans to rent a car and drive to near the northern limit. We also hope to have two or more people from Van Flandern's Eclipse Edge expedition drive to the northern limit from Puerto Vallarta, although the roads are not good and the one-way trip is expected to take 8 hours or more. They would join the Mazatlan effort, driving there the day before. A rental car has been reserved for this purpose in Puerto Vallarta. With over 200 people at the southern limit in Van Flandern's expedition, I hope that a few can be persuaded to endure the extra hardship to augment the meager efforts at the northern limit; we need data from both limits to measure the solar diameter. If you are going to Puerto Vallarta, contact me at the address in the masthead, or by phone at 301,474-4722 if you are interested in joining the northern-limit effort. Contact either me or Paul Maley (see IOTA News), or both, if you will be in Mazatlan and want to go to the northern limit.

North and south of Mexico City. Astronomers from Kiev Observatory, who used their photometers under clouds in Siberia last year, plan to observe from the limits near Mexico City. I hope that arrangements can be made for the Soviet astronomers to go to either Puerto Vallarta or Mazatlan, since skies are virtually certain to be overcast near Mexico City.

The only Southern limit effort will be from Puerto Vallarta, mostly from The Eclipse Edge expedition. Hans Bode and several other members of IOTA/ES will be at the Holiday Inn in Puerto Vallarta, and will be joining the IOTA efforts from The Eclipse Edge expedition. Hans can be reached at (49)-0511, 424696 if you want to join the expedition. They will also participate in the IOTA meeting on July 9.

Pleiades passage on July 8. With the Moon only 15% sunlit, this passage will be spectacular; it is the last in N. America during the current series. Atlas, mag. 3.8, northern limit about 40 miles northwest of La Paz: Richard Nolthenius; Astronomy; Cabillo College, 6500 Soquel Dr., Aptos, CA 95003, phone 408,423-6715 (home) or 479-6506 (weekdays) plans to lead an expedition. Contact him if you want to join the expedition. There is also a graze of a 7.0-mag. star only about 5 miles northwest of La Paz, and Nolthenius has information for that as well. The Atlas graze also passes near Mazatlan, in rather bright twilight. Let me know if you are interested in organizing or joining an effort to observe it.

From Puerto Vallarta, I plan to lead an expedition to near Tuxpan to observe the graze of 5.2-mag. Pleione, which has a companion about 0"2 away, according to speckle interferometric observations. Although the graze occurs in bright twilight (Sun alt. -7 deg), the star's duplicity makes it have special value. A graze of 4.2-mag. Merope passes farther south of Puerto Vallarta, but there are no direct roads making it a much longer trip to reach than Pleione. The only accessible sites are farther inland, where there is likely to be more cloud cover. Contact me if you are interested in joining a Pleiades graze expedition from Puerto Vallarta. Total occultations will be observed from the city as well. On the morning of July 7, we will also watch the total occultation reappearance of the 5.7-mag. close triple star, Mu Arietis, with the Moon about 24% sunlit. If you are not in The Eclipse Edge expedition and plan to observe the Pleiades passage from Mexico, I will provide predictions and chart the Moon's path, if you send me a self-addressed, stamped envelope.

Daniel Falla, San Diego, CA, hopes to observe the Alcyone graze near Acapulco. If you are interested in joining this effort, you may reach him at 2408-21 2nd Ave., San Diego, CA 92101-1529.

We are told that the airlines are completely booked for travel to Hawaii, Baja California, and the Pacific coast of Mexico for the eclipse. Would-be observers who have not already made travel arrangements may find it difficult if not impossible to travel by scheduled airline. Michael Crist plans to drive to Puerto Vallarta and has offered to share the information he has on doing that. He can be reached at (615) 259-8772 (daytime) or (615) 446-9236 (6PM to 9PM CDT).

GRAZING OCCULTATIONS

Don Stockbauer

Please send copies of grazing occultation reports to me at 2846 Mayflower Landing; Webster, TX 77598; USA. If a copy can be sent to the International Lunar Occultation Centre (ILOC), this is greatly appreciated; their address is Geodesy and Geophysics Division; Hydrographic Department; Tsukiji-5, Chuo-ku; Tokyo, 104 Japan. For graze reports on diskette, please send me a printed copy of the data file only and send the actual diskette to ILOC. Total occultation reports on any medium need only be sent to ILOC. Due to the use of an inaccurate ephemeris for the 1990 graze predictions (see ON 5 (2), p. 34), 1990 shifts

are not directly comparable to those of 1991 and should not be used to upgrade your current version 80K (or equivalent 80L) predictions. Reductions of some well-observed events can be performed to determine the 80K shifts.

Northern limit grazes that occur when the Moon is in Pisces, Aries or Taurus appear to be shifting slightly south of version 80K predictions. Also, the Pleiades star catalog (PLDS) is old enough now (30 years) that it gives poorer predictions than the ZZ for all but the brightest cluster members. The new 80L XZ catalog used the ZZ data for all but the brightest Pleiads.

Jean Schwaenen reported a shift of 0.2" south for the graze of ZC 287 observed on 2/19/91. He warns that he generated his own prediction and thus the shift was not calculated using an ACLPPP profile. Also, the graze of ZC 3512 on 10/31/90 at Champion, PA represents only two of the stations; I have not yet received a full report from the expedition leader.

Several items requested on the graze report form are fundamental; without them ILOC cannot reduce the data. These include the observer's name, longitude, latitude, height, datum, date and time, star name and phenomenon. Others, such as personal equation, accuracy, and certainty code are not absolutely necessary but should always be included to lend confidence to the observations. The graze summary list information requested is mainly for my benefit in writing these articles; the only other way I could obtain it would be to have a copy of the limit and profile predictions (which I also encourage expedition leaders to send). If an observer leaves off a fundamental piece of information, I write and request it; often I also ask for any of the optional fields that were not included. Perhaps this is too much for some people, and the whole request gets ignored. I have a report from a Flint, MI observer who did a graze on 4/28/90 near Howell, MI for which no star number was given. I requested the information on 1/22/91 and have still received no reply; the report cannot be listed in O.N. and forwarded to ILOC without this information.

Benny Roberts writes that he solved the ancient problem of feeling insecure and vulnerable during a recent graze by setting up his telescope directly in the parking lot of his local police station! The station was located in a good position on the profile, and during a preliminary visit he asked for permission to observe there. He also asked that he not be spotlighted or shot during his observations, which (happily) the Mississippi police complied with.

Thanks for the reports; see you next issue.

Graze List as of 4/15/91

Date YrMoDy	Star #	Mag	% Sn	l CA	Location	# Star	# Tm	S	Ap Cm	Organizer	N CShS	WA	B
900321	2861	57	32-	4S	Webster, TX	1	1	2	20	Don Stockbauer	182	35	
900814	0541	40	43-		Waldwick, WI	1	8	1	20	Bob Manske			
900815	0750	69	29-	8N	Monte Sereno, CA	1	14	1	32	Rick Baldridge	7N355	-48	
900816	077999	80	19-	7N	Saratoga, CA	1	5	1	32	Rick Baldridge	6N357	-36	
900924	183572	76	22+	11S	Stilson, TX	7	34	1	8	Don Stockbauer	2S173	70	
900927	2650	47	50+	14S	Wellington, CO	5	28			Steve Albers			
901024	2652	64	27+	16S	Kolan, Austrl	2	24	1	20	P. Kearney	0164	28	
901028	3134	69	63+	19S	Reliance, TX	15	48	1	10	Don Stockbauer	4S161	-15	
901030	3494	46	88+	13S	Ivancna, Yugo	2	22	1	20	Rado Klemencic	0171	-49	
901031	3512	58	89+	19S	Champion, PA	2	15	2	15	David Dunham	3N165	-50	
901111	118518	80	30-	-16S	Durbin, FL	7	16	1	13	Harold J. Carney			
901124	164149	75	35+	17S	Eckert, TX	7	29	1	20	Don Stockbauer	5S162	-13	
901124	164158	76	35+	16S	Eckert, TX	7	60	1	20	Don Stockbauer	6S163	-14	
901128	0029	72	75+	16S	Chagrin Falls,OH	2	13	2	20	Robert J. Modic	3N166	-55	
901206	1324	72	77-	16S	Jackson, MS	1	4	1	33	Benny Roberts	2S199	16	
901208	1541	80	57-	6S	Holton, KS	6	24	1	20	Richard P. Wilds	5N188	44	
901208	1541	80	57-	6S	Kearney, MO	1	8	2	15	Robert Sandy	0188	44	
901209	138165	89	46-	13S	Eskridge, KS	3	8	1	25	Richard P. Wilds	0195	58	
901212	158129	94	18-	18S	Eskridge, KS	2	2	1	33	Richard P. Wilds	0193	74	
901220	3017	53	11+	15S	MonteBranco,Port	2	12	2	5	Joaquim Garcia	5S163	-7	
901223	3285	61	28+	16S	Arcadia, FL	1	7	1	20	Tom Campbell	6S162	-38	
901223	3285	61	28+	16S	Lake Placid, FL	3	20	1	20	Chris Stephan	6S162	-38	
901229	0552	30	90+	9S	Pocahontas, MS	1	2	1	33	Benny Roberts	3N178	-56	
910122	109329	83	34+	2N	Jackson, MS	1	3	1	33	Benny Roberts	1N	0-65	
910207	183706	89	41-	6S	Holton, KS	1	2	1	33	Richard P. Wilds	0184	67	
910219	0287	83	27+	6N	HoutainLeVal,Bel	2	10	1	25	Jean Schwaenen		4-63	
910221	075741	88	40+	8N	Eskridge, KS	2	16	1	25	Richard P. Wilds	1S	8-59	
910221	0562	66	48+	6N	TheumaBeiPla,Ger	3	0	1	8	Viertel/Buttner	>8S	7-52	
910223	0900	49	71+	4N	Carcavelos,Port	4	16	1	13	Joaquim Garcia	0	6-29	
910320	076021	85	23+	11N	Cascais, Port	2	4	1	15	Joaquim Garcia	2N	10-53	

NEW DOUBLE STARS

Tony Murray

Response to the article on new double stars in the last issue (ON 5(2) p. 55-56) was very good. The table accompanying this article contains 34 new double stars that will now go into the IOTA Catalog of Double Stars of the Moon's Occultation Zone. These reports are from 6 observers in 3 countries. Most of the discoveries were made by Brian Loader in New Zealand and Henk Bulder in the Netherlands. Bulder has timed[u more than 2100 occultations since he began in 1977. This table has 17 stars that he has discovered to be double.

The comments section includes several stars that are not listed in the table. Most of these are correction of mistakes found in previous ON articles and other sources. It is expected that occasional mistakes or oversights will occur as we renew the article and the maintenance of the Catalog after a 10 year hiatus. If you find an error of any sort in the table or comments, please write to me with the corrections. Your help will be appreciated. It is requested that in your letters concerning mistakes and questions that you refer to the star by all of its name/numbers that you have at hand, at least in the beginning of your letter. It is easier to find data on Alcyone = 25 Tau = ZC 552 = DM +23 541 = SAO 76199 =P-248 than it is on P-248.

Observers who time an occultation of a double or triple star, the components of which can be visually separated and who observe a step or fade event involving one of the components, should clearly indicate which component is involved. Appropriate identifications would be N or S component, E or W component, brighter or fainter component. If this is not done, the data are lost. Observers would do well to record the pertinent information in their personal notes as soon as possible after the event to make sure that it is available years later when the report is made.

It is appropriate that we restate Dunham's comments in ON 2 (1), in which he explained why a double-star occultation that was total would appear different from an occultation of the same star at a favorable graze. "During total occultations, (a fade) often denotes duplicity, but during favorable grazes, continuous fades or brightenings are often due to diffraction of the star's light at the Moon's edge. For total occultations more than 40 degrees of position angle away from being a graze, a fade event more likely would be due to duplicity than to diffraction, whereas the reverse would be true during a graze." This is only to let readers know that fade events observed during grazes receive the code X, but if only one observer reported a fade, the code is K. [ed. note: X is the code for "probably a close double, not certain" and K is the code for "duplicity doubtful".]

Table of New Double Stars

SAO	M	N	Mag1	Mag2	Sep	PA	Date	Disc
075489	T	X	9.0	9.0		134	90Feb02	Bulder
076564	T	K	7.7	7.7		353	84Mch09	Bulder
076627	T	K	7.4	7.4		286	87Aug17	Loader
076827	T	X	10.0	10.0		207	90Jul19	Bulder
076839	T	X	9.4	9.4		143	84Mch10	Loader
077106	T	X	9.8	9.8		299	90Sep11	Bulder
078490	T	X	9.4	9.4		111	85Apr25	Bulder
079412	T	X	10.0	10.0		295	90Sep14	Bulder
079578	T	X	9.6	9.6		92	89Apr12	Bulder
079925	T	X	9.4	9.4		135	90Apr30	Bulder
080574	T	X	9.5	9.5		140	86May15	Bulder
080950	T	X	7.6	7.6		73	85May26	Loader
092605	T	X	9.2	9.2		89	87Dec01	Bulder
092908	T	V	9.4	9.4		211	89Jul26	Bulder
092974	T	X	9.6	9.6		25	90Dec27	Bulder
093131	P	B	9.5	10.0	.06	182.5	83Jan23	Evans
098229	T	K	9.2	9.2		345	90Nov09	Bulder
098613	T	V	8.9	8.9		120	81May10	Bulder
098830	T	X	9.9	9.9			87May06	Bulder
118947	T	X	9.5	9.5		116	84Jul04	Loader
119469	T	K	9.8	9.8		67	83May22	Loader
139656	T	K	9.9	9.9		118	82Jul27	Loader
159887	P	X	9.2	11.2	.013	32.9	78Aug13	Edwards
164718	T	Y	9.7	9.7		294	83Apr08	Loader
185976	G	K	9.2	9.2		165.5	90Oct24	Wilds
186040	T	K	9.9	9.9		146	85Aug25	Loader
187662	T	X	9.3	9.3		79	89Oct08	Murray
187760	T	K	10.1	10.1		24	89Nov04	Loader
188129	T	X	9.5	9.5		83	87Oct01	Loader
188423	G	X	8.8	8.8		155.5	90Oct26	Wilds,et.al.
189126	T	V	10.0	10.0		32	84Nov27	Loader
189350	T	K	10.2	10.2		29	83Nov11	Loader
189405	T	K	9.2	9.2		44	83Nov11	Loader
DM+25 0707	T	B	8.6	8.6		212	89Oct17	Loader

Notes for individual stars are given below:

075671: Not in table. This star is ZC 438 = ADS 2253, code O. H. Bulder's observation of 90Nov30 confirms previously know duplicity.

076131: Not in table. This star is the Pleiad Electra. Bulder's daylight observation of 90Aug30 confirms previously known duplicity.

076472: Not in table. Reported in ON 5(2) page 57. Observers reporting a fade during the graze were R. Easton, R. Wilds, G. Hug, and C. McManus.

076627: This star is ZC 673. B. Loader reports observation of a "possible reappearance, seeing very poor".

079170: Not in table. This star is ZC 1093 = ADS 5781. H. Bulder's observation 87Mar10 confirms previously discovered duplicity.

079238: Not in table. Insufficient data provided.

080950: ZC 1424

092979: This is to correct comment in ON 5(2). R. Sandy did not report that this star, observed during 90Sep09 graze, was double. The code is corrected.

093031: Not in table. H. Bulder's observation of 90Dec28 confirms previously known duplicity.

093130: Not in table. Corrects magnitude in IOTA Catalog.

093131: Reported in Astron. J. 88(12), p. 1855

098830: P. A. of occultation not available.

118784: Not in table. H. Bulder's observation of 90May01 confirms previously known duplicity.

159887: Already in IOTA Catalog, now in the table. D. Edwards reported this discovery in the Astron. J. 85 (4), p. 486.

162413: Not in table. B. Loader's observation of 80May05 confirms earlier suspected duplicity. Its code is now V.

164657: Not in table. This star is ZC 3191. B. Loader's observation of 840ct05 confirms D. Evans' discovery of the star's duplicity by photoelectric observation on 83Sep19. Its code is now Y.

