

Occultation Newsletter

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FROM THE PUBLISHER

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- 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 9701-A; Venezuela), for Europe through Roland Boninsegna (Rue de Mariembourg, 33; B-6381 DOUBES; Belgium), 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 2741; Wellington, New Zealand), and for Japan through Toshio Hongo (1-13 Shimomaruko 1-chome; Uta-ku, Tokyo 146, Japan). Supplements for all other areas will be available from Jim Stamm (Route 13, Box 109; London, KY 40741; U.S.A.) by surface mail at the low price of 1.18 or by air (AO) mail at 1.96.

Observers from Europe and the British Isles should join IOTA/ES, sending DM 40.-- to the account IOTA/ES; Bartold-Knaust Strasse 8; 3090 Hannover 91; Post giro Hannover 555 829 - 303; bank-code-number (Bankcentral) 255 100 30. Full membership in IOTA/ES includes the Supplement for European observers (total and grazing occultations).

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 * Not available for U.S.A., Canada, or Mexico.
 * Area "A" includes Central America, St. Pierre and Miquelon, Caribbean Islands, Bahamas, Bermuda, Colombia, and Venezuela. If desired, area "A" observers may order the North American supplement by surface mail at \$1.18, or by air (AO) mail at \$1.50.
 * Area "B" includes the rest of South America, Mediterranean Africa, and Europe (except Estonia, Latvia, Lithuania, and U.S.S.R.).

IOTA NEWS

David W. Dunham

During February, my top priority will be completion of the first draft of the article about the 1983 May 29th occultation of 1 Vulpeculae by (2) Pallas. I thank numerous readers who responded to my note on p. 145 of the last issue. We are behind schedule on the Pallas work, but I am determined to have the first draft ready in time for the Asteroids II meeting on March 8 - 11 in Tucson, AZ, which I plan to attend. If possible, the first draft will be finished by the end of this month, so that it can be mailed to the numerous co-authors so they can receive it before March 8th.

After Pallas, I will work on completion of analysis of other asteroidal occultations with IOTA involvement. I had hoped to do a preliminary analysis of the 1987 January occultation by (471) Papagena observed from the northeastern U.S.A. in time to include a sky-plane plot with Jim Stamm's summary article (see p. 159), but this was not possible. I will need to complete most of these other analyses for my contribution for the Asteroids II book (I am a co-author with Robert Millis of a chapter on occultations), due in late April.

An obituary for James McMahon is reproduced from the newsletter of the China Lake Astronomical Society on p. 169. His observations were crucial in initiating the debate about satellites of asteroids, and it is a shame that more conclusive evidence for these objects was not obtained while he was alive. I am saddened to report another recent death. Vernon Helms, who photoelectrically recorded the occultation of 14 Piscium by (51) Nemausa at the NASA-Langley Research Center's observatory on 1983 September 11th, passed away in October after a courageous 18-month battle against leukemia.

Canadian provincial boundary data. These were requested in the last issue. They have been provided to me by Chuck Baker, Rockville, ME, but I will not have time to do the work needed to incorporate them into the boundary database that I use, during the next few weeks.

Recent Astrometry. Arnold Klemola measured existing Lick Observatory plates to refine the positions of Astrographic Catalog stars occulted by (58) Concordia on January 9th, and by (87) Sylvia on January 21st and 25th. The 3 stars were considerably south of their A.C. positions, moving the paths northward.

well off the Earth's surface for the events on the 9th and 20th. The shift for the 21st was 0°17' north, shifting the path across northern Africa, with enough uncertainty that an occultation was possible for northern Europe. Joe Churns obtained plates at Cape Observatory early on February, giving positions which I used to calculate that the occultation by 5141 Germania late on February 2nd would shift 1°30' S.S. south, into the Antarctic Ocean well south of any observers. Most of the shift was caused by error in Germania's ephemeris.

I made an error in the table on p. 143 of the last issue; the shift for Z.C. 771 on Aug. 18 should be 0°22' north. Harold Povenmire also reports that the magnitude of X10832 = SAO 79256 is about 9.6, not 7.5 as given in the catalogs.

As noted above, I need to concentrate on performing, and writing about, asteroid occultation analyses during most of the next three months. This will leave little time for star catalog work, which will further delay completion of the new XZ catalog, and filling numerous requests for it. Distribution of the next issue will be targeted for about June 1st. I intend to include information about the June 12th Pleiades passage, which should provide interesting views for observers in the far western parts of North America. Since time between this issue and the last has been relatively short, Don Stockbauer will wait until the next issue for his article on observed grazing occultations. [Ed: see p. 164 for some late IOTA news.]

THE PLEIADES PASSAGE OF FEBRUARY 23-24

David W. Dunham

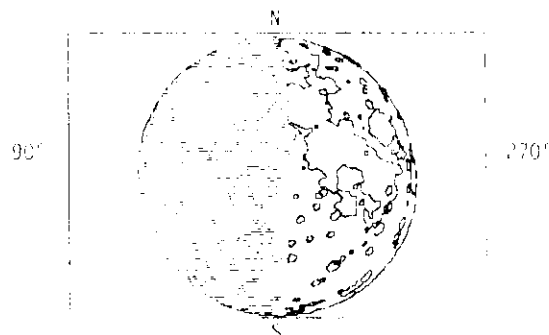
North Americans will be able to see a very favorable transit of the Moon across the Pleiades on Tuesday evening, February 23rd local time (24th U.T.). Information about this passage, including a chart identifying the cluster stars by SAO numbers and giving disappearance predictions for several U.S. and Canadian cities, has been published in this month's issue of *Sky and Telescope*. For more information about Pleiades passages in general, you should read *o.w. 4* (4), pp. 58-61, especially the sections on value, predictions, observing considerations, detailed Pleiades chart using equinox 1950 coordinates, and double stars. Pleiades passages occur each month, and a list of this year's passages was published on p. 68 of last month's issue of *Sky and Telescope*. But *o.w.* readers can learn about passages visible in their areas by examining the Alcyon (Z.C. 552), Maia (Z.C. 541), and other bright Pleiads' graze paths in the Grazing Occultation Supplement enclosed with this issue.

Planning Occultation Expeditions. If you plan to lead an expedition to observe a grazing occultation during this passage, you can telephone me at 301. 555-9089 to give me approximate coordinates of where you plan to observe. If time permits, I will compute and mail you total occultation predictions for the site; some information could be relayed by telephone. I would be interested in knowing about planned expeditions, anyway, so that I can include this information in the IOTA occultation file messages at 301.495-9062; some *Sky and Telescope* readers have already called in for expedition information. I am planning to lead an expedition to observe the northern limit graze of 5.6-mag. Z.C. 538 near Tem-

pleton, VA, a short distance south of Petersburg; Richard Wilds (telephone 913.354-8771 in Topeka) plans to lead a group to (would you believe it?) Moonlight, KS, where the southern limit of Maia and the northern limit of Z.C. 555 intersect; Robert Landy (phone 816.795-8116) plans to observe from Lewisburg, KS, since the graze path for Maia goes over the Kansas City Astronomy Club's observatory there; and Harold Povenmire (phone 305.777-1303) hopes to observe the bright-limb graze of Iaydela (Z.C. 539) in Florida.

Based on the results of last March's passage, discussed in *o.w. 4* (5), p. 100, no corrections should be applied to the IOTA graze predictions as defined by the ACLPPP predicted profiles, for these waxing-phase events. Results from March seem to indicate that the Lichhorn Pleiades catalog star positions used for the predictions now can be in error by 0°2', which is still at least as good as USNO's new Zodiacal Zone (ZZ) catalog discussed on p. 140 of the last issue. Incidentally, the ZZ includes stars within 13° of the ecliptic, not 16°, as stated on page 140.

Pleiades chart. The apparent-place chart of the Pleiades, showing topocentric paths of the Moon's center for several cities, is similar to the charts in *o.w. 4* (4), p. 61 and *o.w. 4* (5), p. 99, and described on pages 59-61. A new Moon figure, sized properly for use with this chart, has been produced with John Westfall's Moonview program using an Apple computer; see *o.w. 4* (5), p. 92. The sunlit limb is the more darkly drawn right side of the figure; most observable events will be disappearances on the dark side, which is lightly drawn (every other line skipped by the dot-matrix printer). During the February 23rd passage, the Moon's apparent radius will average 15'60". For orienting the Moon figure, the position angle of the lunar north cusp will be 347° and the center of the sunlit limb will be at 257°.



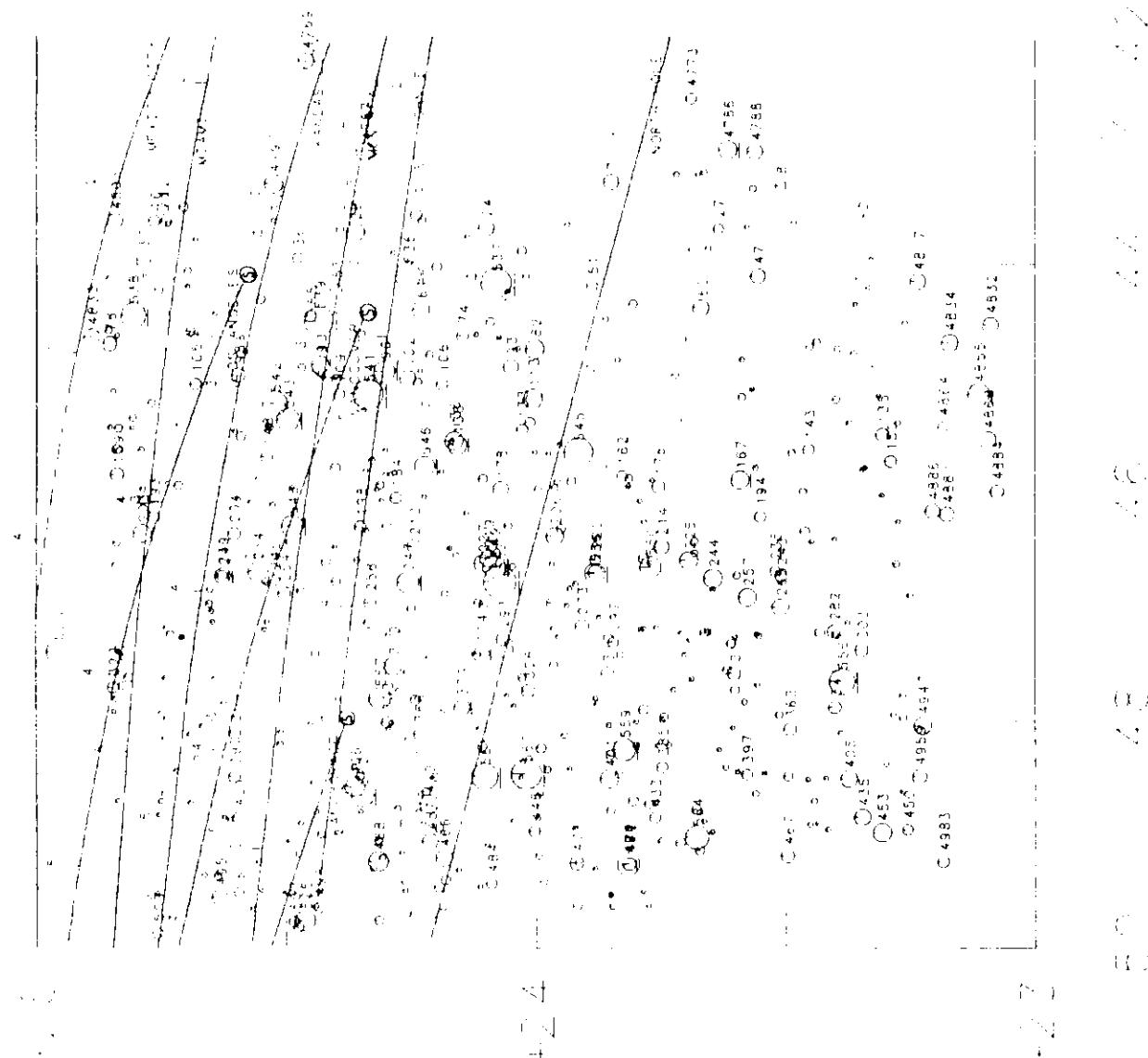
Comparison with the previous two charts shows that the Moon is now passing much farther north across the cluster. The best views of all of this year's passages will be from the arctic regions, where the Moon will pass farthest south across the cluster, and closer to its center. North Americans were denied this time, in that they got no favorable passage with the Moon passing centrally over the cluster. The most central passage for the continent occurred last December 4th, with the waxing Moon 99% sunlit.