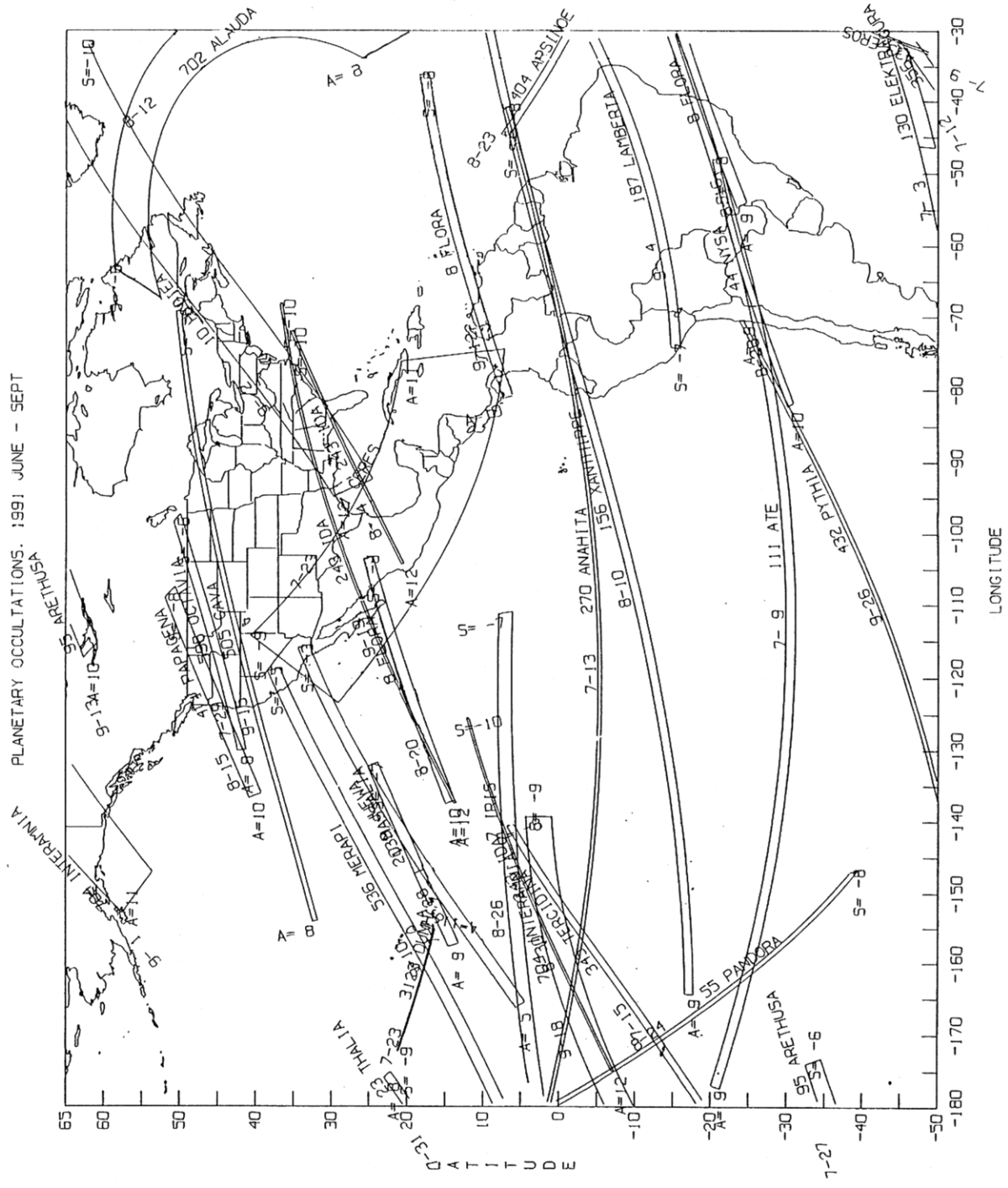
164718: Triple star, data for third member: mag3 = 10.5, Sep3 = 12.6, PA3 = 67.

185976: Graze observed by R. Wilds at Rantoul, Kansas, 900ct24.

187716: Not in table. Reported in ON 5 (2) page 57. Observers reporting fades were R. Wilds (video), C. Hug, B. Culberson, C. McManus.

188423: Graze observed by R. Wilds, T. McManus, C. McManus at Frankfort, Kansas, 900ct26.

DM +25 0707: This star is the distant companion of SAO 076573A. Together, they are ADS 3161 = ZC 647. It is now in the IOTA catalog under its name DM +25 0707.



David W. Dunham

Jim Stamm

These are tables continuing the article with the same title starting in ON 5(2).

If you do not have a regional coordinator who forwards your reports, they should be sent to me at: 11781 N. Joi Dr., Tucson, AZ 85737 USA. Names and addresses of regional coordinators are given in "From

Table 1 Part A

1991 Universal Date	Time	PLANET Name	m_v	Δ,AU	SAO NO	m_v	Sp	STAR R.A.(1950)	Dec.	Occultation Δm	dur	df	P	Possible Path LolLal	LomLam	LoeLae	El Sun	M El	OO %Snl	N Up	Ephem. Source
Jul 29	10^h14^m	Octavia	13.7	2.233	111472	8.4	A3	$3^h50^m.1$	9°50'	5.3	2^s	10	43	-124°43°116°45°-99°49°			68°	83°	93-	all	MPC16844
Jul 31	14 5-20	Thalia	11.5	2.270	210502	8.6	K0	18 40.5	-32 32	3.0	10	27	30	-176 22	134 -1	72 3	150	84	79-	e107E	MPC16208
Aug 4	9 8	Ida	15.3	3.125		12.5		4 39.8	23 10	2.9	1	11	137	-98 23	-98 23	-80 31	59	19	40-	all	Yeomans
Aug 7	1 22	Interamnia	11.8	3.292		12.0		5 31.2	31 22	0.6	9	10	14	38 5	38 5	46 9	50	10	13-	all	Schmadel
Aug 7	13 56-65	Arsinoe	12.5	1.570	185207	9.4	B8	17 12.9	-26 5	3.2	21	51	23	(Japan, Fiji)?s			125	161	9-	none	MPC14930
Aug 8	20 37-43	Pythia	12.0	1.356	166014	6.2	F8	0 0.4	-20 19	5.8	7	33	40	24 26	26 14	12 3	140	123	2-	none	MPC14755
Aug 10	4 58-76	Xanthippe	12.4	1.667	144961	9.2	F8	20 53.9	-1 46	3.2	11	22	19	0 13	-70 0	-163-17	165	167	0+	none	EMP 1986
Aug 11	21 22	Chaldaea	13.3	2.778	96329	8.2	G5	6 55.4	14 17	5.1	2	7	40	106-10	106-10	125 -6	35	59	5+	none	MPC11621
Aug 12	0 56-60	Alauda	12.9	3.060	55813	8.2	G5	2 40.3	37 57	4.7	12	20	22	-30 26	-30 45	-62 56	89	115	5+	none	MPC12432
Aug 15	11 6	Papagena	11.2	2.679		10.5		5 41.9	18 59	1.2	4	9	31	-132 41	-132 41	-115 48	56	125	33+	none	MPC12680
Aug 16	7 30	Flora	10.7	2.357		9.6		6 5.4	20 9	1.4	4	8	24	-45-21	-45-21	-28-15	51	130	41+	none	Goffin86
Aug 18	5 39-42	Europa	11.2	2.366	164094	8.9	G0	21 0.2	-18 25	2.4	21	22	12	3-53	-2-63	27-74	168	66	60+	w 2W	MPC12188
Aug 20	11 56	Flora	10.7	2.328		10.2		6 15.0	20 10	1.0	4	8	24	-127 17	-127 17	-108 23	53	175	80+	none	Goffin86
Aug 23	21 33-47	Arsinoe	12.9	1.776	185353	8.9	K7	17 20.7	-27 23	4.0	11	28	26	-40 4	-8 -8	43 -2	111	52	98+	all	MPC14930
Aug 24	15 49-125	Pandora	11.2	1.582		10.9	G5	1 15.3	6 4	0.9	33	119	34	-154-32	179 1	147 57	131	57	100+	all	MPC15524
Aug 25	23 23-25	Cava	13.0	1.883	93859	8.5	K0	4 16.2	12 9	4.5	3	12	46	16 43	33 48	63 56	87	86	100-	all	MPC14755
Aug 26	12 54-84	Iris	7.8	1.071	127920	9.3	F8	23 0.2	4 59	0.3	31	32	8	-121 7	174 1	91-11	161	7	98-	all	MPC11982
Aug 27	18 45-55	Juno	9.8	2.043	142983	9.1	K2	19 1.7	-9 4	1.2	34	36	11	(s.cen.Europe,w.Afr.)?e			131	75	94-	none	Goffin86
Aug 28	8 53	Nysa	11.3	2.408		10.3	A0	6 3.9	20 27	1.4	2	9	48	-75-28	-67-25	-51-21	63	82	91-	all	MPC11982
Aug 28	13 1- 3	Juewa	13.1	3.043	58852	5.8	M2	6 9.1	32 42	7.4	5	11	27	-161	7-145	18-116 33	63	80	90-	all	MPC12303
Aug 30	13 32-34	Ida	15.2	2.804		12.0		5 15.4	24 10	3.2	1	14	123	-167 -3-158		0-131 10	76	42	73-	all	Yeomans
Sep 1	9 38	Interamnia	11.7	3.042		11.6		6 10.3	30 56	0.8	12	12	13	-149 56-149		56-135 66	66	29	54-	all	Schmadel
Sep 1	18 29	Patientia	12.4	3.694	80363	8.3	K0	8 39.0	23 59	4.2	5	9	23	141 26	141 26	151 29	33	57	50-	all	MPC15529
Sep 2	5 19-27	Hygiea	11.2	3.155		12.0		3 38.0	23 18	0.4	52	43	11	-91 28	-71 41	-40 61	101	17	45-	all	Goffin86
Sep 4	23 17-20	Lamberta	12.5	2.181	207104	9.8	K0	15 51.5	-30 33	2.8	5	11	23	-72-15	-53-12	-26 -2	81	127	16-	none	MPC11620
Sep 5	9 16-18	Nemausa	12.5	2.327		11.4		5 7.8	14 2	1.4	7	15	25	Canada?s			85	43	13-	e120W	Goffin87
Sep 10	1 48	Massalia	12.0	2.272		12.5		6 40.7	22 38	0.5	5	9	22	-10 51	0 55	24 62	67	88	4+	none	MPC11982
Sep 10	13 13-36	Merapi	12.9	2.366	129630	7.1	G5	1 58.3	-8 43	5.8	21	41	22	-124 35-179		7 115 -5	138	154	6+	none	MPC 6191
Sep 12	7 41	Flora	10.6	2.153		10.2	K2	7 4.7	19 43	1.0	4	9	22	-71 9	-61 12	-41 16	63	112	17+	none	Goffin86
Sep 13	7 7	Arethusa	12.9	2.729		10.4		6 7.8	21 45	2.6	6	14	27	-111 63	-111 63	-82 70	78	138	26+	none	MPC12190
Sep 14	6 0	Jupiter	-1.7	6.292	98990	8.0	K5	10 8.9	12 17		1754	12	2	Canaries,nwAfr.,Iceland			20	92	34+	none	NA0001
Sep 15	9 34-39	Cava	12.7	1.645	94125	8.6	G0	4 44.9	13 2	4.1	4	17	40	-145 34-116	41 -72	49 100	167	45+	none	MPC14755
Sep 15	15 9-13	Pluto	15.6	30.213		15.2		15 17.1	-2 56	1.0	95	45	19	(cen.USSR,e.Mideast,India)?s			57	35	47+	none	DE130
Sep 18	14 33-35	Interamnia	11.6	2.845		11.5		6 32.3	30 22	0.8	15	15	12	179 -8-172	-4-147	1	78	161	74+	none	Schmadel
Sep 19	9 27-32	Ida	15.0	2.542		12.1		5 37.0	24 33	2.9	2	19	112	-130 16-111	25 -69	36	91	141	81+	w111W	Yeomans
Sep 22	21 3-43	Minerva	12.3	2.222		10.7	A5	3 21.2	24 56	1.8	38	65	19	123-15	89 25	-6 55	124	68	99+	w116E	MPC11508
Sep 24	21 53-55	Papagena	11.0	2.287		10.5		6 48.2	20 53	1.0	6	13	26	46 34	64 41	96 52	80	89	99-	all	MPC12680
Sep 24	22 27	Chiron	15.5	10.687		12.5		8 28.3	12 19	3.0	7	24	78	73 26	73 26	96 27	55	114	99-	all	MarSDN88
Sep 26	9 55-75	Pythia	12.0	1.379	191893	9.3	K0	23 22.9	-26 13	2.8	6	29	41	-78-28	-131-49	126-46	151	57	93-	e168E	MPC14755
Sep 26	10 23	Alexandra	12.7	3.155	182292	8.2	F8	14 6.4	-22 18	4.5	4	8	27	130-27	130-27	140-23	36	174	93-	none	MPC11723
Sep 27	19 45	Davida	11.4	2.952		10.5		8 17.3	18 31	1.3	11	11	13	106 22	116 24	138 29	61	70	83-	all	MPC15384
Oct 1	12 31-35	Interamnia	11.5	2.689		11.2		6 45.7	29 49	0.9	20	20	12	177 36-160	44-119	49	87	8	44-	all	Schmadel
Oct 2	8 10-13	Nysa	10.9	1.999		9.7	M1	7 7.3	19 23	1.5	3	12	40	-105 0	-86 5	-47 10	82	10	35-	all	MPC11982
Oct 3	0 52	Davida	11.3	2.893		10.8		8 25.0	18 23	1.1	11	11	12	29 12	39 15	59 19	65	2	28-	all	MPC15384
Oct 3	3 17	Irene	11.3	2.711		11.0		8 37.9	21 13	0.9	5	10	25	9-28	9-28	25-24	62	5	27-	all	MPC13923
Oct 10	11 20	Melpomene	10.7	2.319	160736	9.0	F8	17 37.7	-17 15	1.9	5	11	23	120-46	133-45	157-41	69	38	7+	w145E	Goffin87
Oct 11	1 29-34	Venus	-4.5	0.524	118196	8.9	K0	10 14.3	8 30		1006	12	1	e.Afr.,Mideast,e.Europe			44	83	11+	none	NA0001
Oct 12	9 33-51	Nemausa	11.9	1.857		11.6		5 39.1	11 21	0.9	17	34	20	-153 18-118	8	-79-26	113	161	20+	none	Goffin87
Oct 12	22 5-25	Tercidina	11.6	1.323		10.5	K0	23 42.2	5 57	1.4	11	24	19	75 28	22 0	-40-57	159	100	25+	w 2E	MPC13442

the Publisher" on page 61 (the front page) of this issue. All times in this report are UTC.

"Negative" or "Uncertain" reports received too late for inclusion in the summaries:

(1268) Libya and ?, 1988 June 10: G. Soria and E. Valdenassi from La Paz, Bolivia.

(48) Doris and SAO 161893, 1988 June 30: G. Soria and M. Gutierrez from La Paz, Bolivia; R. Lourecon from Jundai, Brazil.

(216) Kleopatra and SAO 143946, 1989 March 31: R. Levai from Sao Paulo, Brazil.

(171) Ophelia and SAO 139358, 1989 May 29: [ON 5(1), p. 9]: M. Lara from Nilopolis and C. Adib from Porto Alegre, Brazil.

Table 2 Part A

1991	MINOR	PLANET					Motion		STAR			Min. Geocentric			Comparison Data			APPARENT	
Date	No.	Name	km-Diam.	-//	RSOI	Type	°/Day	P.A.	SAO No	DM/ID No	D	U. T.	Sep.	S	AGK3 No	Shift	Time	R.A.	Dec.
Jul 29	598	Octavia	75	0.05	174	C:	0.457	78°8	111472	+ 9° 507		10^h15^m9	3"09N	UM	N 9° 359	0"14	0^m0	3^h52^m3	9°57'
Jul 31	23	Thalia	111	0.07	480	S	0.161	266.0	210502	C3214435		14 13.7	1.87N	PS		1.02	1.1	18 43.2	-32 30
Aug 4	243	Ida	33	0.01	67	S	0.341	81.8				9 10.9	1.19N	C				4 42.3	23 15
Aug 7	704	Interamnia	333	0.14	2157	F	0.356	90.8				1 25.0	0.31S	C				5 33.9	31 23
Aug 7	404	Arsinoe	101	0.09	302	C	0.102	149.3	185207	C2512054		14 5.0	5.58N	XS		0.01	0.0	17 15.5	-26 8
Aug 8	432	Pythia	49	0.05	98	SD	0.172	199.5	166014	-20 6703		20 40.1	6.25N	YG		0.88	1.9	0 2.6	-20 5
Aug 10	156	Xanthippe	126	0.10	484	C	0.225	254.5	144961	- 2 5408		5 7.3	0.15S	MA	S 1 2566	-0.27	1.8	20 56.1	-1 36
Aug 11	313	Chaldaea	101	0.05	267	C	0.548	97.5	96329	+14 1512		21 24.2	1.09S	UA	N14 732	0.09	-0.4	6 57.7	14 14
Aug 12	702	Alauda	202	0.09	1184	C	0.189	45.4	55813	+37 608		0 58.2	2.65N	MA	N37 314	0.58	2.3	2 42.9	38 8
Aug 15	471	Papagena	127	0.07	419	S	0.434	82.0		A1943323		11 7.6	2.36N	C				5 44.4	19 0
Aug 16	8	Flora	141	0.08	409	S	0.539	89.4		L 1 140		7 32.2	1.81S	H				6 7.9	20 9
Aug 18	52	Europa	278	0.16	2008	CF	0.189	245.5	164094	-18 5843		5 40.3	3.58S	UX		-0.10	1.5	21 2.6	-18 15
Aug 20	8	Flora	141	0.08	410	S	0.532	90.3		L 1 486		11 58.4	0.74N	H				6 17.4	20 9
Aug 23	404	Arsinoe	101	0.08	307	C	0.173	114.3	185353	C2711627		21 36.9	2.14N	XS				17 23.3	-27 25
Aug 24	55	Pandora	68	0.06	171	M	0.043	339.5		+ 5 166		16 27.0	1.39N	MX	N 6 127	0.60	0.1	1 17.5	6 17
Aug 25	505	Cava	59	0.04	122	FC	0.381	81.9	93859	+11 591		23 26.2	3.53N	UM	N12 428	-0.08	0.1	4 18.6	12 15
Aug 26	7	Iris	203	0.26	765	S	0.199	260.8	127920	+ 4 4949		13 8.0	0.48S	UM	N 4 3099	-0.17	-0.2	23 2.4	5 12
Aug 27	3	Juno	267	0.18	1579	S	0.128	209.7	142983	- 9 4978		18 54.5	4.00N	S				19 4.0	-9 0
Aug 28	44	Nysa	73	0.04	173	E	0.457	91.2		+20 1261	F	8 55.7	2.27S	MX	N20 633	0.28	0.5	6 6.3	20 26
Aug 28	139	Juewa	164	0.07	739	CP	0.344	83.4	58852	+32 1217		13 4.7	0.47N	UM	N32 611	-0.07	0.3	6 11.8	32 42
Aug 30	243	Ida	33	0.02	67	S	0.281	84.9				13 35.7	0.45S	C				5 18.0	24 12
Sep 1	704	Interamnia	333	0.15	2181	F	0.302	95.6				9 39.8	2.29N	C				6 13.0	30 56
Sep 1	451	Patientia	230	0.09	1301	CU	0.378	97.6	80363	+24 1976	A	18 31.7	0.68N	UR	N23 966	-0.80	0.1	8 41.5	23 50
Sep 2	10	Hygiea	429	0.19	3995	C	0.086	68.9				5 27.3	1.95N	C				3 40.4	23 26
Sep 4	187	Lamberta	135	0.09	456	C	0.386	97.8	207104	C3012649		23 16.1	1.12N	S				15 54.1	-30 40
Sep 5	51	Nemausa	137	0.08	506	CU	0.291	99.4				9 20.0	3.40N	C				5 10.2	14 5
Sep 10	20	Massalia	151	0.09	500	S	0.457	94.9		A2350875		1 50.6	2.69N	C				6 43.2	22 36
Sep 10	536	Merapi	158	0.09	816	X	0.104	242.7	129630	- 9 382		13 22.7	1.46N	PY		-0.78	-5.9	2 0.4	-8 30
Sep 12	8	Flora	141	0.09	415	S	0.490	94.6		L 4 190		7 44.0	0.07S	H				7 7.2	19 39
Sep 13	95	Arethusa	145	0.07	607	C	0.283	103.2		L 1 229		7 10.0	2.42N	H				6 10.4	21 45
Sep 14	5	Jupiter	140904	30.88			0.211	110.2	98990	+12 2162		6 3.3	11.27S	UR	N12 1208	-0.18	0.0	10 11.1	12 5
Sep 15	505	Cava	59	0.05	121	FC	0.302	84.0	94125	+12 649		9 38.9	3.20N	UM	N13 378	0.06	-0.4	4 47.2	13 6
Sep 15	9	Pluto	2300	0.10			0.026	122.3		P 14		15 9.7	0.51S	H				15 19.2	-3 5
Sep 18	704	Interamnia	333	0.16	2198	F	0.251	99.2				14 37.1	1.49S	C				6 35.0	30 20
Sep 19	243	Ida	33	0.02	67	S	0.213	86.5				9 32.9	0.78N	C				5 39.6	24 34
Sep 22	93	Minerva	173	0.11	852	CU	0.067	322.5		+24 479		21 20.6	0.01N	MX	N24 289	0.05	-3.8	3 23.7	25 5
Sep 24	471	Papagena	127	0.08	428	S	0.330	83.2		A2151533		21 56.5	2.27N	C				6 50.7	20 50
Sep 24	2060	Chiron	200	0.03	3695	B	0.084	109.7				22 30.9	0.07N	C				8 30.6	12 11
Sep 26	432	Pythia	49	0.05	102	SD	0.194	264.3	191893	C2616626		10 5.7	2.98S	PS		0.90	0.9	23 25.2	-25 59
Sep 26	54	Alexandra	171	0.07	696	C	0.453	106.5	182292	-21 3848		10 21.1	0.26S	US		-0.27	-0.8	14 8.8	-22 30
Sep 27	511	Davida	337	0.16	2090	C	0.358	94.1				19 47.9	0.66N	C				8 19.7	18 23
Oct 1	704	Interamnia	333	0.17	2211	F	0.202	102.8				12 36.7	0.98N	C				6 48.4	29 47
Oct 2	44	Nysa	73	0.05	170	E	0.389	97.4		L 4 295		8 14.4	0.77S	H				7 9.7	19 19
Oct 3	511	Davida	337	0.16	2092	C	0.347	94.1				0 54.9	0.16N	C				8 27.4	18 15
Oct 3	14	Irene	155	0.08	601	S	0.399	98.2		A2165055		3 19.0	2.30S	C				8 40.3	21 4
Oct 10	18	Melpomene	148	0.09	502	S	0.403	101.8	160736	-17 4883		11 18.0	1.66S	UX		0.51	-0.3	17 40.1	-17 16
Oct 11	2	Venus	12220	32.14			0.767	100.0	118196	+ 8 2336	K	1 38.1	4.02S	RZ	N 8 136			10 16.5	8 17
Oct 12	51	Nemausa	137	0.10	501	CU	0.140	132.2				9 44.7	2.03S	C				5 41.4	11 23
Oct 12	345	Tercidina	100	0.10	294	C	0.236	221.6		+ 5 5216		22 14.6	2.21S	A	N 5 3412			23 44.4	6 11

(41) Daphne and SAO 97875, 1989 June 6: Aldo Rodrigues Da Costa reports a miss from Lagoa Santa, Brazil.

I have summarized all of the reports that I have received for the last half of 1989 in the following two tables and section of notes. Table 1 lists the 1989 date, minor planet, occulted star, IDs of successful observers, and references to any notes. Table 2 lists the observers' ID, name, nearest twon to location of observation, country (includes state or province for North America and Australia), and the

Table 1 Part B

1991 Date	Universal Time	PLANET Name	PLANET m_v	PLANET Δ,AU	STAR SAO NO	STAR m_v	STAR Sp	STAR R.A.(1950)	STAR Dec.	Occultation Δm	Occultation dur	Occultation df	Occultation P	Possible Path LoiLai	Possible Path LomLam	Possible Path LoeLae	El Sun	MOON El	MOON %Snl	N Up	Ephem. Source
Oct 13	10h56–66m	Nemausa	11.9	1.845		10.9		5h39m.5	11°15'	1.3	18s	35	20	-168° 68°	128° 60°	-91° 34°	114°	166°	29+	none	Goffin87
Oct 13	12 52–54	Siegena	12.4	2.727	116346	8.7	A2	8 3.7	1 38	3.7	8	14	23	-171 39	-147 36	-115 27	77	138	30+	none	Landgraf
Oct 15	5 33–38	Nysa	10.7	1.844	96955	8.4	F5	7 27.2	18 43	2.5	4	14	37	-85 33	-52 41	-2 42	90	174	45+	none	MPC11982
Oct 15	15 21–23	Erigone	13.2	1.703	97211	7.7	A0	7 42.2	16 1	5.5	4	12	32	130 62	161 67	-146 65	87	174	49+	none	EMP 1982
Oct 15	19 16–19	Papagena	10.8	2.063		9.9	K2	7 13.9	21 50	1.3	8	19	24	(w.&cen. Australia)?n			94	175	51+	none	MPC12680
Oct 15	21 41–46	Papagena	10.8	2.062	79242	9.1	G5	7 14.0	21 51	1.9	8	19	24	50 -21	77 -9	112 4	94	174	52+	none	MPC12680
Oct 16	7 38–60	Ida	14.6	2.193		12.5		5 54.7	24 49	2.2	6	56	96	-118 1	-91 13	-44 22	113	150	56+	w109W	Yeomans
Oct 16	18 58–75	Aegina	11.9	1.437		11.1	K5	1 34.5	10 48	1.2	11	23	18	145 -8	90 -13	14 -38	176	82	60+	w 90E	Goffin87
Oct 17	13 56–72	Aquitania	11.3	1.824	148476	8.7	G5	2 32.0	-14 1	2.7	8	21	25	-127 32	166 0	75 -18	152	80	67+	w166E	MPC14161
Oct 17	16 1– 8	Interamnia	11.3	2.491		10.6		6 57.6	29 5	1.2	34	32	11	138 -23	155 -20	-176 -25	100	147	68+	w144E	Schmadel
Oct 18	11 2– 4	Laetitia	11.3	2.555	162100	8.2	F5	18 58.9	-17 25	3.2	7	14	23	106 20	122 20	155 25	80	40	75+	all	MPC12686
Oct 23	15 26–32	Anahita	11.9	1.443	163766	9.3	F8	20 36.1	-15 28	2.7	3	15	40	42 5	69 12	115 28	98	84	100–	all	MPC16844
Oct 23	23 41–54	Aegina	11.9	1.434		12.1		1 27.9	10 16	0.7	11	23	18	74 64	-15 55	-79 32	175	13	100–	all	Goffin87
Oct 25	1 26–30	Papagena	10.7	1.964		12.0		7 22.5	22 23	0.3	11	23	22	12 -38	20 -34	43 -20	102	58	97–	all	MPC12680
Oct 25	16 34	Papagena	10.7	1.958		11.5		7 23.0	22 26	0.4	11	24	22	163 -52	30 0	163 -52	102	49	94–	all	MPC12680
Oct 26	12 25–47	Ophelia	13.4	2.747	146537	10.0	G5	23 6.9	-9 6	3.4	23	61	33	179 52	129 39	76 29	132	88	88–	e102E	MPC13294
Oct 29	18 13	Melpomene	10.7	2.473		8.1	F2	18 12.1	-18 34	2.7	4	9	24	42 -56	42 -56	53 -53	58	155	56–	none	Goffin87
Oct 29	20 32–39	Nysa	10.5	1.670		10.0	K0	7 46.4	17 56	1.0	5	18	33	60 4	89 8	127 6	100	5	55–	all	MPC11982
Oct 30	3 54–81	Interamnia	11.2	2.343		13.1		7 2.4	28 30	0.2	69	63	10	-77 39	-28 38	11 8	112	22	51–	e 77W	Schmadel
Nov 1	2 53–70	Padua	12.5	1.621	93261	7.4	G5	3 2.1	13 36	5.1	9	23	24	30 -9	-36 -7	-113 -25	170	104	30–	e 16W	MPC12560
Nov 1	6 44–48	Siegena	12.2	2.523	135825	9.1	F5	8 19.7	-0 24	3.2	11	20	21	-70 58	-43 50	-15 34	90	30	28–	all	Landgraf
Nov 2	23 28–48	Sarita	10.7	0.898	75442	8.9	F8	2 31.2	20 56	1.9	4	18	28	66 -33	5 5	-86 18	174	135	13–	e 47E	EMP 1986
Nov 3	3 14–18	Davida	11.1	2.518		11.7		9 5.0	17 59	0.5	17	16	11	-27 14	-7 19	23 25	86	46	12–	e 2E	MPC15384
Nov 3	12 52	Fortuna	12.5	3.435	138672	9.4	G0	12 12.5	-2 13	3.2	4	9	29	-129 24	-129 24	-118 22	36	4	10–	all	MPC13923
Nov 4	12 57	Doris	12.7	3.446		11.3		11 1.0	2 51	1.6	7	11	23	-130 69	-130 69	-98 64	56	32	4–	e 98W	MPC12188
Nov 5	1 2–45	Ida	14.3	1.973		12.2		5 56.1	24 56	2.2	11	96	87	60 44	0 49	-65 35	132	115	2–	none	Yeomans
Nov 5	22 23	Chicago	13.9	3.939		9.8		19 46.6	-21 7	4.1	7	16	34	(e.Canada,n.e.USA)?s			72	79	0–	none	MPC11724
Nov 6	18 52–59	Erigone	12.9	1.471	97721	9.0	F5	8 15.8	13 52	3.9	5	16	28	69 29	103 32	157 24	100	103	0+	none	EMP 1982
Nov 14	4 52–75	Nemausa	11.1	1.532		10.0		5 37.2	8 6	1.4	18	32	16	26 62	-53 36	-118 -1	144	127	46+	w 85W	Goffin87
Nov 14	6 56–60	Davida	11.0	2.379		11.3		9 16.1	18 7	0.6	22	20	10	-116 62	-85 75	45 82	95	174	47+	none	MPC15384
Nov 15	20 17–42	Octavia	12.3	1.294	94524	9.5	B9	5 21.5	14 45	2.9	10	31	25	125 -10	67 12	-7 16	151	105	62+	w 67E	MPC16844
Nov 17	8 41–72	Emita	12.1	1.486	129205	9.4	F8	1 14.1	-1 54	2.8	18	38	19	-87 -27	-151 -10	129 24	142	25	76+	w 98W	MPC11621
Nov 17	15 1	Melpomene	10.7	2.601	161930	8.6	A0	18 50.0	-19 11	2.3	4	8	25	52 -7	61 -4	80 1	48	77	78+	all	Goffin87
Nov 21	1 20	Kleopatra	13.1	3.771	138719	9.3	K2	12 16.9	-9 55	3.8	4	12	40	59 53	59 53	70 49	50	142	99+	all	Goffin89
Nov 22	4 32–52	Nemausa	10.9	1.481		10.5		5 31.9	7 24	1.0	15	26	16	15 20	-46 4	-115 -21	151	28	100–	all	Goffin87
Nov 23	22 10	Elektra	12.3	3.066		10.8		20 4.9	-17 36	1.8	6	11	24	-41 -10	-41 -10	-22 -5	59	147	95–	e 32W	MPC14159
Nov 23	22 46	Juno	10.5	2.918		11.6		20 6.3	-14 24	0.3	9	11	16	-62 0	-53 1	-34 6	60	146	95–	e 43W	Goffin86
Nov 24	2 51–53	Venus	-4.3	0.853	139115	8.8	A5	13 0.2	-4 20		424	6	1	Afr.,e&cenEur.,wMideast			45	105	94–	all	NA0001
Nov 24	13 35	Herculina	10.4	3.014		11.1		13 57.8	1 6	0.5	5	8	20	-125 21	-8 0	-125 21	36	110	91–	all	Goffin88
Nov 30	12 30–33	Hebe	9.4	1.655	191604	6.0	G5	23 0.1	-21 8	3.5	10	13	13	western Siberia?s			91	150	30–	none	Goffin86
Dec 4	2 37–42	Patientia	12.1	2.658		11.1		10 40.2	21 26	1.3	16	22	17	-17 -3	0 4	37 18	97	75	4–	e 27E	MPC15529
Dec 4	3 45–59	Nemausa	10.7	1.433		12.0		5 21.3	6 35	0.3	13	22	15	25 56	-50 49	-128 32	161	142	4–	none	Goffin87
Dec 5	19 31–35	Chaldaea	12.4	1.678	137743	7.2	G5	10 40.3	-1 55	5.2	5	13	24	74 14	104 8	140 -4	90	86	0–	none	MPC11621
Dec 11	13 46–52	Hestia	13.8	2.624		11.7		10 59.9	4 47	2.3	11	26	29	166 -13	-177 -15	-145 -25	94	153	24+	none	Yeomans
Dec 11	18 28–48	Octavia	12.1	1.282		8.8	A2	4 56.3	16 51	3.4	7	21	25	147 -25	81 4	-10 12	173	115	26+	w 51E	MPC16844
Dec 12	9 44–58	Kalliope	10.4	1.654		9.5	M0	4 44.6	26 4	1.3	15	21	13	-72 24	-130 52	107 48	173	106	31+	w165E	MPC12188
Dec 19	5 26	Eurydike	15.0	3.612	139268	7.1	F8	13 15.1	-8 28	7.9	2	14	90	-28 57	-16 54	14 41	66	145	93+	w 5E	MPC12189
Dec 19	19 11–14	Melete	12.8	2.225		10.5		23 34.0	-3 28	2.4	5	13	28	4 -19	22 -14	49 -8	86	72	96+	all	MPC12189
Dec 20	13 43–64	Davida	10.5	1.967		11.1		9 34.8	20 36	0.5	48	39	8	151 -28	164 13	110 56	128	64	99+	all	MPC15384

total number of observations made in the period. The notes section details those events that included positive observations, or other significant information that could not be reported in the tables. I am not including notes on those observations that may have been spurious unless there is some sort of confirmation, or the fact that something may have happened is relevant to another observation. Instead, I will place an asterisk (*) in the REF column to indicate that I have received a report with more than a "no event..." in it.

Notes:
1. [ON 5(1), p. 7]. Graham Blow reports that there were other observers who reported negative results, but their identities were not available.