January 27th Passage Observed in Europe. Hans-Joachim Bode reported good conditions in Hannover, German Federal Republic, during the January 27th passage. Several occultations were recorded photoelectrically and with video equipment. The latter

was used to record bright-limb reappearances of even 5th-mag. stars. Unfortunately, it rained at Hamburg, north of Hannover and near the southern limit for the graze of Alcyone, and clouds also prevented observation from Wiesbaden to the south. Hannover apparently was in a lucky hole in cloud cover that may have blanketed much of Europe, as was the case for last June's occultation of Spica. [11] also see p. 169]

Reporting observations of All Pleiades occultations.
All reports of total occultations observed during Pleiades passages, including timings of stars that

are only in USNO's P-catalog, should now be sent to ILOC, as is the case for total occultations of non-Pleiades stars. A copy of the report does not need to be sent to me, although I am interested if the observation gives more information about a star's duplicity, or if a novel observing method was used. ILOC now has a copy of the P-catalog (see p. 165), so they can reduce timings of stars in that catalog, whose code for the ILOC forms is "P" (not X, etc.). A copy of reports of any graze observed should be sent to Don Stockbauer; see p. 141 of the last issue.



REPORTS OF ASTEROIDAL APPHESES AND OCCULTATIONS

Jim Stamm

If you don't have a regional coordinator who handles these reports, they should be sent to me at: Rt 13 Box 109, London, KY 40741; U.S.A. Comet events should be sent to David Dunham, P.O. Box 7488, Silver Spring, MD 20907; U.S.A. Addresses of the following regional coordinators are given on page 157.

Europe	Roland Boninsegna	GEOS
	Group Européen d'Observation Stellaire	
Australasia	Graham Blow	RASIZ
	Royal Astr. Society of New Zealand	
So. Africa	Danie Overbeek	ASSA
	Astr. Society of Southern Africa	
So. America	Ignacio Ferrin	LIADA
	Liga Iberoamericana de Astronomia	
No. America	Jim Stamm	ARP
	Asteroid Research Project	

I have summarized all of the reports that I have received for the first half of 1987 in the following two tables, and section of notes. Table 1 lists all events for which reports were received; the date, minor planet, star, observer's identification letter (these are different from those used for 1986 because of space), and a reference to notes if there are any for that particular event. Table 2 lists all of the observers who sent in reports; their identification letters, last name, first name, nearest town to point of observation, country (for North America and Australia, only the state or province is given), organization through which the report came (see above), and number of observations made in the first half of 1987. (text continues on page 161)

Table 1. Asteroidal events observed from January through June 1987.

DATE	MINOR PLANET	CATALOG	STAR	OBSERVERS	NOTE
Jan 2, 1987	619 ROSETHA	AOJ3	07° 0113	VasabCpEwKwKwFqYcm	
Jan 10, 1987	624 HECTOR	BAO	094472	Fm	
Jan 10, 1987	868 LOVA	AOJ3	20° 0648	LyFmQa	
Jan 11, 1987	298 BAPTISTINA	AOJ3	34° 0708	34 observers	1
Jan 13, 1987	54 ALEXANDRA	BAO	183058	CHVbEwMwDkSpOySmH	
Jan 16, 1987	431 NEPHELE	AOJ3	22° 0753	AngDsn	
Jan 20, 1987	136 AUSTRIA	BAO	110783	Fm	
Jan 23, 1987	601 NERTHUS	AOJ3	03° 1154	Gudn	
Jan 24, 1987	471 PAPAGENA	BAO	068664	17 observers	2
Jan 26, 1987	30 URANIA	AOJ3	17° 0944	Shuapm	3
Jan 27, 1987	704 INTERAMNA		11.1 mag	Os	
Jan 30, 1987	842 KERSTIN	AOJ3	42° 0422	8BcQuaTUzm	
Feb 1, 1987	5 METIS		10.1 mag	Bc	
Feb 1, 1987	220 ATHAMANTIS	AOJ3	01° 1130	MBew	
Feb 8, 1987	63 AUBONIA	AOJ3	08° 1429	FmQw	
Feb 12, 1987	128 NEMESIS	AOJ3	21° 0363	VYmZPRTIESRq	
Feb 13, 1987	488 KREUBA	AOJ3	184102	SHOMMOY	
Feb 13, 1987	11 PARTHENOPE	LA	122	CLan77	
Feb 14, 1987	63 AUBONIA	AOJ3	08° 1418	MB	
Feb 16, 1987	12 FORTUNA	AOJ3	18° 0303	BncFvQvRuf	
Feb 17, 1987	264 LEBUSIA	AOJ3	00° 1849	Bn	
Feb 17, 1987	211 LUTETIA	AOJ3	16° 1079	Fm	
Feb 17, 1987	102 MEROPS	AOJ3	13° 0759	SchAn	
Feb 18, 1987	320 KATHARINA	AOJ3	11° 0703	37 observers	4
Feb 22, 1987	103 HERA	BAO	159417	PolGg	5
Feb 22, 1987	509 KLANDA	AOJ3	04° 0599	CpEwOvHwWqYmQm	
Feb 26, 1987	786 MELIBOE	AOJ3	13° 1068	BncFvQvRuf	
Mar 3, 1987	101 HELBIA	AOJ3	00° 1489	Bx	
Mar 5, 1987	868 LOVA	AOJ3	22° 0604	BncCJOnGQaPwGzm	
Mar 7, 1987	1 CERES	BAO	185447	Si	
Mar 7, 1987	66 MAJIA	BAO	184392	HEBw	
Mar 7, 1987	345 TERECIA	BAO	182249	Bw	
Mar 8, 1987	43 ARADNE	AOJ3	21° 0648	12 observers	6
Mar 11, 1987	418 ELEMARINA	BAO	184291	SHONASpOy	
Mar 12, 1987	344 DESIDERATA	AOJ3	19° 1247	BcH	
Mar 13, 1987	894 EKARD	B	21.5609	18Anbc	
Mar 16, 1987	832 HERCULINA	BAO	082804	Un	
Mar 14, 1987	611 DAVIDA	BAO	100626	12 observers	7
Mar 23, 1987	16 FORTUNA	AOJ3	20° 0449	MBU	
Mar 24, 1987	146 SYBILLA	BAO	183294	BcH	
Mar 26, 1987	451 PATIENTIA		12.4 mag	Fm	
Mar 28, 1987	121 HERMIONE	BAO	158994	18 observers	8
Mar 29, 1987	198 CAMPILLA	BAO	185654	OvF	
Apr 7, 1987	11 PARTHENOPE	BAO	078661	LyFm	
Apr 7, 1987	877 WALKURE	AOJ3	22° 0644	Bc	
Apr 8, 1987	2 PALLAS		8.9 mag	AngDsnZmHn	
Apr 8, 1987	107 CAMPILLA		12.7 mag	Cp	
Apr 9, 1987	5 METIS		11.0 mag	SchAn	
Apr 11, 1987	298 BAPTISTINA	AOJ3	28° 0756	Gg	
Apr 14, 1987	504 CORA	BAO	180484	BcDbbg	
Apr 19, 1987	380 FRODIA	AOJ3	08° 1841	ShLn	
Apr 22, 1987	594 EKARD	BAO	161164	BcDgCvQvRuf	
Apr 24, 1987	160 HEWA	BAO	163472	18 observers	9
May 2, 1987	87 SYBILLA		8.8 mag	BncDth	
May 3, 1987	54 ALEXANDRA	BAO	208493	MB	11
May 9, 1987	103 HERA	BAO	159432	KvH	
May 12, 1987	200 DYNAMENE	BAO	226778	Fm	
May 14, 1987	875 EDOA	BAO	159480	QKp	
May 15, 1987	588 BLKIB	BAO	144171	OvBm	
May 16, 1987	112 IPHIGENIA	BAO	184633	OvBm	
May 25, 1987	364 ELEONORA	BAO	82039	Lp	
Jun 2, 1987	220 ATHAMANTIS	AOJ3	08° 1222	Cl	
Jun 3, 1987	432 MYTHA	BAO	187531	Si	
Jun 10, 1987	30 URANIA	AOJ3	17° 0943	MBcCvQvRuf	12
Jun 17, 1987	187 LAMBERTA	BAO	190731	Cl	
Jun 18, 1987	168 COMELEY	BAO	144423	Si	
Jun 18, 1987	847 DENISE	AOJ3	08° 2182	CpBm	
Jun 21, 1987	451 PATIENTIA		12.5 mag	CpBm	
Jun 29, 1987	583 OLYMPIA	AOJ3	20° 1817	MBcCvQvRuf	

Table 2. Observer & loc's reported Jan - June 1987.

ID	LAST NAME	FIRST NAME	CITY	COUNTRY	GROUP	NO
A1	ALLEN	BILL	CHRISTCHURCH	NEW ZEALAND	RASNZ	1
A2	ALMARAZA	MOISES	BAROQUISIMETO	VENEZUELA	LIADA	1
A3	ANDERSON	PETER	MELBOURNE	QUEENSLAND	RASNZ	6
A4	APPEMOONDO	E	BARCELONA	SPAIN	GEOS	1
A5	ATHANASOV	JAMES	NORTH PERTH	WESTERN	RASNZ	1
B1	BAETENS	C	BOECHOUT	BELGIUM	GEOS	1
B2	BAISE	D	BRUSSELS	BELGIUM	GEOS	1
B3	BALL	UNOSAY	COOPERS PLAINS	QUEENSLAND	RASNZ	1
B4	BARTHES	J	CASTRES	FRANCE	GEOS	6
B5	BENAVIDES	ALFONSO	CARACAS	VENEZUELA	LIADA	1
B6	BERTOU	O	TORINO	ITALY	GEOS	1
B7	BLANCHART	C	BRUSSELS	BELGIUM	GEOS	3
B8	BLOW	GRAHAM	WELLINGTON	NEW ZEALAND	RASNZ	4
B9	BONINSEGNA	ROLAND	DOURBES	BELGIUM	GEOS	2
B10	BOURGEOIS	J	CINEY	BELGIUM	GEOS	1
B11	BRANDT	GUSTAVO	BAROQUISIMETO	VENEZUELA	LIADA	1
B12	BRETONES	PAULO	CAMPINAS	BRAZIL	LIADA	1
B13	BRIGI	VICTOR	SANTI FE	ARGENTINA	LIADA	1
B14	BULDER	H	ZOETERMEER	NETHERLANDS	GEOS	3
B15	BULLON	JM	VALENCIA	SPAIN	GEOS	1
B16	BUSQUITS	J	TABERNES BL	SPAIN	GEOS	1
C1	CARPENTER	HJT	CRAYFORD	UNITED KINGDOM	GEOS	1
C2	CASAS	R	SABADEL	SPAIN	GEOS	2
C3	CHURKIS	JOE	CAPE TOWN	SOUTH AFRICA	ASSA	1
C4	CIQUERA	I	VALENCIA	SPAIN	GEOS	2
C5	CLARK	MAURICE	ARMADALE	WESTERN	RASNZ	1
C6	CLETTE	F	BRUSSELS	BELGIUM	GEOS	1
C7	CLUYSE	L	TIELT	BELGIUM	GEOS	1
C8	COLOMBA	A	REGGIO CALABRIA	ITALY	GEOS	2
C9	COMERON	F	MATERO	SPAIN	GEOS	1
C10	COOPER	TIM	EAST RAND	SOUTH AFRICA	ASSA	7
C11	CORTE SI	S	LUCERNE	SWITZERLAND	GEOS	1
C12	COURBIN	F	VERNON	FRANCE	GEOS	1
C13	CUTHILL	LAIRD	WEST BERLIN	NEW JERSEY	ARP	1
C14	DE FARIA	CRISTOVAO J	BELO HORIZONTE	BRAZIL	LIADA	1
C15	DE KLERK	J	POTCHESBROOM	SOUTH AFRICA	ASSA	3
C16	DEL CASTILLO	A	VALENCIA	SPAIN	GEOS	1
C17	DELANHAYE	F	BOURDEAUX	FRANCE	GEOS	2
C18	DEQUINZE	R	VELAINE	BELGIUM	GEOS	3
C19	DEKIE	ROSS	GORE	NEW ZEALAND	RASNZ	2
C20	DONHAM	DAVID	EAST BRUNSWICK	NEW JERSEY	ARP	1
C21	EARLE	G	EAST RAND	SOUTH AFRICA	ASSA	4
C22	EITERT	JOE	AMES	IOWA	ARP	1
C23	ELKOTT	A	LEEDS	UNITED KINGDOM	GEOS	1
C24	ESPINOZA	EDGAR	TARLUA	BOLIVIA	LIADA	1
C25	EVANS	GLEN	OXFORD	NEW ZEALAND	RASNZ	1
C26	EWALD	D	BESSENTHAL	EAST GERMANY	GEOS	2
C27	FABREGAT	J	VALENCIA	SPAIN	GEOS	1
C28	FABA	DALBERT	CUGNAUX	FRANCE	GEOS	1
C29	FERRIN	IGNACIO	MERIDA	VENEZUELA	LIADA	1
C30	FLEET	R	HAFARE	SOUTH AFRICA	ASSA	1
C31	FRASER	B	JOHANNESBURG	SOUTH AFRICA	ASSA	2
C32	FREEMAN	TONY	BERKELEY	CALIFORNIA	ARP	7
C33	FUENTES	RAFAEL	BAROQUISIMETO	VENEZUELA	LIADA	1
C34	FUENTES	RUBEN	BAROQUISIMETO	VENEZUELA	LIADA	1
C35	GABEL	A	MAINEZ	WEST GERMANY	GEOS	1
C36	GALLO	V	SALERNO	ITALY	GEOS	1
C37	GARCIA	J	LISBOA	PORTUGAL	GEOS	2
C38	GARDE	T	SHURUGWE	SOUTH AFRICA	ASSA	1
C39	GEORGE	ANTHONY	SALEM	OREGON	ARP	1
C40	GEORGE	DOUG	OTTAWA	ONTARIO	ARP	3
C41	GERRITSEN	A A	AMSTERDAM	NETHERLANDS	GEOS	1
C42	GEYSER	M	PRETORIA	SOUTH AFRICA	ASSA	6
C43	GILMORE	ALAN	MT JOHN OBSERV	NEW ZEALAND	RASNZ	1
C44	GIUNTOLI	M	MONSUMMANTO	ITALY	GEOS	1
C45	GOLDING	ERIC	HAMILTON	ONTARIO	ARP	1
C46	GOLTZ	W	PENSHURST	NEW SOUTH WALES	RASNZ	1
C47	GOMEZ	J	MOLLET	SPAIN	GEOS	1
C48	GOMEZ	J	MOLLET	SPAIN	GEOS	1
C49	GONCALVES	R	LISBON	PORTUGAL	GEOS	2
C50	GONZALEZ	JUAN	BAROQUISIMETO	VENEZUELA	LIADA	1
C51	GONZALEZ	SANTOS	BAROQUISIMETO	VENEZUELA	LIADA	1
C52	GRAHAM	FRANCIS	OIL CITY	PENNSYLVANIA	ARP	1
C53	GRIMAN	ALFREDO	CARACAS	VENEZUELA	LIADA	1
C54	GRUNNET	C	VIRUM	DENMARK	GEOS	1
C55	GRUP D'ESTUDIS	ASTRONOMICS	PERA	SPAIN	GEOS	1
C56	GUEDEZ	FREDDY	BAROQUISIMETO	VENEZUELA	LIADA	1
C57	GUERISSE	J D	BRUSSELS	BELGIUM	GEOS	3
C58	GUERRERO	JESUS	BAROQUISIMETO	VENEZUELA	LIADA	1
C59	GUESSE	M	NOUAKCHOTT	MAURITANIA	GEOS	5
C60	HARVEY	D	MT NEBO	QUEENSLAND	RASNZ	1
C61	HERS	JAN	SEGEFELD	SOUTH AFRICA	ASSA	1
C62	HICKEY	DAVID	REDCLIFFE	QUEENSLAND	RASNZ	1
C63	HICKEY	TERRY	CABOCLURE	QUEENSLAND	RASNZ	1
C64	HUTCHESON	STEVE	TOOMBOOMBA	QUEENSLAND	RASNZ	1

Table 2, continued.

ID	LAST NAME	FIRST NAME	CITY	COUNTRY	GROUP	No
H	HUTCHEON	STEVE	SHELDON	QUEENSLAND	RASNZ	7
I	IZAGUIRRE	JOSE	PUERTO ORDAZ	VENEZUELA	LIADA	1
J	JOIST	JAHN	MOLLN	WEST GERMANY	GEOS	1
K	KNIGHT	J.	EAST RAND	SOUTH AFRICA	ASSA	2
K	KNIGHT	S.	EAST RAND	SOUTH AFRICA	ASSA	1
K	KNOFEL	A.	KARL MARX-STD	EAST GERMANY	GEOS	1
K	KOHL	M.	USTER	SWITZERLAND	GEOS	2
K	KOPP	M.	VELBERT	WEST GERMANY	GEOS	2
K	KRUGSHOOP	ALFRED	MT. WAVERLEY	VICTORIA	RASNZ	1
L	LAURET	RAFAEL	CARACAS	VENEZUELA	LIADA	1
L	LANGHANS	THOMAS	SAN BRUNO	CALIFORNIA	ARP	2
L	LEE	RAY	WANGANUI	NEW ZEALAND	RASNZ	1
L	LEON	JOHNNY	BAROUSIMETO	VENEZUELA	LIADA	1
L	LEVAJ	RENATO	SÃO PAULO	BRAZIL	LIADA	1
L	LEUREUX	A.	BRUSSELS	BELGIUM	GEOS	1
L	LEPSKI	P.	DRESDEN	EAST GERMANY	GEOS	1
L	LOADER	BRIAN	CHRISTCHURCH	NEW ZEALAND	RASNZ	1
L	LYZENGA	GREG	ALTADENA	CALIFORNIA	ARP	2
M	MACDOUGAL	CRAIG	TAMPA	FLORIDA	ARP	1
M	MANLY	PETE	CENTRAL	ARIZONA	ARP	1
M	MANLY	SUSAN	CENTRAL	ARIZONA	ARP	1
M	MANTILLA	JAIRO	MÉRIDA	VENEZUELA	LIADA	1
M	MARCH	M.	MATARO	SPAIN	GEOS	1
M	MARSHALL	G.	JOHANNESBURG	SOUTH AFRICA	ASSA	1
M	MARTI	J.	MATARO	SPAIN	GEOS	1
M	MARTINEZ	CLAUDIO	BUENOS AIRES	ARGENTINA	LIADA	1
M	MARX	M.	STUTTGART	WEST GERMANY	GEOS	2
M	MAZALAEY	P.	VERNON	FRANCE	GEOS	1
M	MCCULLOUGH	ROBERT	BIG RAPIDS	MICHIGAN	ARP	1
M	MCRAE	A.	JOHANNESBURG	SOUTH AFRICA	ASSA	1
M	MENGOLI	G.	BOLOGNA	ITALY	GEOS	1
M	MICHE	D.	JOHANNESBURG	SOUTH AFRICA	ASSA	1
M	MIRALDA	J.	PERAFITA	SPAIN	GEOS	1
M	MOLERO	HEBERT	MÉRIDA	VENEZUELA	LIADA	1
M	MOLINA	MAURICIO	CARACAS	VENEZUELA	LIADA	1
M	MORRISBY	A.	BULAWAYO	SOUTH AFRICA	ASSA	4
M	MOTTRAM	K.	TOOWOOMBA	QUEENSLAND	RASNZ	1
M	MOYLAN	G.	TOOWOOMBA	QUEENSLAND	RASNZ	1
M	MUNFORD	NOEL	PALMERSTON NO.	NEW ZEALAND	RASNZ	1
M	MURPHY	D.	TOOWOOMBA	QUEENSLAND	RASNZ	1
M	MURPHY	T.	TOOWOOMBA	QUEENSLAND	RASNZ	1
M	MURRAY	TONY	GEORGETOWN	GEORGIA	ARP	2
N	NAPOLITANO	G.	S. MARIA D. MOLE	ITALY	GEOS	1
N	NELSON	PETER	KORUMBURRA	VICTORIA	RASNZ	1
N	NOBEL	W.	MUDERBERG	NETHERLANDS	GEOS	2
O	OBSERVATORY	PERTH	PERTH	WESTERN	RASNZ	1
O	OCARIZ	JOSE H.	MÉRIDA	VENEZUELA	LIADA	1
O	ORTIZ	CARLOS	BAROUSIMETO	VENEZUELA	LIADA	1
O	OVERBEEK	DANE	EAST RAND	SOUTH AFRICA	ASSA	9
P	PALZER	W.	WIESBADEN	WEST GERMANY	GEOS	1
P	PANNIER	L.	GORLITZ	EAST GERMANY	GEOS	2
P	PARK	JIM	OLEN WAVERLEY	VICTORIA	RASNZ	1
P	PARRA	GUSTAVO	BAROUSIMETO	VENEZUELA	LIADA	1
P	PARRA LUENA	J.	SANTANDER	SPAIN	GEOS	1
P	PENA	ALEXIS	BAROUSIMETO	VENEZUELA	LIADA	1
P	PEREZ	PABLO	BAROUSIMETO	VENEZUELA	LIADA	1
P	PERCE	ANDREW	NORTH PERTH	WESTERN	RASNZ	1
P	PIRTI	J.	NAGYKANIZSA	HUNGARY	GEOS	1
P	POTERMA	JOHN	OIL CITY	PENNSYLVANIA	ARP	1
P	PREDOM	CHRIS	WEST HAVEN	CONNECTICUT	ARP	1
P	PRIESTLEY	JOHN	PUKERUA BAY	NEW ZEALAND	RASNZ	2
Q	QUINTANA	CARLOS J.	CARACAS	VENEZUELA	LIADA	1
R	RAMON	J.	VALENCIA	SPAIN	GEOS	1
R	RASPADORI	G.	BOLOGNA	ITALY	GEOS	1
R	REGHEERE	G.	GRENOBLE	FRANCE	GEOS	1
R	RENOU	A.	BRISAC	FRANCE	GEOS	2
R	RILEY	PHILIP	WELLINGTON	NEW ZEALAND	RASNZ	1
R	RIVAS	L.	TABERNES BLA	SPAIN	GEOS	1
R	RIZZO	RICARDO	BUENOS AIRES	ARGENTINA	LIADA	1
R	RODRIGUEZ	VICTOR	TEJERIA	VENEZUELA	LIADA	1
R	ROJAS	JOSE	TARLA	BOLIVIA	LIADA	1
R	ROMJUN	J.J.	LEIDEN	NETHERLANDS	GEOS	1
R	RONDON	FREDDY	BAROUSIMETO	VENEZUELA	LIADA	1
R	ROZENBAUM	SAMI	CARACAS	VENEZUELA	LIADA	1
R	RUDENKO	MICHAEL	AMHERST	MASSACHUSETTS	ARP	1
S	SAMOLYK	G.	WEST ALLIS	WISCONSIN	ARP	3
S	SANCHEZ	DARWIN	BAROUSIMETO	VENEZUELA	LIADA	1
S	SANCHEZ	DOMINGO	PUERTO ORDAZ	VENEZUELA	LIADA	1
S	SANCHEZ	GILBERT	BAROUSIMETO	VENEZUELA	LIADA	1
S	SANCHEZ	JENNY	BAROUSIMETO	VENEZUELA	LIADA	1
S	SANCHEZ	RAFAEL	BAROUSIMETO	VENEZUELA	LIADA	1
S	SCHAEFER	BRAD	CERRO TOLOLO	CHILE	LIADA	1
S	SCHIEB	D.	ILLFURTH	FRANCE	GEOS	1
S	SCHILLER	D.	EAST RAND	SOUTH AFRICA	ASSA	3
S	SCHNABEL	C.	BARCELONA	SPAIN	GEOS	4