2. 28 European observers (Amg Brh Cab Dbn Den Dmd Dnz Dss Ewl Frd Gbf Gcv Gez Grc Gss Hei Iel Imr Koc Mel Mln Mrq Mti Pir Orc Tal Tem Whk). One questionable

Table 2 Part B

1991	MINOR PLANET						Motion		STAR			Min. Geocentric			Comparison Data				APPARENT	
Date	No.	Name	km-Diam.	-//	RSOI	Type	°/Day	P.A.	SAO No	DM/ID No	D	U. T.	Sep.	S	AGK3	No	Shift	Time	R.A.	Dec.
Oct 13	51	Nemausa	137	0.10	501	CU	0.136	134°.4				$11^h\ 8^m.4$	1".86N	C					$5^h41^m.9$	11°17'
Oct 13	386	Siegena	173	0.09	787	C	0.275	114.0	116346	+ 1°1994		12 56.4	0.87N	MA	N 1°	995	0".01	$-0^m.9$	8 5.8	1 31
Oct 15	44	Nysa	73	0.05	169	E	0.346	99.2	96955	+18 1641		5 38.4	1.85N	UM	N18	741	0.12	-0.1	7 29.6	18 38
Oct 15	163	Erigone	77	0.06	167	C	0.422	103.2	97211	+16 1549		15 24.1	3.77N	UM	N16	801	-0.01	-0.1	7 44.6	15 55
Oct 15	471	Papagena	127	0.08	435	S	0.245	77.6		L 4 549		19 21.2	5.10S	HC			-1.66	-0.8	7 16.4	21 46
Oct 15	471	Papagena	127	0.08	435	S	0.245	77.5	79242	+21 1560		21 47.6	1.15S	UH	N21	798	-0.35	-0.4	7 16.5	21 46
Oct 16	243	Ida	33	0.02	67	S	0.078	85.2				7 56.9	0.20S	C					5 57.3	24 49
Oct 16	91	Aegina	114	0.11	381	CP	0.236	252.8		+10 212		19 6.8	2.89S	MX	N10	174	0.44	0.1	1 36.7	11 1
Oct 17	387	Aquitania	106	0.08	386	S	0.228	243.1	148476	-14 481		14 4.3	0.82N	S					2 34.1	-13 50
Oct 17	704	Interamnia	333	0.18	2228	F	0.129	111.5				16 6.8	2.91S	C					7 0.2	29 2
Oct 18	39	Laetitia	159	0.09	666	S	0.298	96.5	162100	-17 5419		11 1.0	2.15N	UX			0.50	2.8	19 1.4	-17 22
Oct 23	270	Anahita	52	0.05	90	S	0.371	78.3	163766	-15 5738		15 25.7	2.17N	UH			-0.05	-0.2	20 38.5	-15 19
Oct 23	91	Aegina	114	0.11	380	CP	0.236	252.2		A1012036		23 48.0	4.29N	C					1 30.1	10 30
Oct 25	471	Papagena	127	0.09	437	S	0.201	71.1		A2256133		1 33.3	2.58S	C					7 25.0	22 18
Oct 25	471	Papagena	127	0.09	438	S	0.198	70.4		A2256152		16 39.1	3.59S	C					7 25.5	22 21
Oct 26	171	Ophelia	121	0.06	599	C	0.064	256.8	146537	- 9 6134	A	12 38.4	2.27N	UG			0.99	-2.7	23 9.1	-8 52
Oct 29	18	Melpomene	148	0.08	491	S	0.455	96.3		-18 4858		18 11.0	2.47S	HY			-0.34	-0.6	18 14.5	-18 33
Oct 29	44	Nysa	73	0.06	168	E	0.282	100.7		L 4 2753		20 38.9	1.08S	H					7 48.8	17 50
Oct 30	704	Interamnia	333	0.20	2242	F	0.068	134.2				4 14.0	0.55S	C					7 5.1	28 26
Nov 1	363	Padua	97	0.08	320	XC	0.226	262.5	93261	+13 496		3 1.5	1.99S	UM	N13	243	0.20	-0.6	3 4.4	13 46
Nov 1	386	Siegena	173	0.09	796	C	0.202	121.8	135825	- 0 1973		6 49.9	1.73N	MA	S 0	1201	-0.04	-1.6	8 21.8	-0 33
Nov 2	796	Sarita	47	0.07	78	XD	0.387	298.7	75442	+20 424		23 37.9	2.13S	UM	N20	229	0.64	0.8	2 33.6	21 7
Nov 3	511	Davida	337	0.18	2108	C	0.258	89.4				3 19.4	0.55N	C					9 7.4	17 49
Nov 3	19	Fortuna	171	0.07	778	G	0.386	113.2	138672	- 1 2637		12 54.8	0.08N	UX	S 2	723	-0.46	0.0	12 14.6	-2 27
Nov 4	48	Doris	219	0.09	1253	CG	0.317	111.8				12 59.3	1.90N	C					11 3.2	2 37
Nov 5	243	Ida	33	0.02	67	S	0.049	276.2				1 13.7	1.82N	C					5 58.7	24 56
Nov 5	334	Chicago	170	0.06	1073	C	0.208	82.5		L 5 1308		22 22.5	2.42N	HC			-2.51	-0.6	19 49.1	-21 1
Nov 6	163	Erigone	77	0.07	167	C	0.328	107.1	97721	+14 1870		18 58.8	1.16N	UM	N13	827	0.56	0.4	8 18.1	13 44
Nov 14	51	Nemausa	137	0.12	496	CU	0.166	236.0				5 3.7	2.71N	C					5 39.5	8 8
Nov 14	511	Davida	337	0.20	2115	C	0.215	83.9				6 58.8	3.36N	C					9 18.5	17 57
Nov 15	598	Octavia	75	0.08	185	C:	0.188	290.7	94524	+14 897		20 28.1	0.69S	UM	N14	493	-0.11	-0.1	5 23.9	14 47
Nov 17	481	Emita	116	0.11	377	C	0.141	298.9	129205	- 2 191		8 57.4	0.08N	UX	S 1	111	0.57	-0.9	1 16.3	-1 40
Nov 17	18	Melpomene	148	0.08	480	S	0.497	91.2	161930	-19 5202		14 58.8	0.35N	U7			0.24	0.1	18 52.5	-19 8
Nov 21	216	Kleopatra	137	0.05	667	M	0.287	113.7	138719	- 9 3480		1 22.8	1.45N	US			-1.26	2.8	12 19.1	-10 9
Nov 22	51	Nemausa	137	0.13	495	CU	0.206	246.9				4 41.5	0.28S	C					5 34.2	7 26
Nov 23	130	Elektra	189	0.08	903	G	0.352	92.7		L 5 2605		22 7.1	0.15N	H					20 7.3	-17 28
Nov 23	3	Juno	267	0.13	1447	S	0.354	88.1		L 5 2674		22 43.8	0.50N	H					20 8.6	-14 17
Nov 24	2	Venus	12220	19.76			1.119	110.3	139115	- 3 3396		2 54.6	1.98S	UH			0.00	0.1	13 2.3	-4 34
Nov 24	532	Herculina	217	0.10	943	S	0.498	106.7		L 2 4043		13 36.9	0.27N	H					13 59.9	0 54
Nov 30	6	Hebe	186	0.15	633	S	0.381	65.1	191604	-21 6354		12 29.6	5.29N	PU			0.65	-0.1	23 2.3	-20 55
Dec 4	451	Patientia	230	0.12	1325	CU	0.182	77.9				2 43.4	0.01S	C					10 42.5	21 13
Dec 4	51	Nemausa	137	0.13	493	CU	0.250	257.7				3 52.0	4.13N	C					5 23.6	6 37
Dec 5	313	Chaldaea	101	0.08	255	C	0.377	111.7	137743	- 1 2431		19 36.4	0.60S	UM	S 1	1522	0.03	0.3	10 42.4	-2 8
Dec 11	46	Hestia	131	0.07	554	P	0.155	113.2				13 52.8	2.01S	C					11 2.1	4 33
Dec 11	598	Octavia	75	0.08	189	C:	0.269	290.5		+16 676		18 37.7	1.14S	MX	N16	423	-0.10	-0.3	4 58.8	16 55
Dec 12	22	Kalliope	187	0.16	868	M	0.244	283.5		+25 733		9 51.2	2.76N	MX	N26	444	0.49	1.4	4 47.2	26 8
Dec 19	75	Eurydike	58	0.02	189	M	0.242	115.1	139268	- 7 3582		5 29.1	1.46N	UH			0.04	0.0	13 17.3	-8 42
Dec 19	56	Melete	117	0.07	386	P	0.328	73.3		B7233091		19 9.9	1.55S	C					23 36.2	-3 14
Dec 20	511	Davida	337	0.24	2141	C	0.119	8.3				13 53.5	2.93W	C					9 37.2	20 25

1991 Date	Universal Time	PLANET Name	m_v	Δ,AU	SAO NO	STAR m_v	Sp	R.A.(1950)	Dec.	Occultation Δm	dur	df	P	Possible Path Lo1Lal	LomLam	LoeLae	El Sun	El	MOO %Snl	N Up	Ephem. Source
Dec 20	16^h41-57^m	Patientia	11.8	2.450	81564	9.0	G5	$10^h50^m.3$	22°25'	2.9	24^s	32	15	116°23°	154° 7°	153°44°	112°	78°	99+	all	MPC15529
Dec 20	17 14-20	Patientia	11.8	2.450		9.8		10 50.3	22 25	2.2	24	32	15	140-41	155-27	174 -8	112	77	99+	all	MPC15529
Dec 21	1 28	Venus	-4.1	1.045	158985	8.9	K0	14 59.9	-14 36		326	5	1	se&s.cen.Afr.,	Madagascar		41	144	100+	all	NA0001
Dec 21	6 43-59	Nephthys	11.3	1.447		9.5	G0	6 31.9	10 44	2.0	6	21	30	-16 21	-75 36	-171 41	164	18	100+	all	EMP 1983
Dec 21	13 56-73	Gallia	10.9	1.511	150507	8.7	A0	5 28.1	-13 32	2.3	9	21	21	-141-23	147 -4	72 36	142	39	100-	all	MPC15527
Dec 21	15 48-68	Leda	11.5	1.365		11.8	G	7 4.3	26 15	0.6	14	26	17	-144 40	133 49	54 23	164	13	100-	all	MPC14158
Dec 21	20 44-46	Eleonora	11.3	2.784		11.1		13 47.6	1 25	0.8	5	10	25	96 29	107 29	138 28	65	109	100-	all	MPC11509
Dec 23	13 43-114	Erigone	11.9	1.063	98120	7.6	A0	8 44.5	11 21	4.3	49	130	20	-153-38	165-27	108-24	140	11	93-	all	EMP 1982
Dec 25	1 9-11	Euridike	14.9	3.521	139305	9.3	F8	13 20.1	-9 3	5.6	2	15	88	18 31	39 25	67 12	70	60	82-	all	MPC12189
Dec 25	9 11-20	Nemausa	10.7	1.440	112355	8.7	K5	5 0.1	6 7	2.2	14	24	15	-73 60	-136 67	121 66	156	72	79-	e158E	Goffin87
Dec 27	9 35	Venus	-4.1	1.088	159335	5.5	B3	15 30.1	-16 41		310	5	1	e.Caribbean,	nwS.America		40	59	57-	all	NA0001
Dec 30	12 10-12	Venus	-4.1	1.108	159502	9.4	F2	15 45.2	-17 37		303	5	1	cen.&e. USA &	Canada		40	22	26-	all	NA0001
Dec 30	21 8-15	Nephthys	11.2	1.438	95637	6.9	K0	6 21.8	11 17	4.3	6	20	30	55-59	26-48	-13-42	168	124	22-	e 40E	EMP 1983
Dec 30	21 49-57	Ida	13.9	1.793		12.2		5 13.4	24 29	1.9	3	25	79	124 67	56 83	-75 64	161	143	22-	e124E	Yeomans
Dec 31	17 50-75	Virginia	12.1	1.301	93933	8.1	G0	4 23.5	16 44	4.0	22	56	21	155 54	91 71	-38 68	148	163	16-	none	Landgraf

Table 1 Part C

3. 29 European observers (Amg Bff Bnn Bul Cle Dbn Dnz Dss E11 Far Frd Fsh Gdi Grc Gss Hff Iel Krt Mdd Mlr Mlt Mrx Spr Tal Vgl Vil) and 3 South African observers (Wac Smi Mud) monitored this event. Three European observers reported positive events that they "...were not sure of". None of these "events" could be related.

7-second occultation was reported. It was not confirmed by a station 2.5km perpendicular to Niobe's motion.

1991 Date	MINOR PLANET No.	Name	km-Diam.-//	RSOI	Type	Motion °/Day	P.A.	STAR SAO No	DM/ID No	D	Min. Geocentric U. T.	Sep.	S	Comparison Data AGK3 No	Shift	Time	APPARENT R.A.	Dec.
Dec 20	451	Patientia	230 0.13	1330	CU	0.130	51°8	81564	+22°2286		$16^h51^m.3$	0".45N	MA	N22°1197	0".12	$-2^m.2$	$10^h52^m.6$	22°11'
Dec 20	451	Patientia	230 0.13	1330	CU	0.130	51.8				17 23.1	1.42S	C				10 52.6	22 11
Dec 21	2	Venus	12220 16.13			1.188	106.7	158985	-14 4095		1 31.2	8.74S	UX		0.23	0.0	15 2.2	-14 46
Dec 21	287	Nephthys	70 0.07	182	S	0.255	280.7		+10 1184		6 51.2	2.91N	MA	N10 780	0.33	0.3	6 34.2	10 42
Dec 21	148	Gallia	104 0.09	324	GU	0.256	301.0	150507	-13 1167		14 3.9	1.01N	S				5 30.1	-13 30
Dec 21	38	Leda	120 0.12	394	C	0.211	263.0		+26 1460		15 57.4	2.56N	MX	N26 763	0.05	-0.6	7 6.9	26 11
Dec 21	354	Eleonora	162 0.08	672	S	0.378	95.3		L 2 3480		20 47.3	1.31N	H				13 49.7	1 13
Dec 23	163	Erigone	77 0.10	167	C	0.049	286.0	98120	+11 1913	A	14 7.4	5.64S	MG	N11 1034	-0.21	1.7	8 46.8	11 11
Dec 25	75	Eurydike	58 0.02	189	M	0.229	115.3	139305	- 8 3543		1 13.6	0.41N	UH		0.48	0.5	13 22.4	-9 17
Dec 25	51	Nemausa	137 0.13	490	CU	0.229	273.4	112355	+ 5 792		9 15.5	5.37N	MA	N 6 522	0.16	0.4	5 2.4	6 11
Dec 27	2	Venus	12220 15.49			1.199	104.8	159335	-16 4110	X	9 38.1	6.17S	7P		0.20	0.0	15 32.5	-16 50
Dec 30	2	Venus	12220 15.20			1.203	103.7	159502	-17 4425		12 13.1	11.61N	UX		-0.19	-0.1	15 47.6	-17 45
Dec 30	287	Nephthys	70 0.07	182	S	0.269	284.9	95637	+11 1159		21 11.6	5.32S	UM	N11 674	-0.30	-0.7	6 24.2	11 16
Dec 30	243	Ida	33 0.03	67	S	0.193	263.5				21 53.2	4.18N	C				5 16.0	24 32
Dec 31	50	Virginia	88 0.09	233	X	0.103	275.7	93933	+16 598	K	18 2.9	5.73N	UM	N16 373	-0.12	-0.1	4 26.0	16 50

Table 2 Part C

4. 41 European observers (Aqy Brh Brz Bul Cas Cif Cra Dbn Djk Dlr Dss Ewl Gbd Gbf Gcv Grc Hei Iel Jlx Mel

Mih Mln Mtt Pgt Rvs Sav Sht Tem Tip Tod Trr Vid Vii Wkl)

5. 25 European observers (cab Cmb Dbn Den Dlr Dmd Ell Ewl Far Fdr Fen Frd Gbf Gcv Grc Hbk Hei Ond Psr Snz Tho Tlp Tod Trr Tvh)

6. [ON 5(2), p. 27]. Observers were: Mur Sau Pav Pak Sam Dic Bol Ge Agr Can Dss Far Frd Grl Mrx Ohp San Sut Trr

7. [ON 5(2), p. 27]

8. Wal recorded a 10.7-sec. occultation beginning at 14:51:31.9, but believes the event was probably spurious

9. [ON 4(16), p. 389]

10. Derald Nye noticed this event was predicted to occur on the Amazon River when and where he would be during a cruise. He sought cooperation from the ship's captain, and along with his wife Denise, and a fellow passenger, Jack Peterson, was rewarded with a 14-sec. occultation beginning at 2:57:46.5.

11. Dwd observed from Moon Run, Pennsylvania. David Dunham has forwarded a report that Svek and Moeller observed a 14-sec. occultation, apparently from the track's northern limit in Urbana, Illinois.

12. Dss reported a 1.6-sec. occultation beginning at 23:04:36.1, and a blink before (23:04)29.6) and after the event. Glo was not sure of his 11-sec. event which began at 12:06:30. These events cannot be related.