Table 2, concluded.

ID	LAST NAME	FIRST NAME	CITY	COUNTRY	GROUP	No
S	SCHOLTEN	A.	EEBEEK	NETHERLANDS	GEOS	1
S	SERNE	P.	LEIDEN	NETHERLANDS	GEOS	1
S	SMIT	J.	PRET. XHA	SOUTH AFRICA	ASSA	8
S	SMITH	CHARLIE	WOODRIDGE	QUEENSLAND	RASNZ	8
S	SOMMAGNE	D.	SOMMAGNE	BELGIUM	GEOS	1
S	SPECOLA SOLARE	LOCARNO	LUCERNE	SWITZERLAND	GEOS	1
S	SPOELSTRA	J.	POTCHERSTROOM	SOUTH AFRICA	ASSA	3
S	STAMM	JIM	LONDON	KENTUCKY	ARP	4
S	STAMM	JIM	MAYSVILLE	KENTUCKY	ARP	1
S	STOKER	MAURICE	AUCKLAND	NEW ZEALAND	RASNZ	1
S	SWANSON	BRENT	CEDAR CITY	UTAH	ARP	1
T	TAYLOR	W.	WAKEFIELD	UNITED KINGDOM	GEOS	1
T	THRONET	Y.	BRUSSELS	BELGIUM	GEOS	5
T	THOORIS	B.	WERVIK	BELGIUM	GEOS	2
T	TRENTIN	S.	BOLOGNA	ITALY	GEOS	1
T	TRUJILLO	MACEDONIO	TARLA	BOLIVIA	LIADA	1
T	TULIPANI	F.	BOLOGNA	ITALY	GEOS	1
V	VAN BLOMMESTEIN	P.	CAPE TOWN	SOUTH AFRICA	ASSA	1
V	VAN ELLINGHUYZEN	J.	BLOEMFONTEIN	SOUTH AFRICA	ASSA	1
V	VAN LOO	F.	GENK	EAST GERMANY	GEOS	1
V	VILLEGAS	SILVINA	BUENOS AIRES	ARGENTINA	LIADA	1
V	VINCENT	KEITH	WELLINGTON	NEW ZEALAND	RASNZ	1
V	VINSON	ED.	DUNCAN	OKLAHOMA	ARP	1
V	VITMATCHANKA	ANATOLI	TARLA	BOLIVIA	LIADA	1
V	WALLACE	R.	JOHANNESBURG	SOUTH AFRICA	ASSA	1
W	WUNSCHE	N.	DREIBACH	EAST GERMANY	GEOS	1
Y	YAMAGUCHI	WALTER	TARLA	BOLIVIA	LIADA	1
Y	YUEN	TAK YUN	BAROUSIMETO	VENEZUELA	LIADA	1
Z	ZALLES	RODOLFO	TARLA	BOLIVIA	LIADA	1
Z	ZIMMERMANN	L.	BRUSSELS	BELGIUM	GEOS	8
Z	ZISSELL	R.E.	SOUTH HADLEY	MASSACHUSETTS	ARP	1
??	??	??	ABASTUMANY	SOVIET UNION	GEOS	1

period. The notes section indicates those reports where positive observations were made, 12 or more observers participated, full reports published elsewhere in O.N., or where other significant activity was recorded.

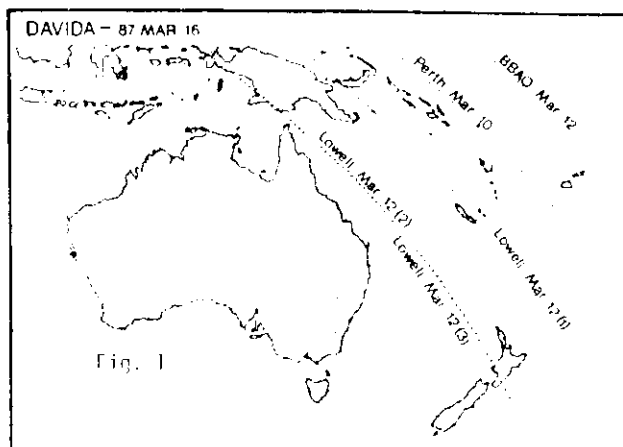
The appropriate report form has been included for you with this issue (except for ASSA). Use a copy of it when reporting your observations to IOTA.

Notes: Events from January through June 1987, referenced in Table 1.

- 1) Observers were BtBbBdBjGqCsGcFCyCmCrDhDsElFbGrGmGsGuMrMttYlBbRvRuRoSuSeSaTyTtVfZmRz. Romijn reported a 3.2-sec. occultation beginning at 20:23:33.2, but it was not confirmed by Serne, who was only 44 meters away.
- 2) Observers: CtMlZsGeDnPhGmSyGqRkEtArGcGuMsApPi.
- 3) Pete and Susan Manly reported a blink at 10:34:31, a 1-sec. disappearance at 10:37:30, and a 4-sec. disappearance at 10:39:27.5.
- 4) Observers for this event were SyVnlvMwVlRfEiMiMeOcQnLaRmBvIzSzMmGpPnSjSdSrGjLeSqYuBaOtGfGxGbPrPzAzFuRnFn. 37 in all -- a record since! -- have been reporting these events! A 5-sec. disappearance was recorded by Jose Izaguirre and Domingo Sanchez from Puerto Ordaz, Venezuela, beginning at 03:43:25. This indicates a diameter of at least 20.4 km. Sanchez notes that the occultation took place 16 minutes later than Gollin's prediction.
- 5) A 5-sec. blink was observed by Doug George at about 08:18:01.
- 6) Observers were BcBnBdCoJqGjLHmXpWtThZm. Falzer recorded three occultation events under a clear sky. All were gradual from 23:48:42 to 23:48:50, from 23:56:28 to 23:56:38, and from 23:58:?? to 23:59:?? (about 4 sec.).

Notes 7 and 8 were taken from reports received from Graham Blow, and published in CIRCULAR CQ 8712 (July

1957) of the Occultation Section of the Royal Astronomical Society of New Zealand



- Edwin Goffin's original prediction placed this event across central New Zealand and the coast of Queensland, Australia. Perth Observatory obtained a plate on the 10th, and Black Birch Astrometric Observatory and Lowell Observatory each obtained plates on the 12th. The paths are shown in Fig. 1. Graham Blow notified a number of observers in the affected area, and two positive records were obtained. Details:

Observer: Graham Blow at Carter Observatory in Wellington

Longitude: $174^{\circ} 46' 01.05''$ E

Latitude: $41^{\circ} 17' 09.37''$ S

Height: 129 meters

Disappearance at $15:27:17.4 \pm 0.1$

Reappearance at $15:27:36.7 \pm 0.1$

Observer: J. Priestley at Pukera Bay (10 km north of Wellington)

Longitude: $174^{\circ} 55' 50.19''$ E

Latitude: $41^{\circ} 01' 56.6''$ S

Height: 61 meters

Reappearance at $15:27:36.6$

It is fortunate that this event was recorded at all. In Wellington it was quite clear up until about 20 minutes before the event, and again about 40 minutes afterwards, but the clouds became thicker and thicker as event time approached. The image was difficult to see on the video screen, and a few seconds after reappearance, the star was obscured completely. Priestley could see the star clearly up to about 15:26:40, when cloud obscured the field; when the cloud cleared at 15:27:22.2, the star was missing, a definite reappearance occurring about 14 seconds later.

Following the path out across the Tasman indicates that it would have skimmed just off the coast of Queensland. Observers who monitored there were:

Charlie Smith	Woodridge	15:11	to 15:50
Peter Anderson	The Gap	15:20	to 15:45
Steve Hutcheon	Maroochy	15:15	to 15:50
Lindsay Ball	Coopers Plains	15:09:30	to 15:45
David Hickey	Redcliffe	15:15	to 15:47
Jeremy Hickey	Caboolture	15:25	to 15:48
D. Harvey	Mt. Neb	15:15	to 15:45

Observers farther south were:

Alfred Krughoop Mt. Waverley, Victoria

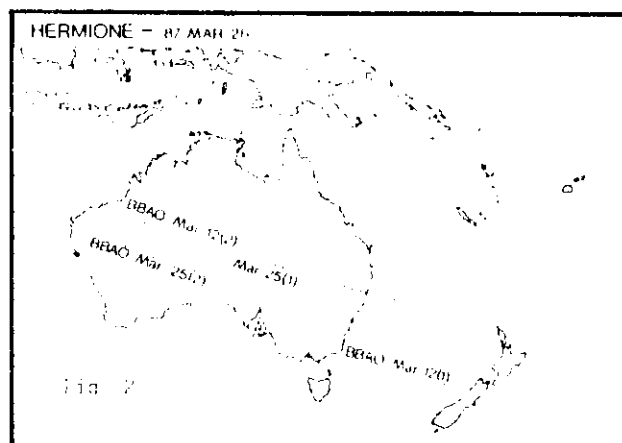
15:31 to 15:49

Maurice Stoker Auckland, N.Z. 15:27 to 15:31

Ross Dickie Gore, N.Z. 15:25 to 15:44

The observed occultation path coincides closely with paths predicted by Lowell. Graham is concerned that the data from BBAO and Perth differ so much from that of Lowell, and he is working on the problem with Craig Bowers in Perth, and others. A positive result of this occultation however, was that it was able to show up several errors in the prediction routines used in Wellington. These have been corrected, and now the update paths agree very closely with those from the Lowell programs.

- Geoff Douglas at BBAO obtained 4 consistent plates for this event, placing the path over southeastern Australia, as shown in Fig. 2. However, Bob Millis at Lowell obtained a plate which indicated a path over India. Graham Blow respected the consistency of the BBAO plates, and notified a large number of observers, resulting in the largest turnout for an Australasian asteroidal event so far.



While the main event was not observed anywhere, Perth Observatory did photoelectrically record a strange drop of 0.25 magnitude at the time of the event. This is discussed later. Those who monitored from Australia were:

Steve Hutcheon	Woodburn	17:40 to 18:09
Peter Anderson	The Gap	17:40 to 18:07
Charlie Smith	Woodridge	18:04 to 18:17:18
Maurice Clark	Armadaile	17:55 to 18:15
James Athanasov	North Perth	17:50 to 18:20
Andrew Pierce	North Perth	17:50 to 18:20

New Zealand observers were:

Bill Allen	Christchurch	17:42 to 17:58
Brian Loader	Christchurch	17:37 to 18:15
Noel Munford	Palmerston North	17:40 to 18:18
Glenn Evans	Oxford	17:42 to 18:12
Alan Gilmore	Mt. John Obs.	17:48 to 18:19
Keith Vincent	Wellington	17:42 to 18:05
J. Priestley	Pukera Bay	17:52 to 18:05
Graham Blow	Wellington	17:42 to 18:05
Ross Dickie	Gore	17:49 to 18:07
Ray Lee	Wanganui	?? to 18:00
Philip Riley	Wellington	?? to 18:00

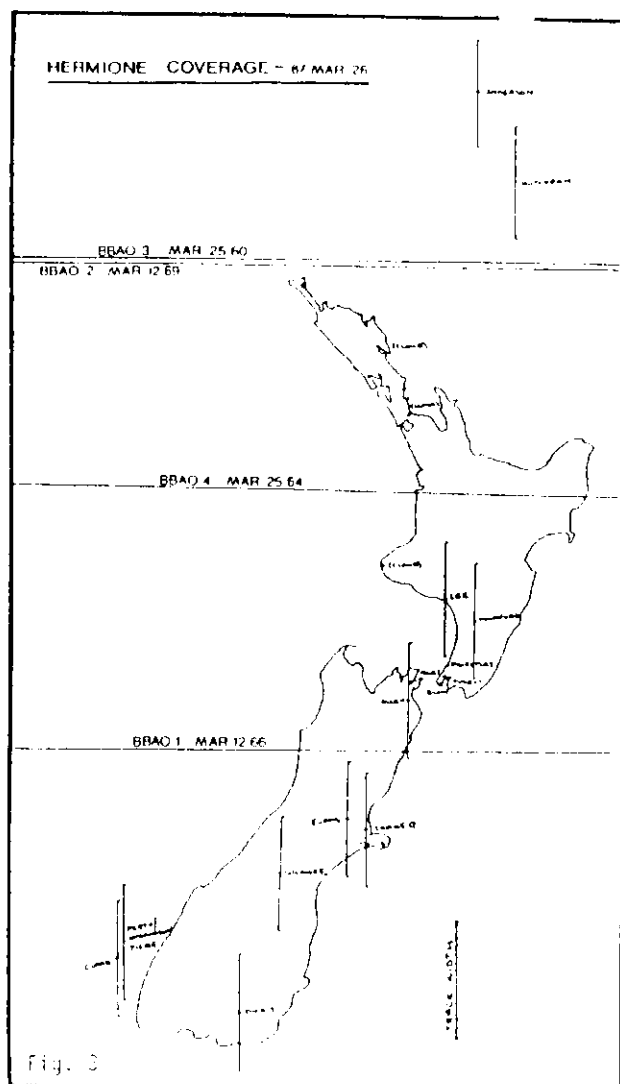
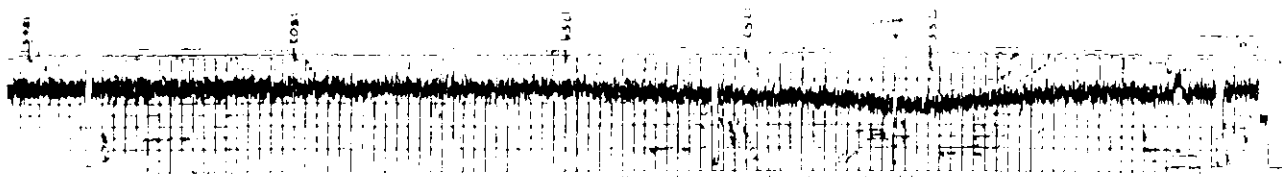


Fig. 3

As Fig. 3 indicates, overall cross-track coverage was good, with the only area not covered being a clouded-out gap of $0^{\circ}27'$ (2.7 track widths) over the northern North Island and Sydney - Siding Spring area. This region unfortunately coincides with the mean of the four predicted BBAO tracks. Blow suspects that the occultation occurred in the gap, but because of Lowell's generally highly accurate astrometry, he is not totally confident. The discrepancy remains unresolved, but is being researched.

Fig. 4 is a reproduction of the photoelectric record that Perth obtained very close to the predicted event time. This took the form of a



HERMIONE - 1987 Mar 26

END

0.25-magnitude drop commencing at 17:53.7, reaching minimum at 17:55.15, and then rising slowly to regain full brightness at 17:58.9. Both Craig Bowers and Peter Birch are adamant that there was no cloud at the time, and that the observatory never experiences airplane contrails. One explanation that Blow proposes is that some sort of absorbing material might be surrounding the asteroid. This explanation has been suggested before (o.w. (15), 325) by V. B. Kapkov for the photoelectric record that Engelgardt Observatory obtained of a Pallas event. Fig. 5 is a reproduction of the data. Comparison with Fig. 4 shows a similar pattern.

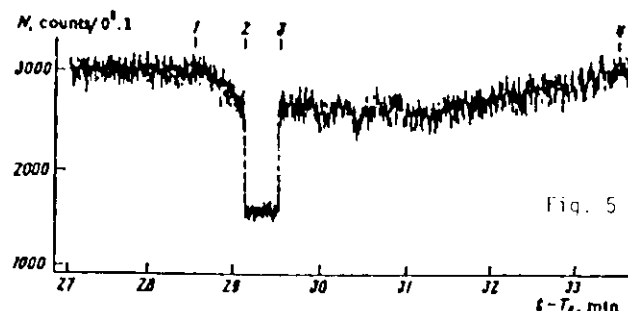
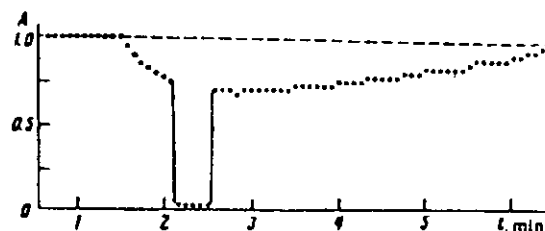


Fig. 5

The occultation curve. $T_0 = 1983 \text{ May } 4^{\text{d}22^{\text{b}}} \text{ UT.}$



A computer model of the occultation of a $9^{\text{m}}.2$ star by a $10^{\text{m}}.5$ asteroid accompanied by a cloud of gas and dust. Model parameters: $a = 2000 \text{ km}$, cloud eccentricity $e = 0.08$, particle density $3 \cdot 10^8 \text{ m}^{-3}$, grain radius $R = 1 \mu$, constant $r_0 = 2400 \text{ km}$, $F = 0$. The ordinate A is the normalized star brightness.

If the Hermes event was caused by a non-circular cloud of orbiting debris, its linear extent would be 2600 km. Interestingly, twice the "radius of sphere of influence," as tabulated by David Dunham, is very close to this value, at 2614 km. However, one might then have expected the main occultation band to have passed close to Perth.

- 9) Kohl reported a "spurious?" 4.1-sec. occultation beginning at 02:46:56.3.
- 10) Observers were BhBcBnBuDqGsKIMxMoPeRpRhItInIo.
- 11) Two blinks of about $1/10$ sec., separated by $1/2$ sec. were observed in the 57th sec. of 08:35. They "seemed like atmosphere, but the rest of the time the images were rock-steady."

Fig. 4

START

11. Morrisby reported a 1-sec. disappearance at 17 04:03 \pm 1 sec. Disappearance and reappearance were not quite instantaneous. Other field stars remained at the same brightness. The event was 9 minutes earlier than Goffin's prediction.

1987 MAY 22 APPULSE OF SAO 175746 BY COMET WILSON

Luiz Augusto L. da Silva

I observed the subject appulse using the 0.5-m Cassegrain reflector of Morro Santana Observatory at Porto Alegre, Brazil, to continuously monitor the star, starting at 22h 25m UT, and ending at 22h 26m 40s, through a window of clear sky in the cumulus clouds. In spite of the relatively small predicted magnitude drop (0.34), I think it is possible to affirm that there was no occultation. The nucleus of the comet passed to the west of the star, and at 22h 25m it was impossible to distinguish the central condensation; the comet merged with the star. At 22h 26m 37s, the coma was visible again. The predicted closest approach for my position was about 22h 23m UT. At that time, the star and the comet were separated.

MORE ON REPORTING OCCULTATIONS ON DISKETTE
AND OTHER NEWS FROM ILOC AND ILOC

David W. Dunham

The format and procedures for reporting occultation observations as ASCII files on IBM-PC-compatible floppy disks was given in my article in *O.N.* 4 (5), pp. 92-97. A couple of minor errors were made in Figure 1 on p. 93. A fourth line, just under the "REPRESENTATIVE" line, was left out; it should read, starting in column 1, "REPORTED TO ILOC, IOTA." Also, "0.3" was omitted from the OC line (TERRY JOSON-SKY); it should be in columns 44-46, like in the OA and OB lines. These errors were corrected before I sent anybody copies of the figure data on diskette.

On January 20th, during another business trip to Tokyo, Mitsuru Soma and I visited the International Lunar Occultation Centre (ILOC), where we had discussions with Akio Senda and Yoshio Kubo. As of that date, only three people had sent them observations on diskette, including me. But it was only twenty days after the end of 1987, and many observers probably had not had time to complete entering their data for 1987 and mailing it so as to be received by ILOC by then. At the time, ILOC did not have their system ready to accept data from diskette for direct residual computation, but they were working on it, expecting implementation soon. ILOC does hope to receive more data on diskettes, and to encourage it, they will process the diskette data much more quickly than manually completed forms. They plan to process data in batches a few times a year, so that those sending diskettes should get preliminary residuals back within 2 to 3 months. Observers who make errors in their data, that causes the residual calculation to fail, will be sent the page giving the error message that will show which observation caused the error.

Return by diskette and the need for regional data centers. So far, ILOC has returned diskettes sent to them. However, diskettes (at least in the U.S.A.) are now quite inexpensive, costing as little

as 25 cents, much less than the cost to mail them, especially by air mail overseas. Asking someone to return a diskette is becoming almost like asking someone to return the paper on which a letter is written. From now on, ILOC will return diskettes only upon request. Sometime in the future, ILOC might be able to return the residual output in ASCII files on the diskettes sent by the observer, a suggestion by Peter Manly. Peter also suggests that, to decrease overseas mailing costs, the observations of several observers in a city, or in a country, be included on a single diskette. This requires a network of local, regional, and national coordinators, as I already suggested in my *O.N.* 4 (5) article. So far, I have received only two offers to enter other observers' data onto diskette, as follows:

For Australia: Peter Nelson; RMB 5578; Bloomfield Road; Nilma 3821; Australia.