13. Dss reported some gradual unconfirmed events.

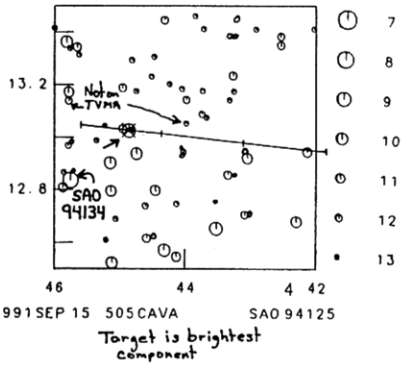
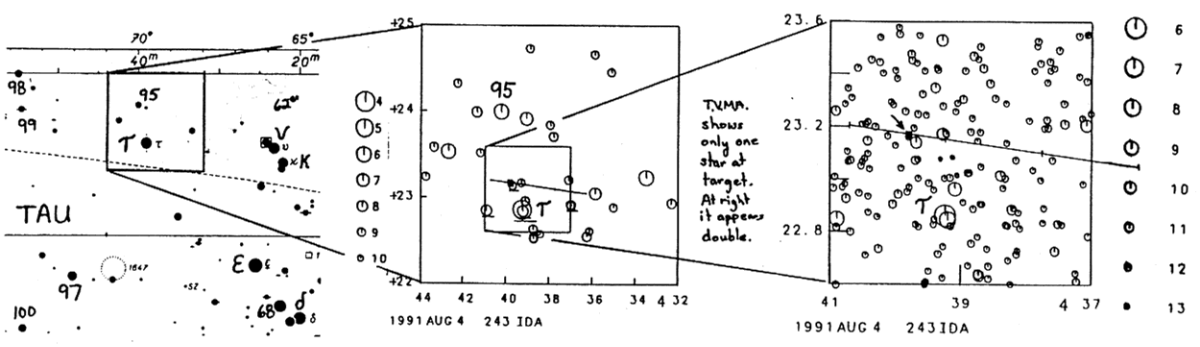


Table 1. Asteroidal appulses and occultations: Jul-Dec 1989.

1989	MINOR PLANET		STAR	OBSERVERS	REF
JUL 02	87	SYLVIA	AGK3 -00° 1825	VikLoaStgRog	
JUL 09	675	LUDMILLA	SAO 157428	CopMitSmiVnbMud	
JUL 10	762	PULCOVA	SAO 156877	DalHawAnd	
JUL 17	747	WINCHESTER	SAO 129884/5	BrhDssGrcIel	
JUL 18	359	GEORGIA	SAO 212139	SmcAnd	
JUL 22	862	FRANZIA	SAO 207704	TmpMcm	
JUL 23	693	ZERBINETTA	SAO 211938	OveMitVnb	
JUL 24	1867	DEIPHOBUS	AGK3 +33° 0035	SmcAnd	
AUG 01	45	EUGENIA	AGK3 +15° 0370	FalLouAdi	
AUG 06	9	METIS	SAO 190531	DalPriRilGemAll	
				MunHilDieWat	1
AUG 07	359	GEORGIA	SAO 211847	LoaBlkBlwPriSmcDalAnd	
AUG 09	236	HONORIA	AGK3 +16° 0231	Dik	
AUG 11	2269	EFREMIANA	SAO 147437	SmcDikStgGemDalLyzFre	
AUG 14	216	KLEOPATRA	AGK3 +00° 2438	LyzSta	
AUG 14	71	NIOBE	SAO 145856		2
AUG 15	409	ASPASIA	AGK3 +00° 2576	DenEwlOve	
AUG 19	4	VESTA	SAO 185928	LyzSamLev	
AUG 19	759	VINIFERA	SAO 209944	DikLoaStgAnd	
AUG 20	386	SIEGENA	AGK3 +00° 1998		3
AUG 25	19	FORTUNA	SAO 186483		4
SEP 01	89	JULIA	AGK3 +39° 0567		5
SEP 01	411	XANTHE	SAO 192019	SmcAnd	
SEP 02	24	THEMIS	AGK3 +03° 0076	OveSmi	
SEP 02	273	ATROPOS	SAO 145234	DikKruHawBlk	
				LegStoSmcAnd	
SEP 05	79	EURYNOME	AGK3 +01° 2821	EwlOveSmiMud	
SEP 09	63	AUSONIA	AGK3 +29° 0604	LrzEwlDen	
SEP 15	46	HESTIA	SAO 159969	And	
SEP 19	893	LEOPOLDINA	SAO 130468	CopOveSmi	
SEP 20	2326	TOLOLO	SAO 164400	BlkGriRolSto	
SEP 23	246	ASPORINA	AGK3 +04° 0492	OveMag	
SEP 28	346	HERMENTARIA	SAO 186612	BrwTruSckDwdDunSea	*
OCT 13	980	ANACOSTIA	AGK3 +03° 2754	SmcAnd	
OCT 15	617	PATROCLUS	AGK3 +09° 0236	GrhGrt	
OCT 16	359	GEORGIA	SAO 189062	LaiVijVnb	
OCT 19	30	URANIA	AGK3 +09° 0065	DnzDptDssFdr	
				GrcLntOhpVgl	
OCT 20	15	EUNOMIA	AGK3 +00° 2723	Sta	
OCT 21	456	ABNOBA	AGK3 +04° 2954	Smm	
OCT 23	521	BRIXIA	SAO 147658		6
OCT 23	146	LUCINA	FAC 212517	HolOhpPdmTrrWpp	7
NOV 07	781	KARTVELIA	AGK3 +10° 1275	BffDssFrdMddMltVgl	
NOV 08	16	PSYCHE	SAO 164047	Vnb	
NOV 11	147	PROTOGENEIA	AGK3 +03° 1473	Sta	
NOV 13	712	BOLIVIANA	AGK3 +00° 1333	BgsBulDnzKknPdmTrr	
NOV 17	146	LUCINA	FAC 205355	HffDnz	
NOV 18	43	ARIADNE	AGK3 +24° 0469	BemWal	8
NOV 21	369	AERIA	AGK3 +07° 0405	Blk	9
NOV 22	15	EUNOMIA	AGK3 +01° 2691	NyePetNyd	10
NOV 26	146	LUCINA	FAC 197033	BgsMeuOdtOhp	
NOV 27	192	NAUSIKAA	AGK3 +35° 0478	Sta	
DEC 01	498	TOKIO	AGK3 +21° 0987	VnbBulDssFrdGbf	
				KknMddShkVgl	
DEC 01	207	HEDDA	SAO 165084	Lyz	
DEC 02	895	HELIO	LJ 1028	HonPilBurHozGeo	
				WilDwdSveMoe	11
DEC 03	146	LUCINA	FAC 185871	BdeBffBnnBulHffMrxPdm	
DEC 04	1437	DIOMEDES	SAO 156969	Frd	
DEC 08	146	LUCINA	FAC 176313	CvgErnMeuMrxPoh	
DEC 09	449	HAMBURGA	AGK3 +13° 0222	PadLou	
DEC 13	369	AERIA	AGK3 +08° 0362	ChuVnb	
DEC 21	895	HELIO	AC 22299	BffBulCksDss	
				GloKknMti	12
DEC 23	240	VANADIS	AC 124	BdaBffDhyDssThzVll	13
DEC 23	1196	SHEBA	AGK3 +24° 1043	Blk	
DEC 23	584	SEMIRAMIS	AGK3 +22° 0871	OveCopSmiWacMit	
DEC 24	187	LAMBERTA	AGK3 +38° 0655	DssGenMihMtiPrcRgeThz	
DEC 26	1	CERES	AGK3 +26° 0556	Jun	
DEC 27	6	HEBE	Anonymous	Smi	
DEC 28	150	NUWA	A 2044436	MurBoyDhyJunMihThz	
DEC 31	303	JOSEPHINA	AGK3 +26° 0948	JunTrl	

Table 2. Observers and locations of events: Jul-Dec 1989.

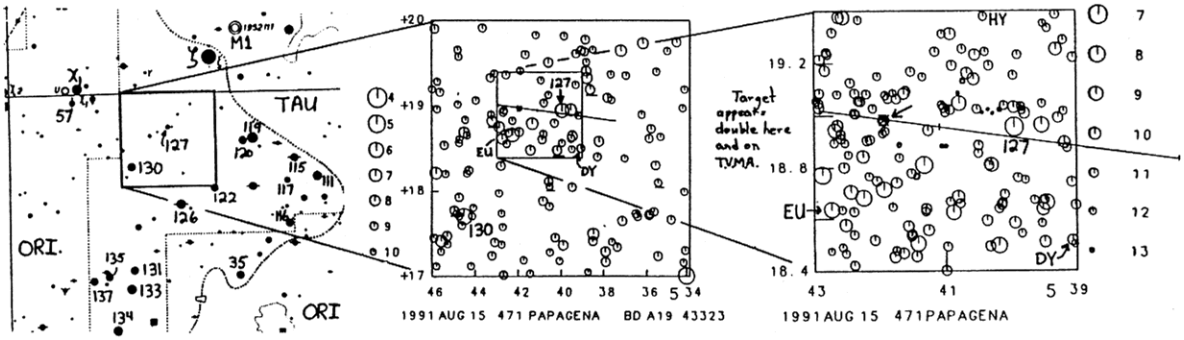
ID	OBSERVER	CITY	COUNTRY	REPORTS
Adi	ADIB, CARLOS	PORTO ALEGRE	BRAZIL	1
Agr	AGERER, FRANZ	ZWEIKIRCHEN	GERMANY	1
All	ALLEN, WILLIAM	BLENHEIM	NEW ZEALAND	1
Amg	AMENGUAL, CARLOS	BARCELONA	SPAIN	2
And	ANDERSON, PETER	THE GAP	QUEENSLAND - AUS	9
Aqy	ASTROQUEYRAS 89	ABRIES	FRANCE	1
Bda	BARANDA GOMEZ, M.A.	ALCALA DE HENARES	SPAIN	1
Bde	BODE, HANS JOACHIM	HANNOVER	GERMANY	1
Bem	BEMBRICK, COLIN	BATHURST	N.S.W. - AUS	1
Bff	BARUFFETTI, PIETRO	MASSA	ITALY	5
Bgs	BOURGEOIS, JEAN	CONNEUX	BELGIUM	2
Blk	BLANKSBY, JIM	WANDIN	VICTORIA - AUS	5
Blw	BLOW, GRAHAM	WELLINGTON	NEW ZEALAND	1
Bnn	BONINSEGNA, ROLAND	DOURBES	BELGIUM	2
Bol	BOLTWOOD, PAUL	OTTAWA	ONTARIO -CAN	1
Boy	BOIGEY, MYRIAM	CALUIRE	FRANCE	1
Brh	BARTHES, JACQUES	TOULOUSE	FRANCE	3
Brw	BREWER, J. DENNIS	MISSION	KANSAS - USA	1
Brz	BARRUEZO, JOSE	GRANADA	SPAIN	1
Bul	BULDER, HENK J.J.	CS ZOETERMEER	NETHERLANDS	6
Bur	BURKHEAD, MARTIN S.	BLOOMINGTON	INDIANA - USA	1
Cab	CABRERA RODRIGUEZ, A.	ALCALA DE HENERES	SPAIN	2
Can	CANDELA, BERNARD	SOLLIES-PONT	FRANCE	1
Cas	CASAS, RICARD	LA LAGUNA, TENER.	SPAIN	1
Chu	CHURMS, JOE	CAPE TOWN	SOUTH AFRICA	1
Cif	CIFUENTES, EDUARDO	SAN SABASTIAN	SPAIN	1
Cks	CSUKAS, MATYAS	SALONTA	ROMANIA	1
Cle	CLETTE, FREDERIC	BRUXELLES	BELGIUM	1
Cmb	COLOMBA, ARMANDO	REGGIO CALABRIA	ITALY	1
Cop	COOPER, TIM	EAST RAND	SOUTH AFRICA	3
Cra	MELANDRI, ANTONIO	ARGENTA	ITALY	1
Cvg	CAVAGNA, MARCO	SESTO ST. GIOVANNI	ITALY	2
Dal	DAALDER, PETER	LAUNCETON	TASMANIA	4
Dbn	DE BENEDETTO, GAETANO	REGGIO CALABRIA	ITALY	4
Den	DENTEL, MARTIN	BERNAU	GERMANY	4
Dhy	DELAHAYE, FRANCIS	LANGOIRAN	FRANCE	2
Dic	DICK, ROB	OTTAWA	ONTARIO -CAN	1
Die	DIETERS, S.	HOBART	TASMANIA	1
Dik	DICKIE, ROSS	GORE	NEW ZEALAND	4
Djk	DIJKSTRA, SIETSE	ALMELO	NETHERLANDS	1
Dlr	DI LUCA, ROBERTO	BOLOGNA	ITALY	2
Dmd	MARTINEZ, DAVID	CORDOBA	SPAIN	2
Dnz	DENZAU, HELMUT	ESSEN 15	GERMANY	5
Dpt	DE PONTIEU, BART	GENT	BELGIUM	1
Dss	DUSSER, RAYMOND	KALAA SGHIRA	TUNISIA	11
Dun	DUNHAM, JOAN BIXBIE	GREENBELT	MARYLAND - USA	1
Dwd	DUNHAM, DAVID W.	GREENBELT	MARYLAND - USA	2
Ell	ELLIOTT, A.J.	READING	UNITED KINGDOM	2
Ern	ERNST, CHRISTOPH	GRAZ	AUSTRIA	1
Ewl	EWALD, D.	MELCHOW	GERMANY	6
Fal	FALSARELLA, NELSON	S. JOSE DO RIO PRETO	BRAZIL	1
Far	FARAGO, OTTO	STUTTGART	GERMANY	3
Fdr	FEDERSPIEL, MARTIN	HEUWEILER	GERMANY	3
Fen	FERNANDES, JANUARIO	PEDROGAO PEQUENO	PORTUGAL	1
Frd	FRIEDLINGSTEIN, CLAIRE	BRUXELLES	BELGIUM	7
Fre	FREEMAN, TONY	FERNDALE	CALIFORNIA - USA	1
Fsh	FISCHER, REINHOLD	TROISDORF	GERMANY	1
Gbd	GABOURDES, JOELLE	LYON	FRANCE	1
Gbf	GOBET, FRANCK	BELLEVILLE	FRANCE	4
Gcv	GONCALVES, RUI	PAREDE	PORTUGAL	3
Gdi	GUALDONI, CARLO	MILANO	ITALY	1
Gem	GEORGE, MARTIN	LAUNCETON	TASMANIA	2
Gen	GENOVESE, MARCO	TORINO	ITALY	1
Geo	GEORGE, DOUG	OTTAWA	ONTARIO - CAN	2
Gez	GOMEZ, JOSEPH M.	MOLLET EDEL VALLES	SPAIN	1
Glo	GALLO, VICENZO	SALERNO	ITALY	1
Grc	GARCIA, JOAQUIM	OEIRAS	PORTUGAL	6
Grh	GRAHAM, FRANCES	EAST PITTSBURG	PENNSYLVANIA - USA	1
Gri	GRIDA, JOE	ABERFOYLE PARK	SOUTH AUSTRALIA	1
Grl	GREIMEL, ROBERT	FREIBURG	GERMANY	1
Grs	GRIESER, DAN	STRATFORD	OHIO - USA	2
Grt	GRAHAM, THERESA	EAST PITTSBURG	PENNSYLVANIA	1
Haw	HAYWARD, STEVE	MADANG	PAPUA NEW GUINEA	2
Hbk	HASUBICK, WERNER	BUCHLOE	GERMANY	1
Hei	HEISING, THOMAS	OSCHERLEBEN	GERMANY	3
Hff	HOFFMAN, MARTIN	WEIDENBACH	GERMANY	3
Hil	HILL, KYM	HOBART	TASMANIA	1
Hol	HOLLER, GERT	GRAZ	AUSTRIA	1
Hon	HONKUS, EDWARD S.	POTSDAM	OHIO - USA	1
Hoz	HOLTZ, JOHN	GREENVILLE	OHIO - USA	1
Iel	IELO, ANTONIO	REGGIO CALABRIA	ITALY	4
Imr	IMRE, ZOLTAN	GYOR	HUNGARY	1
Jlx	LECACHEUX, JEAN	MEUDON	FRANCE	1
Jun	OBSER. DU JUNGFRAUJOCH	JUNGFRAUJOCH	SWITZERLAND	3
Kkn	KOSA-KISS, ATTILA	SALONTA	ROMANIA	3
Koc	KOCSIS, ANTAL	BALATONKENESE	HUNGARY	1
Krt	KRETLOW, MIKE	SIEGEN	GERMANY	1
Kru	KRUIJSHOOP, ALFRED	MT. PLEASANT	VICTORIA - AUS	1
Lai	LAING, D.	SUTHERLAND	SOUTH AFRICA	1
Leg	LEGG, JONATHON	MODBURY NORTH	SOUTH AUSTRALIA	1
Lev	LEVAI, RENATO	SAO PAULO	BRAZIL	1
Lnt	LAURENT, DIRK	GENT	BELGIUM	1
Loa	LOADER, BRIAN	BLACK BIRCH	NEW ZEALAND	3
Lou	LOURECON, ROMUALDO	JUNDAI	BRAZIL	2
Lrz	LORENZ, H.	BERLIN	GERMANY	1
Lyz	LYZENGA, GREG	ALTADENA	CALIFORNIA - USA	4
Mag	MARSHALL, G.	JOHANNESBURG	SOUTH AFRICA	1
Mcm	MCMANUS, BARBARA	FALMOUTH	MASS. - USA	1
Mdd	MIDDLETON, R.W.	BRIGHTLINGSEA, COL.	UNITED KINGDOM	3
Mel	MELCHIOR, ANNE-LAURE	SOLAIZE	FRANCE	2
Meu	OBSERVATOIR DE MEUDON	MEUDON	FRANCE	2
Mih	MICHON, JEAN-POL	HERMENT	FRANCE	3
Mit	MITCHELL, H.	PENNINGTON	SOUTH AFRICA	3
Mln	MORILLON, ERIC	LIGUGE	FRANCE	2
Mlr	MULLER, RUDOLF	BERLIN 42	GERMANY	1
Mlt	MARLOT, CHRISTOPHE	GUINES	FRANCE	2
Moe	MOELLER, RAY	URBANA	ILLINOIS - USA	1
Mrq	MARQUES, RUI	PAREDE	PORTUGAL	1
Mrx	MARX, HARALD	KORNTAL-MUNCHINGEN	GERMANY	4
Mti	MARTI RIBAS, JOSEP	MATARO	SPAIN	3
Mtt	MORETTI, STEFANO	S. BENEDETTO IN ALPE	ITALY	2
Mud	MULDER, M.	THABAZIMBI	SOUTH AFRICA	3
Mun	MUNFORD, NOEL	PALMERTON NORTH	NEW ZEALAND	1
Mur	MURRAY, TONY	GEORGETOWN	GEORGIA - USA	2
Nyd	NYE, DENISE	AMAZON RIVER	BRAZIL	1
Nye	NYE, DERALD	AMAZON RIVER	BRAZIL	1
Odt	OBSERVATORIO DEL TEIDE	LA LUGUNA	SPAIN	1
Ohp	OBS. DE HAUTE-PROVENCE	ST. MICHEL	FRANCE	4
Ond	ONDRA, LEOS	UPICE	CZECHOSLOVAKIA	1
Ove	OVERBEEK, DANIE	EAST RAND	SOUTH AFRICA	7
Pad	PADILLA, ANTONIO	RIO	BRAZIL	1
Pak	PAVLAKIS, SUSAN	WATERBURY	CONNECTICUT - USA	1
Pav	PAVLAKIS, PAUL	WATERBURY	CONNECTICUT - USA	1
Pdm	OBSER. DU PIC-DU-MIDI	BAGNERE DE BIGORRE	FRANCE	3
Pet	PETERSON, JACK	AMAZON RIVER	BRAZIL	1
Pgt	POUGET, JEROME	LYON	FRANCE	1
Pil	PILCHER, FREDERICK	JACKSONVILLE	ILLINOIS - USA	1
Pir	PIRITI, JANOS	NAGYKANIZSA	HUNGARY	1
Poh	POSCH, THOMAS	GRAZ	AUSTRIA	1
Prc	PORCINI, ROBERTO	SALERNO	ITALY	2
Pri	PRIESTLEY, JOHN	PUKERUA BAY	NEW ZEALAND	2
Psr	PASSERINI, G.M.	CASALECCHIO DI REMO	ITALY	1
Rge	REGHEERE, GILLES	VALENCIENNES	FRANCE	1