For New Mexico: MacPherson Morgan; 408 Monte Largo Drive NE; Albuquerque, NM 87123. He notes that, in last December's roster, there are no other IOTA members or *O.N.* subscribers in New Mexico [Ed: still true], so he volunteered to help with data entry for others. I have sent him some graze reports using non-standard forms.

Others already may have made arrangements to coordinate this work in their cities, states, or countries. If so, or if you are willing to do some of this valuable work, please write to me at P.O. Box 7488; Silver Spring, MD 20907; U.S.A., so that I can include your address as a contact point in a future issue.

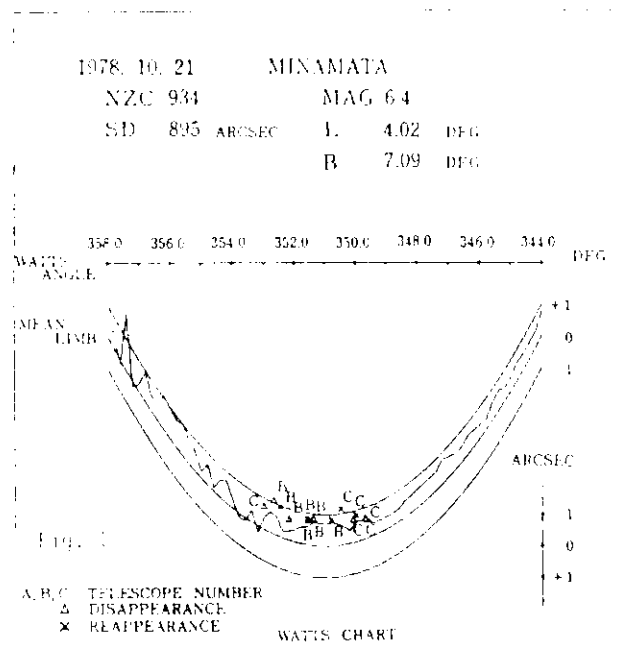
Data entry by menu. I find that, using a copy of an old observation dataset as a template, it is easier to type new data to create a new observation dataset on diskette, than it is to manually fill out a form. To make the job even easier, Peter Manly has created a program in Basic called IOTADATA (see p. 167) that is a menu-driven system prompting the observer for information needed to create the diskette dataset. It should help observers to submit complete, error-free datasets to ILOC. The IOTADATA program uses the last four columns (76-80) of the REPRESENTATIVE line for a right-justified integer number that is a sequential version number of the menu program. These columns should be left blank by those who write their files with a text editor, rather than using the menu program.

File names. Peter Manly suggests that we standardize the naming of files, or datasets, containing occultation observations on diskette. For total occultations, I suggest using "ssss:yyx.occ," where ssss is the ILOC station code, yy is the last two digits of the calendar year, and x (not used) if data for the whole year are included, - a for data for the first half of the year, and = b for data for the second half. An example for my station in Silver Spring covering the second half of 1987 would be: sa18787b.occ; my station is SA187. For grazing occultation expedition results, I suggest "ooyymmdd.grz," where oo are the expedition leader's initials, yy is the last two digits of the year, mm is the month number, and dd is the day of the month. Hence, the data for the 1987 July 20th graze that I led are in dd870720.grz. For minor planet occultations and appulses, the same format can be used with oo either the observer or a regional or local coor-

inator, and replacing the extent "grz" with "mpa" or "mpo" (minor planet apulse or minor planet occultation, respectively)

Provides occultation data. These should now be sent to ILOC, without a copy to me, like regular total occultation reports. I gave ILOC a copy of the U.S. Naval Observatory's (USNO's) detailed Pleiades (P) catalog used to compute the special USNO Pleiades occultation predictions. I also gave ILOC a copy of diskette files giving lunar limb correction data for Watts angle 36°0, sent to me earlier by David Herald. Herald had discovered that all of the data for only Watts angle 36°6 is wrong in the Watts dataset at USNO, and presumably also those at HMNAO (Her Majesty's Nautical Almanac Office) and at ILOC, since all were derived from digitization of Watts' charts by HMNAO.

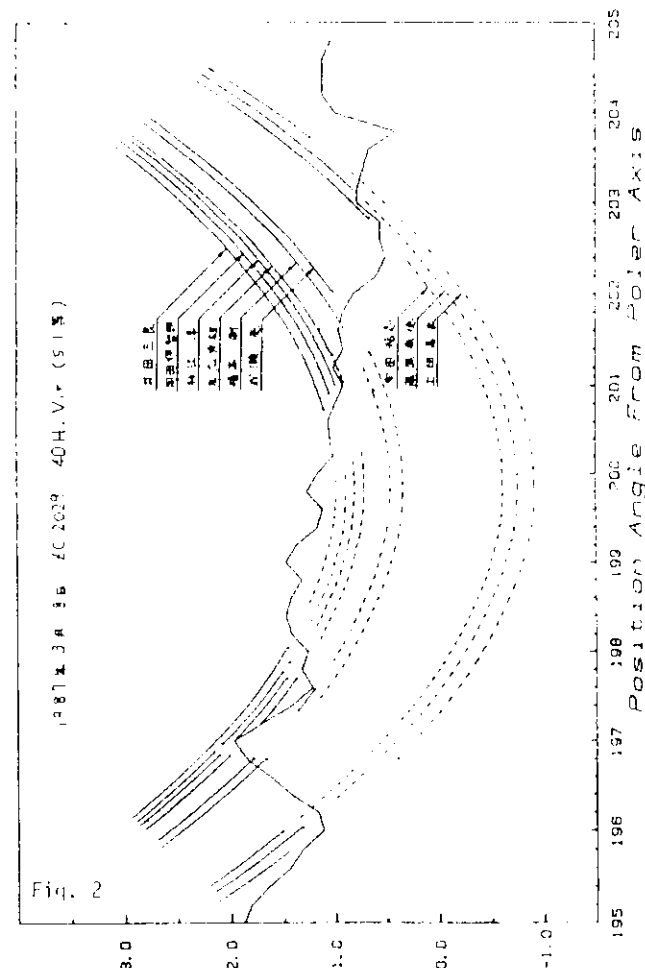
and grazing occultations. Although ILOC does not currently prepare reduction profiles for grazes reported to them, as HMNAO often did, they do realize that graze observations have special value, and have themselves mounted several three-station expeditions to various parts of Japan. They are now undertaking expeditions twice a year, but most efforts are negated by clouds. From 1978 through 1986, they obtained data during 5 grazes, details of which are reported in a Hydrographic Department publication. The reduction profile published for their timings of the graze of 6.4-mag. Z.C. 934, observed near Minamata on 1978 October 21, is reproduced in Figure 1. Summaries of the five expeditions will be reported in Stockbauer's list in the next issue of *OLN*.



ILOC plans to send me a magnetic tape containing all occultation timings that they have on record from 1940 to 1987. They plan to send it in April, which will give them time to include at least their own observations made during 1987. I will provide the data to Joseph Carroll for use in preparing his total occultation tallies, and will later try to pro-

vide it to Don Oliver for our delayed grazing occultation expedition summary work. Later, we will try to use the data for our own reductions at USNO.

Lunar Occultation Observers' Group. The LOOG, composed mostly of Japanese amateur astronomers, observed several grazes during 1987. A reduction profile for one of these events, which occurred on March 18th, was provided by Toshio Hirose and is shown in Figure 2. On December 31st, 37 stations were set up in northern Honshu for a bright-limb graze of Alcyone, the largest graze expedition so far in Japan. Skies were clear, but some stations were not successful due to either the bright limb, lack of experience, or a combination of the two. Perhaps a preliminary reduction profile will be ready when I return to Japan on my next business trip there in late May.



Isao Sato obtained time on the Kiso Observatory Schmidt telescope, which he used to take a plate of (324) Bamberga and SAO 41263 (see p. 145 of the last issue). Using Sato's measurements of the plate, Mitsuru Soma calculated a 0.29 south shift for the December 8th occultation, in much better agreement with astrometry by Lick and Lowell observatories, and the actual occultation, than their estimate of the uncertainty, ±1.0. Soma alerted observers in northern and western Japan, based on the astrometric update that I relayed to him via Hiroki Yokota at the Institute of Space and Astronautical Science,

since our update had a smaller estimated error. An observer named Odaqiri, in Aomari City in the northernmost part of Honshu, timed a 24-second occultation by Bamberg. Another observer farther south saw no occultation by Bamberg, but timed a possible short secondary extinction.

THE DELTA SCORPII GRAZE NEAR WELLTON, ARIZONA, ON 1985 JULY 27

Gerald W. Rattley and David W. Dunham

On 1985 July 27, Rattley organized an expedition to observe the graze of 2.5-magnitude Delta Scorpii (Z.C. 2290 = SAO 184014) from a rural crossroads named Asher, 4 miles east of the city of Wellton, in southwestern Arizona. The graze was listed in *O.N.* 7 (13), p. 274, with a brief account on the following page. Most expedition participants were members of the Saguaro Astronomy Club from the Phoenix area, but they were joined by the Dunhams from Maryland (who were visiting relatives in southern California that week) and by Laveda Oliver from Bakersfield, CA. At the time, it set a record for the most stations with video setups, 4. Since the star is a close double and each station timed events involving both components, it still holds the record for the most video chords obtained during a graze, 8. The secondary seems to be about 2 magnitudes fainter than the primary. The star's duplicity is discussed in *O.N.* 1 (1), p. 5 and 10, and (3), p. 21. The duplicity was discovered visually during a total occultation at the turn of the century, as reported in *Mon. Not. R. A. S.* 61, p. 414. The star is actually

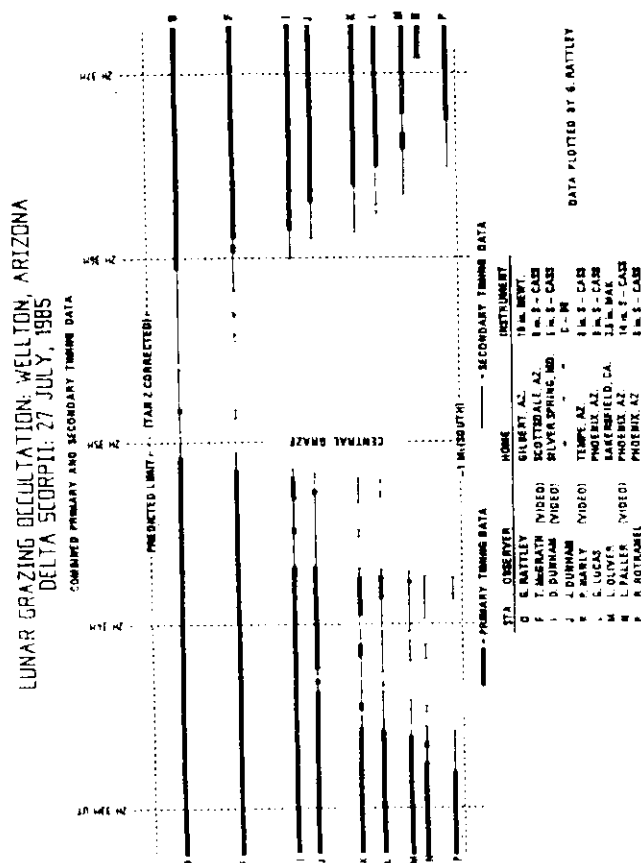


Fig. 1

triple, since the primary is a spectroscopic binary with a period of 20 days. The component that we observed can not be the spectroscopic secondary, since it must be less than 0".0001 from the primary.