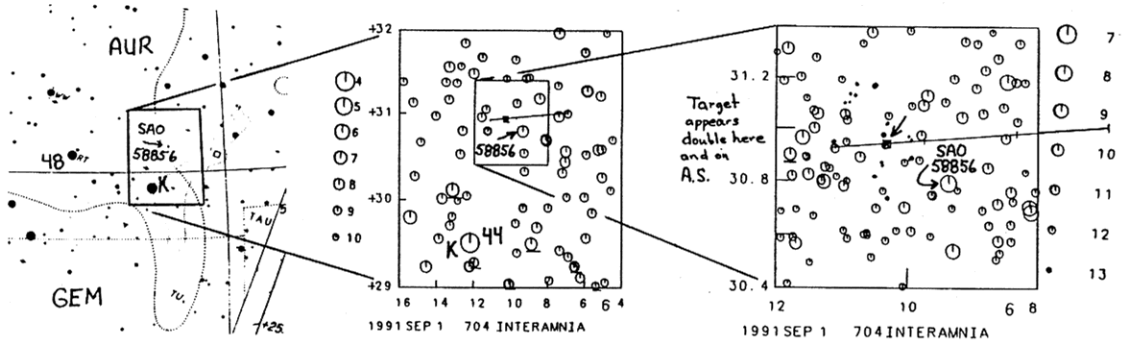


ID	OBSERVER	CITY	COUNTRY	REPORTS
Ril	RILEY, PHILIP	TAWA	NEW ZEALAND	1
Rog	ROWE, GLEN	LOWER HUTT	NEW ZEALAND	1
Rol	ROWELL, LYN	ABERFOYLE PARK	SOUTH AUSTRALIA	1
Rvs	RIVAS, LUIS	TABERNES BLANQUES	SPAIN	1
Sam	SAMOLYK, G	MILWAUKEE	WISCONSIN - USA	2
San	SANCHEZ, FLORENTINO	CACERES	SPAIN	1
Sau	SAUTER, CHRISTOF	ST. MARGARETHEN	SWITZERLAND	1
Sav	GRUPPO, ASTRO. SAVO.	SAVONA	ITALY	1
Sck	SCHEIDKER, ERNIE	GREENBELT	MARYLAND - USA	1
Sea	SEACORD, ANDREW	GLEN DALE	MARYLAND - USA	1
Shk	SCHOENMAKER, A.A.	RODENm HP	NETHERLANDS	1
Sht	SCHOLTEN, ALEX	KP EERBEEK	NETHERLANDS	1
Smc	SMITH, CHARLIE	WOODRIDGE	QUEENSLAND - AUS	7
Smi	SMIT, J.	PRETORIA	SOUTH AFRICA	7
Smm	SMITH, MIKE	TUCSON	ARIZONA - USA	1
Snz	SANCHEZ, JAVIER	S. CRUZ DE TENERIFE	SPAIN	1
Spr	SPRINGOB, C.	SIEGEN	GERMANY	1
Sta	STAMM, JIM	TUCSON	ARIZONA - USA	4
Stg	ST. GEORGE, LOU	AUCKLAND	NEW ZEALAND	3
Sto	STOECKELER, RALF	LYNDOCH	SOUTH AUSTRALIA	2
Sut	SUTTERLIN, PETER	FREIBURG	GERMANY	1
Sve	SVEK, MIKE	URBANA	ILLINOIS - USA	1
Tal	TALERO, MANUEL	ALCALA DE HENARES	SPAIN	2
Tem	TEMPRANO, JAVIER	SANTANDER	SPAIN	2
Tho	THOORIS, BERTRAND	WERVIK	BELGIUM	1
Thz	THIZY, OLIVIER	PARIS	FRANCE	3
Tlp	TULIPANI, FRANCO	BOLOGNA	ITALY	2
Tmp	THOMPSON, BRUCE	WHAKATANE	NEW ZEALAND	1
Tod	TODONI, PAOLO	ORVIETO	ITALY	2
Trl	TORRELL, SEBASTIA	BARCELONA	SPAIN	1
Trr	TERRIER, PIERRE	CHAMONIX	FRANCE	5
Tru	TRUEBLOOD, MARK	POTOMAC	MARYLAND - USA	1
Tvh	HAYMES, TIM V.	READING	UNITED KINGDOM	1
Vgl	VAN GESTEL, JAN	GEEL	BELGIUM	4
Vid	VIDAL SAINZ, JOAQUIN	ZARAGOZA	SPAIN	1
Vii	VILLI, MIRKO	FORLI	ITALY	2
Vij	VINCENT, J.	HARARE	SOUTH AFRICA	1
Vik	VINCENT, KEITH	BLENHEIM	NEW ZEALAND	1
Vll	VON ALVENSLEBEN	FREIBURG	GERMANY	1
Vnb	VAN BLOMMESTEIN, P.	SIMONS TOWN	SOUTH AFRICA	6
Wac	WALLACE, R.	JOHANNESBURG	SOUTH AFRICA	2
Wal	WALLACE, ADRIAN	BERRE	SOUTH AUSTRALIA	1
Wat	WATSON, ROBERT	HOBART	TASMANIA	1
Whk	WIETH-KNUDSEN, N.P.	TISVILDELEJE	DENMARK	1
Wil	WILDS, RICHARD	TOPEKA	KANSAS - USA	1
Wkl	WINKEL, J.-M.	ARNHEM	NETHERLANDS	1
Wpp	WIPPEL, THOMAS	HITZENDORF	AUSTRIA	1

SAO 146041 by (6) Hebe 1991 June 10

SAO 98207 by (5) Jupiter 1991 June 11





ANNULAR ECLIPSE OF 15-16 JANUARY 1991

David Herald

We were very successful with our observations from the northern limit. Conditions were perfect, and results were obtained from 4 sites, two of which were just outside the limit of full annularity. It would seem that the northern limit of annularity had moved slightly south to that predicted by Fiala (i.e., that including the limb data). Unfortunately, the southern limit in Tasmania was completely clouded out, as was New Zealand. Thus, I have not put any effort into extracting the observations from tape. If anyone was able to make observations from the southern limit, please let me know.

One of our group (Jim Blanksby) hired a video camera to record the beads. The result was very disapointing - from a parallel audio recording, it was quite apparent that the video was not recording sufficiently faint light levels -- there were differences of up to 10 secs. near maximum eclipse of the time of bead events!

[Ed. David also included the following reports written by expedition members.]

Eclipse Observation Report from the Northern Limit - Flinders Island

Pat Larkin (in collaboration with
Bruce Tregaskis, Jim Blanksby, David Herald)

Three ASV members, Bruce Tregaskis, Jim Blanksby, Pat Larkin, and organiser David Herald from the Canberra Astronomical Society, straggled into Flinders Island to observe the northern limit of the annular solar eclipse and time Baily's Beads (made by the Sun shining through valleys on the Moon just when the edges of the two bodies coincide). The island - a pleasant surprise of rolling farmlands, lagoons, and with mountain ranges and beaches resembling those of Wilson's Promontory and greeted each arrival with warm sunshine. But would these conditions last for Wednesday morning?

Monday afternoon saw the last arrival - the illustrious David Herald. David barely had time to breathe after an 8-hour drive and flight from the mainland, before setting out on a tour of trigonometrical stations. Using these gives accurate geographic coordinates for reference in observing Baily's Beads during the eclipse, but access to two of them entailed a climb and bit of bush-bashing. Only five trig stations existed in the right positions for observations, and since two of those were in the same relative position, only four were useful; just enough for us four scientific high-fliers!

Late in the afternoon, we met for a discussion on what to expect, do, not do, and contingency plans, etc. David even simulated an annular eclipse for the benefit of the uninitiated, using two ashtrays from our dining table! Following dinner and discussion of great scientific detail, a few wound-up people with brains working overtime retired about 11 pm.

Tuesday morning found each of us checking out our sites. Jim looked at David's site, thought it impossible to be mastered, and questioned David's sanity. David scrambled up to his site - taking 30 minutes to conquer the 190-metre mountain upon which it stood - and subsequently arranged (or was it conned?) for people from a nearby bird sanctuary to act as porters. David and Bruce in their respective vehicles almost met head-on on the road to Bruce's site. This site, of "easy access", had Bruce planning to observe from a haunted building close to the trig point!

Jim, Pat, and David dined together again. As significant cloud was observed and a howling wind began to rattle the windows, a mood of general despondency prevailed. David was concerned that he might be blown off his site and Pat considered taking a noose to use from the trig pole. All retired about 11:30 pm, with grave fears of sleeping in, only to have David awake at 4 am and the rest of us at 5 am, from slumbers punctuated by nightmares of flat batteries, radios and tape recorders failing, equipment being knocked over, etc. However, and to our amazement, Mother Nature was kind, since there was no wind and virtually no cloud on the morning of the eclipse.

Everyone organized, with rampant improvisation. Bruce had to borrow the spare ASV radio (because his wouldn't work properly), Jim borrowed some lengths of pipe from a garage to use as a counterweight, David had a length of wire to throw over the side of "his" mountain as an aerial to improve VNG reception, and Pat had a novel finderscope - a PostPak tube - the brilliance and virtue of which she is happy to share with other novice solar observers!

We left for our sites before 7 am, Jim looking impressive with his video weaponry and affording to appear cool, calm, and collected about getting to his site, since he could drive right up to it. Pat was assisted by a tribe of porters and managed to set up in time for first contact around 8:03 am. David met his porters at the base of the mountain, which he climbed in 40 minutes.

VNG came through strongly and clearly on 10 MHz until half an hour before mid-eclipse, predicted for 9:23 am, when it was turned off! Still all were able to gain a good signal on 5 MHz instead. The eclipse was viewed by all in perfect conditions; no wind or cloud. Pat and David, having assaulted their respective summits, felt their arduous climbs to have been vindicated. Bruce and Jim, after their relaxed drives to their sites, likewise enjoyed the eclipse. All of us recorded heaps of Baily's Beads, using VNG and tape recorders, with Jim also filming the eclipse on videotape. After annularity Jim and David went over to Pat's site, where Pat was adamant that she was going to record second contact, much to David's disbelief. Despite low-level clouds rolling in, Pat did get to time second contact at about 10:50 am, and Jim got it on video too.

This article was drafted (on two placemats!) during a jovial dinner - after appropriate refreshments - on the evening of the day of the eclipse. Spirits were high, although the knowledge that the Taswegians were generally clouded out at the southern limit cast a

bit of a shadow.

For those unaware of what Flinders Island has to offer, or who wonder how anyone can amuse themselves there for a few days, the members of the ASV Flinders Island Annular Eclipse Expedition 1991 unanimously felt that the time we later spent on the island was insufficient to explore it properly. Between climbing peaks, exploring the island by pedal-power, swimming, fossicking, looking at the antics of shellfish and the flight patterns of the mutton-birds and Cape Barren geese, there was no time left for mischief! "We shall return".

Reports From Other Locations

Steve Roberts

Steve Roberts at work in central Melbourne noticed a distinct darkness through complete cloud cover around 9:20 to 9:25; external lights were well visible; cloud cleared at 11:05 (15 minutes after everything was over - Curses!). Jim Park at home in Mount Waverley saw the eclipse sporadically through the clouds, as did Eddie Gainsford at Warranwood and several others on the periphery of Melbourne. Peter Nelson at Warragul had clear conditions and saw all stages of the event. Ian Sullivan, on holiday just south of Devonport, Tasmania, also saw the whole event under ideal conditions.

However, the 13 stations and 30 observers who had set up along the southern limit across southern Tasmania were completely clouded out, except for two observers who travelled north as far as Oaklands and who saw the eclipse in clear conditions with some rather poor Baily's Beads - too poor to measure scientifically, but at least they saw an eclipse! Both the northern and southern limits through New Zealand were also clouded out. Launceston Planetarium had clear conditions and conducted a highly successful public viewing.

GRAZE EXPEDITION 1991 FEBRUARY 21

Andrew Elliott

[Extracted from the BAA Lunar Section newsletter 27(4) of April, 1991] There were several grazes predicted during the Pleiades passage on February 21. Two of the graze tracks intersected near the village of Hurstbourne Tarrant in Hampshire [England]. I organized a graze expedition there so that we could potentially observe two grazes from the one site within half an hour of each other, a rare event.

The two grazes, of ZC 556 and ZC 562 were due to occur at 18h 52m and 19h 18m UT, respectively, from the chosen site. I had found an excellent secluded road running at right angles to the tracks and starting within 1/2 km of the point of intersection. The local residents and estate owner were very amenable to our trip. We managed to line up 12-13 observers, mainly from Reading Astro., with telescopes ranging in size from 4" to 14" (mostly in the 8" to 10" range).

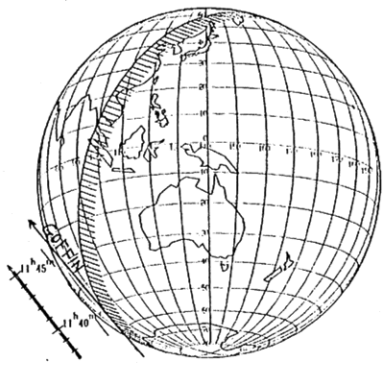
The day of the grazes arrived and the weather looked very discouraging...A hole in the cloud was on its way to the graze site...There was a 50:50 chance that it would arrive at the graze site by 1900 UT. Because of the rarity of the event I decided not to abandon the attempt outright. Also, the Americans (IOTA) wanted information about any possible graze shift so that they could plan their next Pleiades passage graze expeditions on March 20-21.

It rained at the graze site heavily and intermittently from 1700 to 1830 UT. Another five intrepid observers turned up -- Martin Burger, Richard Fleet, Tim Haymes, Chris Menmuir, and Anthony Thomas. At 1830, a thinning of the cloud occurred and the Moon appeared: a great cheer went up! However, visibility was intermittent due to scudding clouds, and the wind became squally as forecast. We made a mad dash to set up telescopes along the road. But the Moon remained covered for the first event.

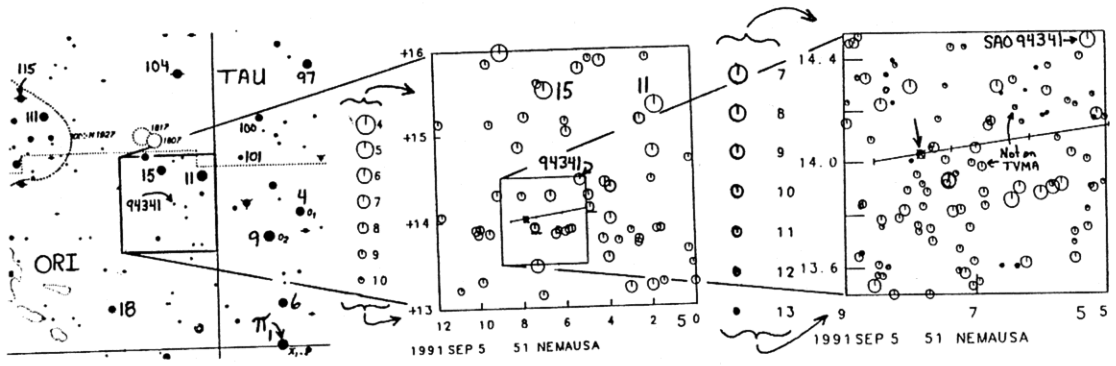
We sat and waited for the next event. It rained, and all the equipment got wet. My MSF clock went on the blink. The only time it ever does is on a graze expedition! A passing car shone its lights into my eyes. My feet were getting cold and soggy on the wet grass.

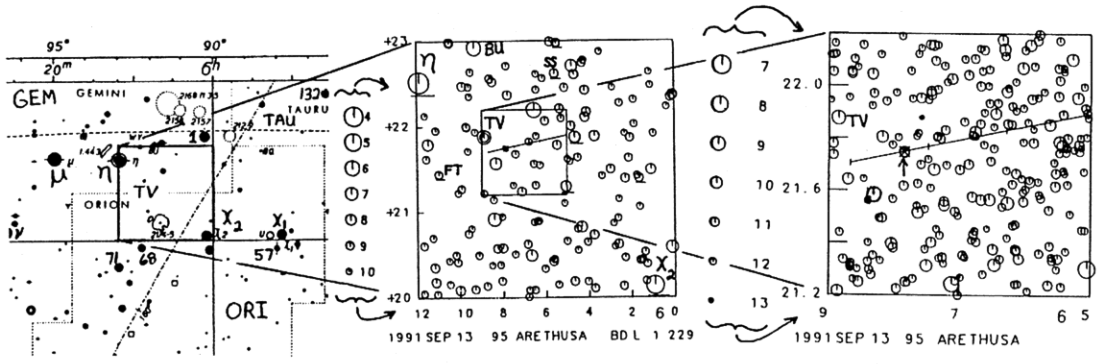
The Moon and star did appear fleetingly a few times for the second event but most of us did not obtain any timings. Congratulations to Tim Haymes who managed to time six events during the disappearance phase. Unfortunately, he was clouded out for the reappearance phase and so it is difficult to make any conclusions about a possible graze shift. It would appear from the graze profile and Tim's results that any shift is likely to be quite small.

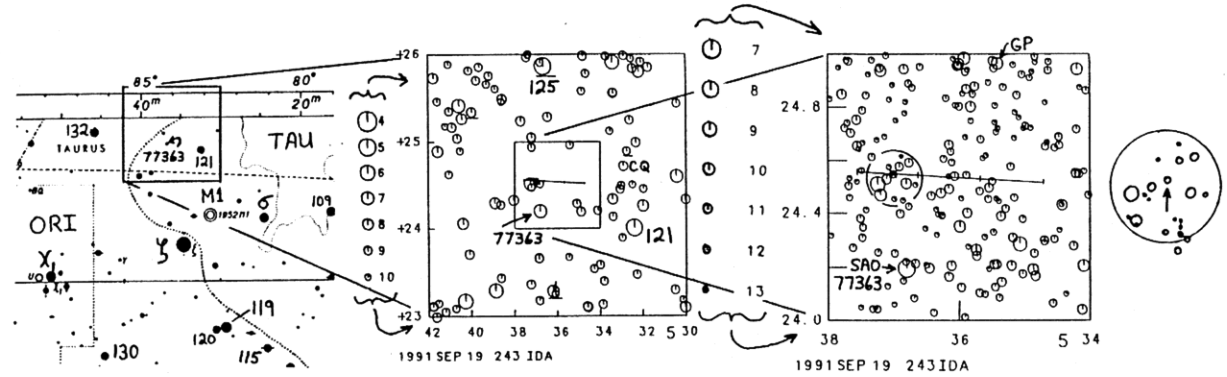
We packed up and went to the local hostelry to dry out. As we arrived there the "hole" arrived with a crystal clear black sky: the forecast was not far out! Spirits were not damped and we have continued enthusiasm for the next graze.

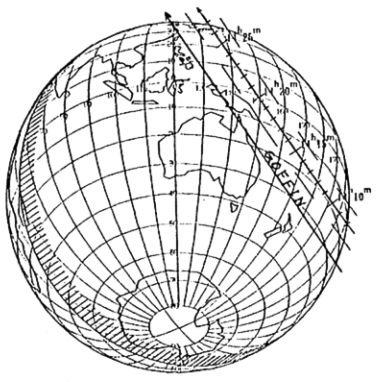


SAO 158489 by (694) Ekard 1991 June 11









SAO 226006 by (433) Eros
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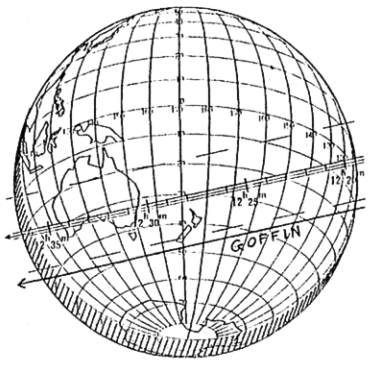

SAO 185272 by (423) Diotima
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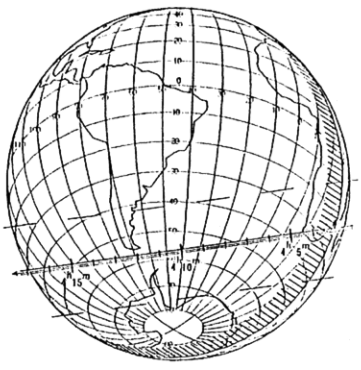

SAO 210543 by (356) Ligura
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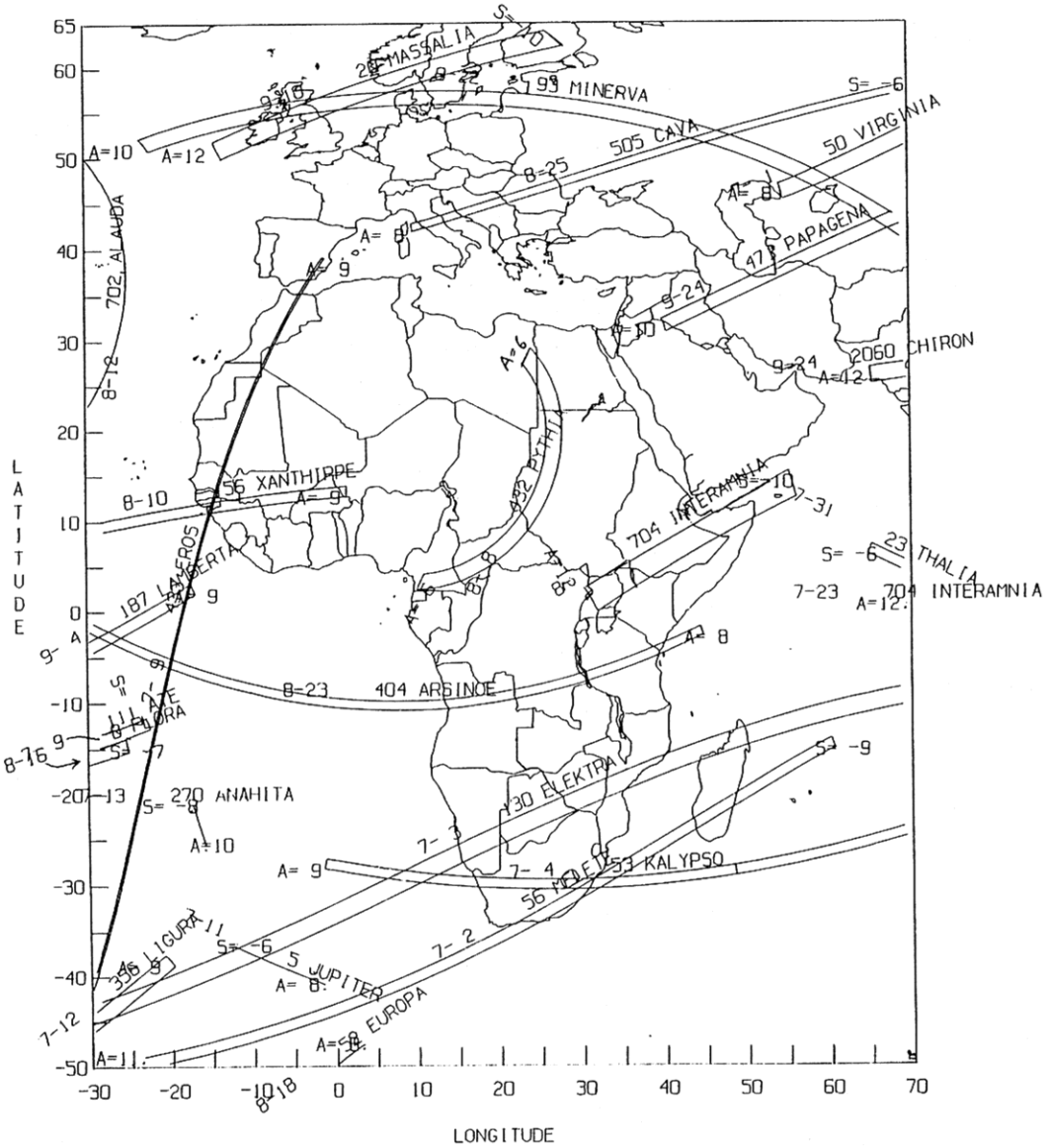
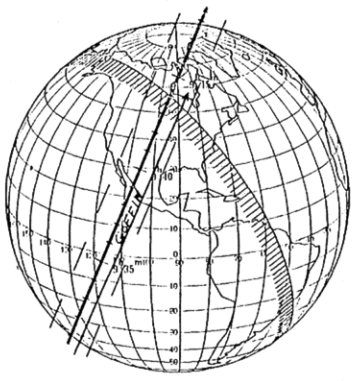
PLANETARY OCCULTATIONS. 1991 JUNE - SEPT



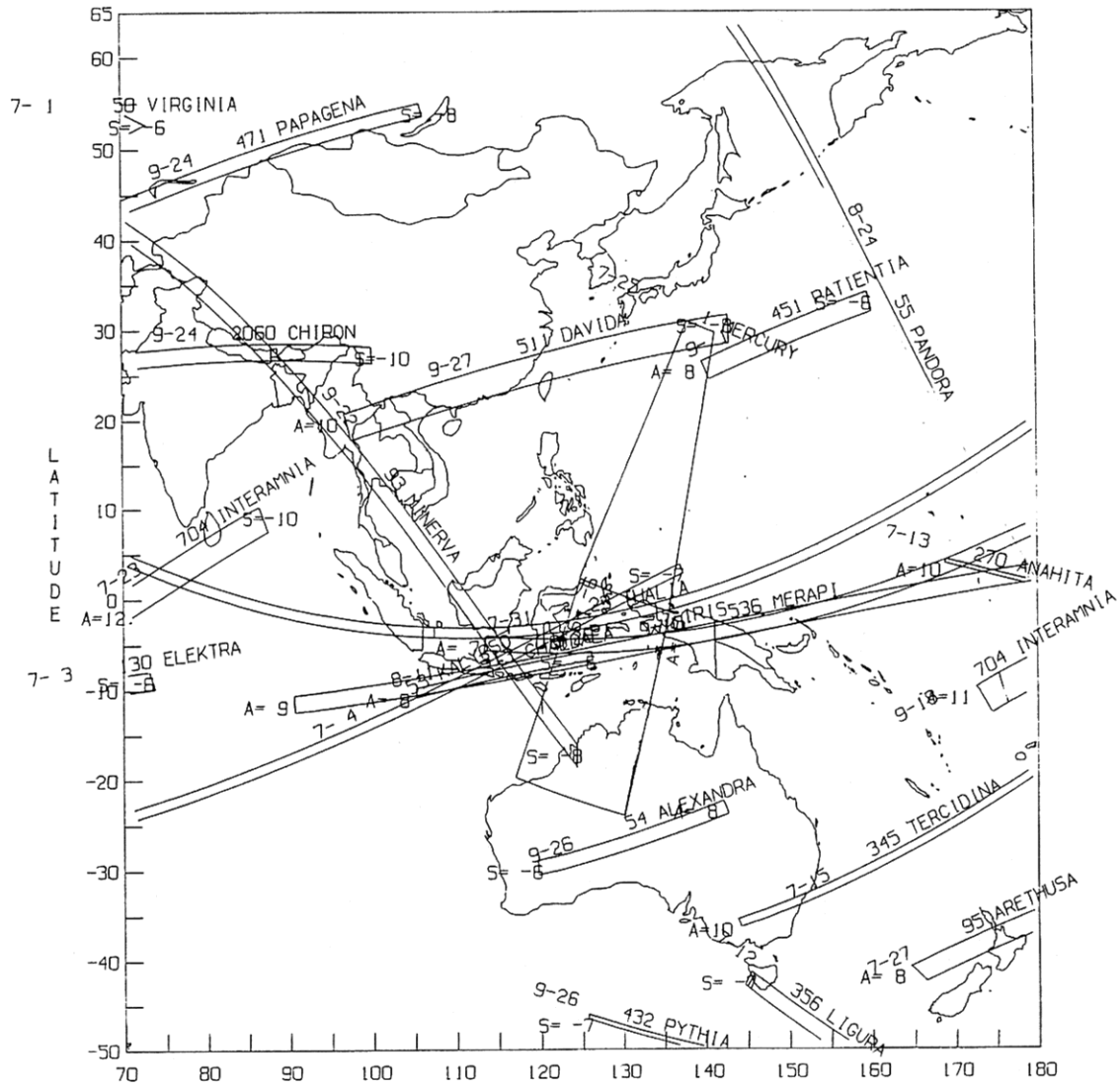


19° 4686 by Phocaea 1991 Jun 16

Anonymous by Dunham 1991 Jun 17

SAO 98329 by Venus 1991 Jun 19

PLANETARY OCCULTATIONS. 1991 JUNE - SEPT



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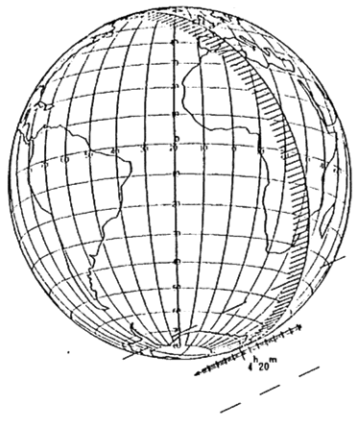
SAO 93133 by Cybele 1991 Jun 20



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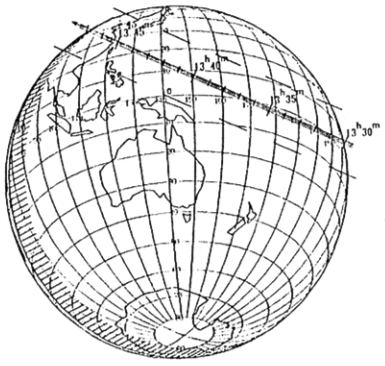

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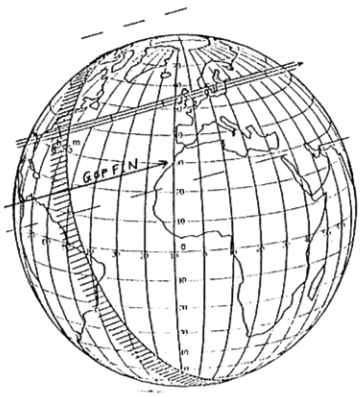
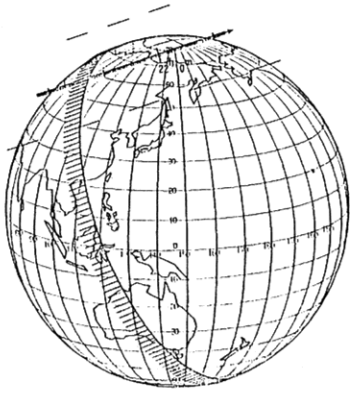


+13° 488 by Cybele 1991 Jun 29



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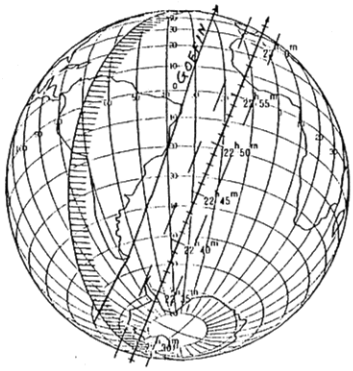
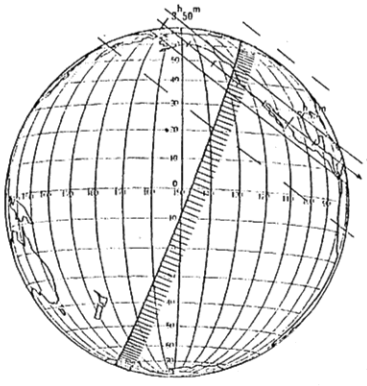
SAO 76609 by Massalia 1991 Jul 7



SAO 206699 by Eros 1991 Jul 9

SAO 98472 by Jupiter 1991 Jul 11

+10° 16 by Tercidina 1991 Jul 15



L 2 3446 by Ceres 1991 Jul 23

Anonymous by Dunham 1991 Jul 23

Anonymous by Interamnia 1991 Jul 23

SAO 76932 by Massalia 1991 Jul 24

SAO 98923 by Mercury 1991 Jul 25

ASTRONOMY AND PERSONAL COMPUTERS

Joan Bixby Dunham

Computerizing Research: A recent Byte magazine had an article on intelligent document management which I read the same day I read newspaper articles on the investigation of fraud committed by Thereza Imanishi-Kari, a genetics researcher. One of the major points of the Byte article was that researchers should keep all their records electronically. The author remarked that "Laboratory work has changed a lot from the early days when all notes and calculations could be kept in notebooks." Although the Byte article suffers from the lack of experience of its author with practices in scientific research ("early days" indeed!), it does make some good arguments for use of computers to store all research notes.