The observations are displayed in Figure 1 (combined timing data). By plotting the chords for the two components separately and using transparency copies, the two profiles can be shifted to match, as shown in Figure 2 (secondary timing data shifted). The plot for the secondary had to be shifted 0.218 mile to the north, and 0.75 second of time to the right, to achieve the match. Using the scales from the predicted profile (VPS = 0".67/mile and HPS = 1".508/minute), the shifts become 0".146 in height and 0".019 in Watts angle (or position angle), the latter translating into 0".31 in horizontal scale on the sky. Using the position angle (p.a.) of graze (272°), the separation (0".34) and p.a. (323°) of the secondary star from the primary can be computed.

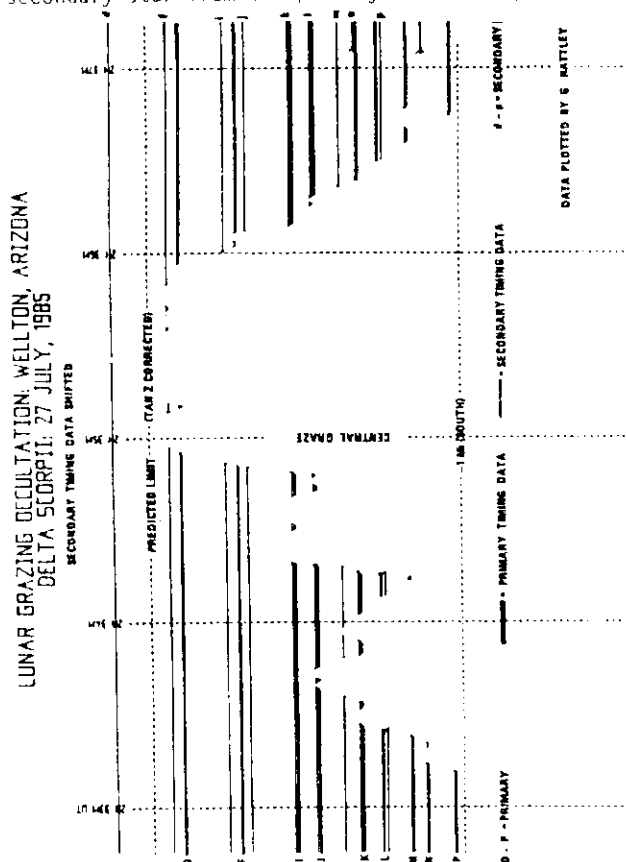


Fig. 2

Delta Scorpii has been resolved several times by speckle interferometry, as reported in *Center for High Angular Resolution Astronomy (CHARA) Contribution No. 1, "Catalog of Interferometric Measurements of Binary Stars,"* Harold McAlister and William Hartkopf, Atlanta, 1984. Unlike the case for Sigma Scorpii as noted in *O.N.* 3 (16), p. 346, there is not a clear trend in the observations, but only a scattering about the mean values of 176° for the p.a. and 0".14 for the separation during the 8 years reported (1973 to 1981). This can be expected, since the orbital period is probably greater than 100 years, and the accuracy of most of the p.a. measurements is quoted as ±2°. The speckle observations have a 180° ambiguity in position angle, and

the results from Wellton show that 180° needs to be added to the speckle p.a.s. The separation is not in good agreement (speckle versus graze), but nearly exact agreement would result if the graze horizontal shift were zero. The horizontal shift could be in considerable error, since visual timings were involved in the profile fitting. The vertical shift is well-determined from all of the graze timings (visual as well as video), but the horizontal shift amount could be refined by a more careful analysis of only the video data, especially Dunham's timings for the primary and Manly's timings for the secondary. Since their stations had nearly the same vertical separation as the two components. Also, more recent speckle observations may reveal a trend in the position angles that could be used to fix this parameter at the time of the graze (1985.570), to improve the determination of the separation.

THE IOTADATA PROGRAM

Peter Manly and Joan Bixby Dunham

Peter is distributing for beta testing Program IOTADATA, software designed to enter, record, retrieve, and print IOTA occultation data according to the format specified in *O.N.* 4 (5), p. 92 (August, 1987). The sole exception to this specification is the addition to the REPRESENTATIVE line, columns 76 through 80. These spaces are reserved for revision data of the program generating the file. The current revision is "0," indicating the "beta test" version. This is a revision of earlier software he had written for a C/PM machine with a different output format.

It is the intent of this program to be generic, in that it works on a CP/M Otrona Attache computer, an MS-DOS clone, and the Macintosh. Other machines may be added in the future. The software is generated on the Macintosh SE using system 4.1 and on the Macintosh 512K upgraded to Mac Plus, system 3.2. Both Macs use Microsoft Basic version 3.0. The Otrona Attache uses CP/M system software version 2.2.5 and Microsoft Basic-80 rev 5.22. The MS-DOS clone uses Microsoft MS-DOS version 2.11 system software and Microsoft GWBASIC version 2.1.

The IOTADATA user must supply his own version of a BASIC computer language interpreter or compiler. The IOTADATA software is distributed as ASCII text files on disks. The software is written using only the instructions most common to all three machines. Also, to make it easier to convert this software to other machines, all variable names are limited to 2 characters to accommodate early versions of BASIC. All program segments require less than 20 Kbytes of memory. Statement numbering within each program segment is designed so that program segments can be combined for use in larger machines. The software is in modules which are CHAINed, so the version of BASIC used must allow the CHAIN statement.

The minimum machine required must have at least one disk drive and 64 Kbytes of RAM. Either a 40-column or 80-column display screen may be used, although the displays are set up for 80 columns. The program will still run, but the list of data on 80-column format will be doubled over. The program is split into several sections and chained together so that each piece may fit into those machines limited to 64 Kbytes of RAM space. Much time is spent swapping

sections, so if you have a larger machine, and do not want to modify the program, you may want to use either a cache RAM or a randisk to speed it up.

The original program was intended to be used with a CP/M Otrona Attache and a C. Itoh printer. The print section was written with unique printer commands which generated the entire IOTA report form which was formerly filled in by hand. The current program allows either the C. Itoh or a more generic form for other printers. The disk storage section also allows storage in one of two formats.

We will report on IOTADATA in future issues as testing and conversion progress. There is already a long list of proposed enhancements to investigate, once testing is completed. Further information can be obtained from: Peter L. Manly; 1533 W. 7th St.; Tempe, AZ 85281; U.S.A.

VIDEO DEVELOPMENTS FOR OCCULTATIONS

David W. Dunham

DAK Industries now sells a low-light-level black-and-white camera that rivals the RCA Ultricon camera, which has been the mainstay of occultation video since 1981. The DAK surveillance camera has a range of 3 to 30,000 lux and costs only \$169 (order no. 4549). It has a detachable lens, so it can be attached to a C-mount and a telescope. The only problem is that it uses a special cable that supplies power in and video/audio out. With the right connectors, it should be possible to operate the camera from a battery like Orion's Portapac, but the setup might be complex. By paying \$299, you can get the camera plus a 12-inch monitor, electronic switcher, and cables for power and video, order no. 4415, for \$299. The monitor is too large for easy transport by airplane, and there may be no way out of using A.C. power to run the system. Peter Manly knows an amateur in Phoenix who has purchased this DAK system, so we should be able to give some more practical information later. DAK has a 24-hour sales phone, 800,325-0800; technical information is available 6 am - 7 pm Pacific time weekdays at 800, 272-3200. Their address is 8200 Remmet Ave., Canoga Park, CA 91304. The RCA Ultricon camera can still be purchased, but at a considerably higher price than the DAK [Ed: Magnavox] camera.

Once you get a camera, a major problem now is getting a portable VCR. The old portable VCRs have deliberately been taken off the market, in an effort to sell camcorders, most of which have non-removable lenses. Those that do have removable lenses, including CCD models, cost over \$1000, and as cameras, they are not as sensitive as the Ultricon or DAK surveillance cameras. To be used with these other cameras, the camcorder needs to have dubbing capability that can be used as a video input, but these seem to cost more than \$1200. Regular VCRs can be purchased for less than \$300, but require A.C. power. This would be all right if you plan to observe mainly from home (total lunar occultations), but for a graze, it would limit your ability to select sites. If anyone can locate a source of relatively inexpensive portable VCRs, or have any other answers to some of the dilemmas posed above, contact me at P.O. Box 7488; Silver Spring, MD 20907, phone 301, 585-0989, so it can be published in a future issue. Peter Manly has supplied much of the information re-

ported above. He also has information about image intensifiers (see p. 137 of the last issue) that are considerably more expensive than the costs mentioned above. Watch future issues of *Sky and Telescope*, *Astronomy*, and *Occultation Newsletter* for image intensifier developments.

REPORT FROM ESOP VI

Dr. Eberhard Bredner, secretary IOTA/ES

[Ed: I admit my inability to comprehend some of the Germanic idiom in this article, as received, and have decided to reproduce it, letter-for-letter, rather than to introduce my own mistakes.]

The annual 'European Symposium on Occultation Projects' was in 1987 organized by Kyril W. Fabrin from Aalborg, Danmark for a long weekend (August 21 to 23). We started with an informal opening and social evening in the club house of the Amateur Astronomical Society of Northern Jutland. From the first moment there was a heartily, familiar situation between the Danish amateurs and their guests. Two members from the town own's planning staff, Mrs. Else Kristiansen and Mr. Ove Horn, gave us first an introduction to the project of the new Aalborg Observatory. A very pleasing observing site would arise there, with sufficient additional possibilities for meetings and preparational work. It will now be opened in April 1988.

We had an agreeable evening with a Danish buffet, French wine and German beer. Later the evening when starting for the night most of us had travelled quite a long way, we noticed pleased that some of us could stay the night free of charge in the club house. So it is even for those with a smaller budget possible to take part in ESOP-conferences.

The official meeting ESOP VI was arranged in the Great Auditorium, University of Aalborg. When we met there the other morning our presentiments got clear: some of our friends especially those from Eastern Europe won't come. This light disappointment vanished away when the IOTA/ES President Mr. Hans-Joachim Bode and the ESOP VI-Organizer Kyril W. Fabrin opened the conference. We first had a review of ESOP V in Warsaw/Lodz by Secretary Bredner to get the connection to the former conference. The lectures then started with a survey of National occultation work in Finland by Matti Suhonen. Since 1948 a small group observes Lunar occultations regularly, they got the note-worthy amount of some 500 timings since 1975. Matti Suhonen invited all IOTA-members to visit Finland for the July 1990 total eclipse (Teuvo Pakkalantie 12 a 19, SF -- 00400 Helsinki 40). A more international aspect was presented by H. J. Bode and Dr. Beisker who attended the IAU-Meeting in Paris on the occasion of the 100th Anniversary of the French Astronomical Society where they presented own papers and two of Dr. Dunham (IOTA/USA).

After a coffee break the Great Old Man of Occultation, Dr. Niels Wieth-Knudsen (then 78, see his 378 timings for 1979 in *o. v. iv*, 6 !) accompanied and supported as we are used to by his wife Inger Wieth-Knudsen, introduced us to the Watt's Limb Data Centre in Aalborg. Ingo Reimann from Lübeck, Germany showed an observing project for motivating and training occultation-observers. His idea is particularly to get trained observers for outstanding

(very rare) events, motivating them with a method of total occultation-observations that yields to a result for the distance Earth-Moon.