In many fields the researcher's notebook is sacred. Entries are written in ink, dated, and, while later entries may correct earlier ones, written entries are not changed. The notebooks are used to resolve questions of data accuracy, priority of discovery, patent disputes, and other questions. The evidence for fraud committed by Dr. Imanishi-Kari was, in part, based on examination of her notebooks, finding that the records could not have been written on the dates claimed but must have been made later. Using researcher notebooks is not a universal practice in astronomy, although many astronomers do. There are scenes in the PBS series "The Astronomers" where observers are shown in front of a console, capturing their data with computers, recording the observation date, time, and so on by hand in notebooks. There are occasions when the date and time of an observation becomes important in establishing who first discovered something. If the observer is aware that a comet, nova, or minor planet has been found, then the discovery can be established with a telegram to the IAU. But the observer may not always be aware immediately that the image just taken contains a unique observation. Pre-explosion observations of a supernova, for example, would become valuable only after the star becomes a supernova.

The difficulty with using a computer-based set of research notes to establish precedence is that, absent any outside confirming evidence, the dates attached to computer records cannot be trusted. The computer clock can be used to date records, but computer users can set the clock to whatever they wish. And in cases where the clock is not under the users' control, changing the date of a record or a file is still no problem for a competent programmer. Also, there may be quite legitimate reasons to do with data storage, archiving, reformatting, or editing why the date of a file could be much later than the actual date the data were originally stored. Methods to establish a trustworthy date all require an outside agent or act. Also, the researcher needs to know then that the date specific data were recorded must be established. Years may pass before the dates data were taken become important. This was certainly true in the case of the investigation of Imanishi-Kari.

The convenience of using computers to keep observing records and notes outweighs the possible need to establish an observation date in astronomy. Another way to consider the question is that legal disputes as to the legitimacy of observations or time data were taken seldom arise in astronomy. This may have more to do with the lack of financial incentive than the moral character of those attracted to astronomy. Whoever finally wins the court fights to establish the first inventor of the microprocessor is likely to become very wealthy, while the loser just gets very large legal bills. In astronomy, questions of discovery are handled by attaching all the observers names to the event. This is why numerous comets have multiple names.

A second difficulty in using computers to maintain researchers' notes is the probability that changes in technology may leave an observer unable to read old files. Those of us who have used computers for more than 10 years all know of data written to media that can no longer be read. At one time, disk drives for personal computer were expensive and not very common. The most common data storage medium was cassette tapes. I certainly have no desire to keep old computers around to read my cassette tape files. The only storage format I disliked even more was punched paper tape. At one time, every facility with a computer had card readers and we thought they would always be available. We still have yet to see a storage format whose ease of access over the long term outdoes the printed page. While it may take a long time to search through printed documents to find relevant information, it can take even longer if a search must begin with a nation-wide hunt for a museum piece in operating condition to read old files.

There are plans to archive data from major observing programs that include with them the commitment to provide the equipment to read from the archives indefinitely. Research notes stored on those media are more likely to be accessible in the future. However, a researcher's notebook is a personal record of work done. Individuals may not want to spend the money to store their notes on media designed for large data volume and high speed retrieval.

Software In 1987, at Universe 87, I purchased an interesting program called Deep Space, written by David Chandler. I have mentioned this program several times, and used it in demonstrations and Astronomy Day programs. It generates star maps in several projections, including pairs for stereo viewing. I have just received an updated version of this program, now called Deep Space 3-D. There are many new and improved features, but the one which I noticed first (and which I found most impressive) was that the star map plotting is considerably faster than in the old version. Other new features are:

Option to purchase up to 14 additional disks containing a star catalog of 248,709 stars, down to 10th magnitude. The unregistered distribution disks contain stars to 5.6 (3200 stars), the registered version has stars to 7.25 (19000 stars). The star catalog source for this was the SKYMAP data base, which Chandler received from the National Space Science Data Center.

Additional star map types, including one that matches the sky as it appears to the observer.

Ability to label constellations, move the labels so that they will not detract from the map, and use three letter abbreviations or full names as desired.

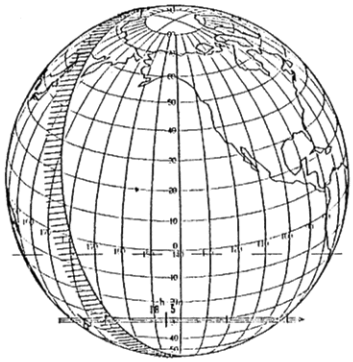
Two 3-d formats, the large 8-1/2 x 11 offered in the original version of Deep Space, and a new small scale format.

The program is, in David Chandler's words, "heavy on comets." It plots comet trajectories against the background stars, produces special search charts for comet recovery, lists where comets are (a feature to help comet searchers avoid the embarrassment of "discovering" a known comet.)

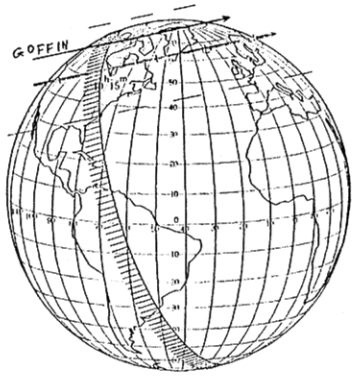
This is version 2.1a of the software. This runs on MS-DOS machines, and requires 512K memory. It does not require a math co-processor, but runs much more efficiently with one.

The program can be freely distributed in its unregistered version. Registration costs $59, and includes a 3-D viewer. The viewer can be purchased separately for $5, and a larger viewer is offered for $35. Additional data sold to accompany Deep Space are the 14 diskettes of the star catalog, and orbital elements for 1100+ comets. If you are interested, write David Chandler at PO Box 309, La Verne, CA 91750.

Andrew Lowe has sent a PC program to present a display of computer graphics, EclipseLive. This program gives a real-time simulation of partial, annular, and total eclipses. I could not read the diskette Lowe sent, so I cannot give an evaluation of the program. It does sound interesting, especially for public displays. The program requires a MS-DOS machine with DOS 2.1 or later, and a CGA, EGA, or VGA graphics board. The co-processor is used if present. The price is $39.93 US, which includes shipping. He will provide the program in 5-1/4 and 3-1/2 diskettes (specify the density). You may write to him at
4939 Vantage Crescent N.W.
Calgary, AB T3A 1X6
Canada



SAO 76893 by Arethusa 1991 Jul 27



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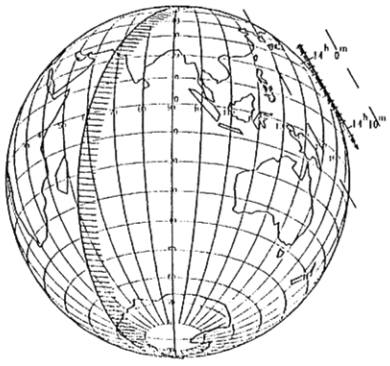
Anon. by Interamnia 1991 Aug 7



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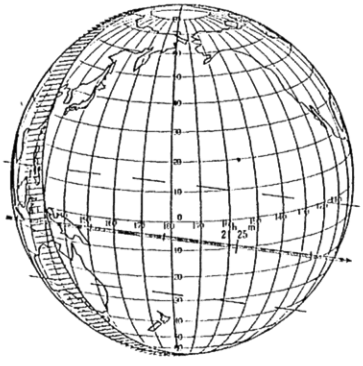
SAO 166014 by Pythia 1991 Aug 8



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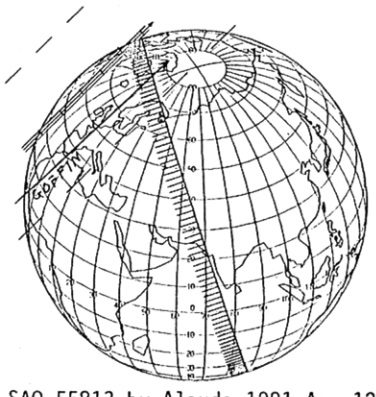

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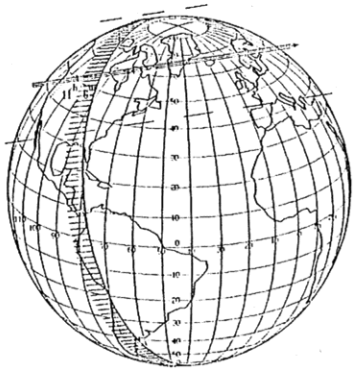

A1943324 by Papagena 1991 Aug 15

IOTA

The International Occultation Timing Association 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. IOTA is a tax-exempt organization under section 509(a)(2) of the (USA) Internal Revenue Code, and is incorporated in the state of Texas.

The ON is the IOTA newsletter and is published approximately four times a year. It is also available separately to non-members.

The officers of IOTA are:

President	David W. Dunham
Executive Vice President	Paul Maley
Executive Secretary	Gary Nealis
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VP for Grazing Occultation Services	Joe Senne
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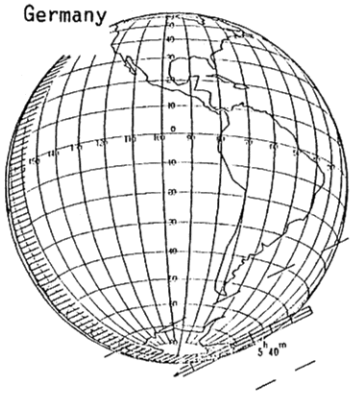
VP for Lunar Occultation Services	Walter Morgan
ON Editor	Joan Bixby Dunham
IOTA/European Section President	Hans-Joachim Bode
IOTA/ES Secretary	Eberhard Bredner

Addresses, membership and subscription rates, and information on where to write for predictions are found on the front page.

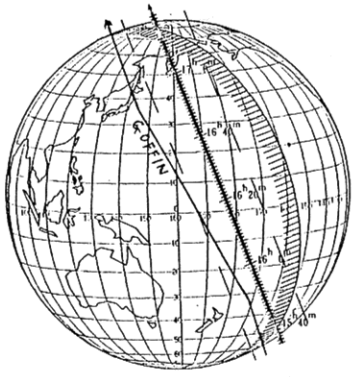
The Dunhams maintain the occultation information line at (301) 474-4945. Messages may also be left at that number.

Observers from Europe and the British isles should join IOTA/ES, sending DM 40.-- to the account IOTA/ES; Bartold-Knaust Strasse 8; 3000 Hannover 91; Postgiro Hannover 555 829 - 303; bank-code-number (Bankleitzahl) 250 100 30. Full membership in IOTA/ES includes the supplement for European observers (total and grazing occultations) and minor planet occultation data, including last-minute predictions, when available. The address for IOTA/ES is

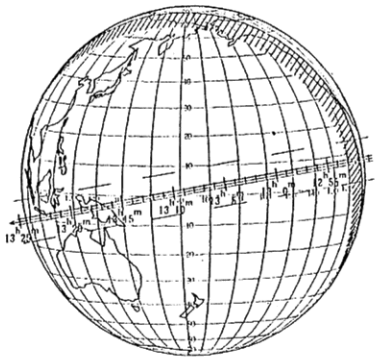
Eberhard Bredner
Astrag VHS Hamm
PO Box 2449-41
D-4700 Hamm 1
Germany



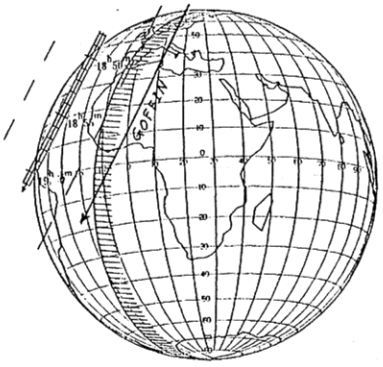
SAO 164094 by Europa 1991 Aug 18



+5° 166 by Pandora 1991 Aug 20



SAO 127920 by Iris 1991 Aug 26

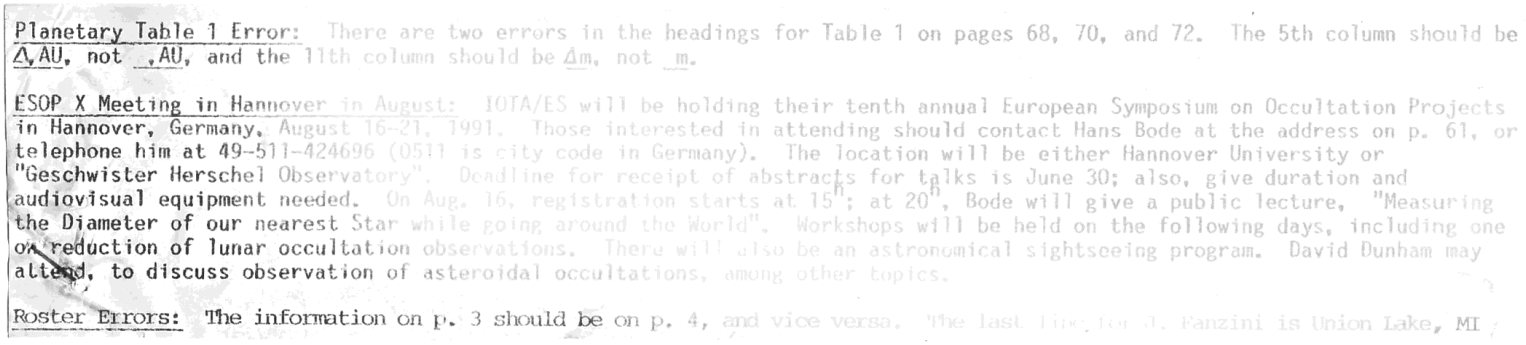


SAO 142983 by Juno 1991 Aug 27

SAO 58852 by Juewa 1991 Aug 28

Anonymous by Ida 1991 Aug 30

Anon. by Interamnia 1991 Sept 1



Planetary Table 1 Error: There are two errors in the headings for Table 1 on pages 68, 70, and 72. The 5th column should be Δ,AU, not ,AU, and the 11th column should be Δm, not m.

ESOP X Meeting in Hannover in August: IOTA/ES will be holding their tenth annual European Symposium on Occultation Projects in Hannover, Germany, August 16-21, 1991. Those interested in attending should contact Hans Bode at the address on p. 61, or telephone him at 49-511-424696 (0511 is city code in Germany). The location will be either Hannover University or "Geschwister Herschel Observatory". Deadline for receipt of abstracts for talks is June 30; also, give duration and audiovisual equipment needed. On Aug. 16, registration starts at 15h; at 20h, Bode will give a public lecture, "Measuring the Diameter of our nearest Star while going around the World". Workshops will be held on the following days, including one on reduction of lunar occultation observations. There will also be an astronomical sightseeing program. David Dunham may attend, to discuss observation of asteroidal occultations, among other topics.

Roster Errors: The information on p. 3 should be on p. 4, and vice versa. The last line for D. Panzini is Union Lake, MI

The erratum and the additional information were found as a strip of copy paper with the printed issue of *Occultation Newsletter* Vol. 5 No. 3.

The Planetary Table 1 Errors on pages 68, 70 and 72 were corrected for the scan of this project. The issue is marked on the front page as revised.

(Transscript)
ESOP X Meeting in Hannover in August:
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Roster Errors: The roster with personal addresses is not included in the scans of the project.

Oliver Klös
IOTA/ES
The *Occultation Newsletter* Heritage Project, May 2020