We had lunch then in the Universities own restaurant, the famous worldwide known Danish Smørrødder! Our conversation was powerfull supported by this excellent boarding. The afternoon session started with a paper from the absend Leif Kahl Kristensen: On Asteroid Occultations, read by Kyril W. Fabrin. Some very encouraging initial successes ("beginners luck") in 1983/1984 were followed by a periode of inactivity. Mainly the absence of last minute predictions, the missing of feed-back and no coordinated programmes give the lonely observer the feeling of helplessness. We discussed this situation engaged without result. Subsequent to that Mogens Blichfeldt gave a report of the 146-Lucina Occultation on April 18th, 1982. He and his co-observer are certain that they saw at least 8 and certainly more short-timed occultations, which they discussed as satellite occultations of 146-Lucina and not of pseudo-occultations from starlight hitten by the blind spot of the eye.

A refreshing coffee break led to the last part: Hardware and Data Analysis. Once more the Great Old Man of Occultation Niels Wieth-Knudsen climbed the stage to give a lecture on a Baderian Analysis of Residuals from the final ILOC-Report 1984, pleading for new Lunar Ephemeris to minimize the residuals! A short highlight from a grazing occultation October 14th, 1986 (Psi 1 Aquarii, Z. C. 3419) registered by Dr. Bredner with a tape recorder gave the audience the possibility of occupation. He showed his time measuring device adapted from a DCF 77.5 clock with memory (512 timings), that can take sound coded timings from several stations. Much more professional was the presentation from C. Bittner and H. J. Goldan as they showed a Small High-Speed Data Reduction System with Spectrum 48 k, which was first tested for the Lunar occultation of Spica June 7th, 1987. Their methode (1000 measurements per second) has an uncertainty of not more than 6 msec (Which Datapoint is it?). The slope of the intensity is quite small. For a proper interpretation of those data Dr. Beisker showed the efficiency of his Computerized Data Analysis of Photoelectric Occultation Data by a programme package, which is as far as possible machine independent and accessible for all IOTA-members.

President Bode closed the session ESOP VI emphasizing the careful preparations by Kyril W. Fabrin, transmitting an invitation to ESOP VII in Valasske Mezirici organized by Bohumil Malecek.

Later the evening we met for the conference dinner at the Restaurant Skydepavillon, once more an impressive evening party, the dishes bend - you couldn't count the various courses, always there was an additional one! A real Danish coffee (and Cognak) we got high over the town lights (no occultation) on the top of the Aalborg Tower, a well known landmark. Long lasting discussions accompanied the evening.

Our last day in the northern part of Danmark started at 9 o'clock as a car-convoy with international load to Skagen at the northernmost tip of the peninsula Jutland. By the way we road a long time on the concrete-hard beach, with a footbath (Madame Bode) or total (Mr. Bredner) in the North Sea. We took the opportunity to visit the northernmost observatory of

cutland constructed and operated by Mr. Harald Aaen. We then had a footwalk to the point where North Sea and Great Belt (Baltic Sea) met another, one could see the different colors of the seas. To end this social excursion we had a last lunch at the northernmost Restaurant De 2 Have (the two harbors). The end was as always something depressing, but the prospect of a new ESOP with new (and old) discussions refreshed us for the journey back!

Oh, what a lovely time it was!

Supplement: ESOP VII will be arranged August 8 to 10, 1988 with an additional excursion to the High Tatras Mountains by Bohumil Malecek, coordinator of IOTA/ES in C.S.S.R., Hvezdarna, 75701 Valasske Mezirici, C.S.S.R. All IOTA/ES members get an invitation directly from him. Other interested members please write to him directly.

ADDENDUM TO PLEIADES ARTICLE

A note received from Dr. Eberhard Bredner on February 8 mentions successful observation of the January 27th graze of Alcyone in the German Federal Republic. This apparently was a separate expedition from the one reported by H.-J. Bode, noted on pp. 158-9.

JAMES H. MCMAHON, 1919-1987

Carroll L. Evans, Jr.

[Ed: Extracted from the *Skywatcher's Newsletter*, of the China Lake (California) Astronomical Society]

CLAS founding member Jim McMahon had been in poor health for some time. The combination of medications and modern technology had allowed him to continue what he wanted to do most to be involved with amateur astronomy. . . . After his hospital stay he transferred to Beverly Manor Health Care Facility. Just as he seemed to be improving, he took a turn for the worse, and passed on unexpectedly on Monday, December 21. . . . The CLAS was formed over 30 years ago. Jim was one of the original members. Over the years he has held every office at least once. His interests in astronomy were theoretical, practical, and educational. . . . he observed with the 4-inch wide-field Astroscan. A couple of years ago he bought a used 8-inch reflector telescope. His health did not allow him to use it as much as he wished. . . . Jim observed and reported over 250 total occultations over the years. . . . Jim and others in the club organized many graze expeditions. . . . In 1972 Jim, using his Astroscan, made an observation of the asteroid Herculina which, when combined with a professional [Ed: photoelectric] observation made in Flagstaff, Arizona, suggested that the asteroid might have its own satellite. This possibility generated a lot of interest among astronomers and some polarization of opinion. Some went so far as to say that satellites of asteroids were commonplace, and others denied that there were any at all. . . . For the past 19 years Jim edited and typed the *Skywatcher's Newsletter*. . . . Yet another facet of Jim's astronomy was the series of public and classroom lectures which he prepared and delivered. . . . This past September was Jim's final public lecture, given at the Maturango Museum. . . . He was able to repeat the lecture for the Cerro Coso astronomy class a few weeks later. . . . In 1979 Jim received the Astronomical Society of the Pacific's Amateur

Achievement Award, and in 1986 he was given the Club Service award of the Western Amateur Astronomers.

IOTA NEWS ADDENDUM

David W. Dunham

M. D. Overbeek has led occultation activity in the Republic of South Africa for many years. He is also a member of the American Association of Variable Star Observers. According to last December's *AASVO Newsletter*, Overbeek made the most variable star observations during their 1987 fiscal year, 13,682. He also kept up the occultation work; congratulations, Danie.

Last August, I sent a notice to IOTA members and several other amateur and professional astronomers in Brazil giving predictions for the atmospheric re-entry of the first and second International Sun-Earth Explorer (ISEE) artificial satellites on September 26th. This caused some embarrassment at the time, since the Brazilians had not been notified earlier through official channels. A member of the Clube Estudantil de Astronomia (Recife, Brazil) watched from Salgueiro, where he saw both satellites appear as brilliant meteors as they burned up in the atmosphere. An account, in Spanish and Portuguese, was published in *LA RED de observadores*, number 19, distributed by the Liga Ibero-Americana de Astronomia. A translation of this account will be published in the next issue of *Occultation Newsletter*.

OCCULTATIONS BY TRITON AND PLUTO

David W. Dunham

Douglas Mink, Center for Astrophysics, Cambridge, MA, has computed predictions of occultations of faint stars by Neptune's large satellite Triton. This satellite has special interest for Voyager-2's flyby in 1989 August. Preliminary data are given in the table below; these predictions will be refined later, and updates (including more complete information; the table is incomplete for 1989) will be published in *O.N.* or distributed to potential observers. Since Triton's mean opposition visual magnitude is 13.5, a photometer or CCD/intensified-video system will be needed with a large telescope to detect most of these events.

Date	U.I.	Star Mag.	Possible Area
1988 Apr 11	0 ^h	14	Africa, Middle East
1988 Sep 2	5	15	Chile, Argentina, N.Z.
1988 Oct 22		14	Hawaii?
1989 May 11			Mideast, w. U.S.S.R.
1989 May 15			Hawaii
1989 Aug 14		13	Australia

The apparent distance from Neptune at the time of an occultation will be crucial for detecting these events; scattered light from Neptune will render some of them unobservable. For this year's April 11th occultation, Triton will be 14" from Neptune, in position angle 75°.

The following is from the *Journal of the Association of Lunar and Planetary Observers*, 32, p. 139 (1987 October): "John Hewitt (418 Boynton Ave.; Berkeley, CA 94707; telephone 415,525-5096) is organizing a program to watch for occultations of stars by Nep-

tune's large moon Triton. Such observations could help us determine Triton's diameter, orbital position, possible atmospheric properties, and would be of value in planning for the 1989 Voyager-2 flyby. If you have access to a telescope of 30-cm aperture or more, you are invited to send a "status" to Mr. Hewitt for more information." As of late January, Mr. Hewitt did not have any specific information to distribute. Doug Mink will be the best source for predictions, and, as noted above, the latest information will be published in *O.N.* or distributed to readers in the possible area of visibility.

The June 9th occultation of a 13.2-mag. star by Pluto was mentioned on p. 152 of the last issue. The event is especially important since in the period 1985 to 1990, it is one of only two stars brighter than Pluto itself that may be occulted, the other being mag. 12.8, to be occulted 1990 January 10, probably in Asia. The 1950 coordinates of the June 9th star are: R.A. 14h 49m 37s, Dec. +0° 04' 18". Pluto and the star can also be found from the detailed charts published in *Sky and Telescope* and elsewhere. In a recent letter, Bob Millis notes that subsequent astrometry by A. Klemola continues to indicate that an occultation will occur, around 10h 24m J.T., somewhere on Earth, but it is not yet possible to tell just where the ground track will be. Some reasonable estimate of it will be distributed to readers when it becomes available. In the meantime, Millis has prepared a map showing the area where Pluto will be more than 15" high in a dark sky at the time. This area includes most of the Pacific Ocean (including Hawaii and New Zealand, but not Japan, the Philippines, or the Aleutians), the coastal areas of California and Oregon, New Guinea, and Australia except the extreme northwestern part.

ASTRONOMY AND PERSONAL COMPUTERS

Joan Bixby Dunham

Converting Among Filing Systems. One task which PCs perform admirably is that of maintaining lists, files, data bases, or spreadsheets of information. These lists can be astronomical data, stocks, collections, addresses—something we might want to keep in an organized fashion. It is almost a certainty that, at some time, the owner of a given list will conclude that it would be better maintained in a different piece of software, perhaps even on a different computer. The reason for changing is immaterial. The most important question to answer in performing the change is this: Should the data be converted to the new system using a computer, or would it be faster to retype it? There is the "Myth of the Machine Readable," which is the belief that once something is in machine-readable form, it never again needs to be manually reentered. If conversion to another format requires writing a special program, if there is anything complex or confusing about that program, and if the data set is not particularly large, a good typist will be done with re-entry of the data before the program is debugged. Retyping should not be necessary in cases where the data in the original source are organized in approximately the same way they will be in the new format.

A key consideration in successful conversion to another system is that the data not violate constraints of the new system. For example, many spreadsheet, database, and file programs do not al-

low individual fields in a record to be longer than 255 characters. Sometimes multiple fields can be strung together to hold the long input fields if they are always present. If long fields are there for some records and not others, conversion will be much harder. The inconsistency can confuse the software.

It has been my experience that just about all data set formats from any software on any computer can (eventually) be converted to virtually any other program's format on the same or another computer, keeping in mind the restrictions listed above. Software which maintains its data in formats which are very different from others might first require that the data set be "printed to disk," an option in many programs that results in an ASCII file of the data. It might also be necessary to connect two computers together through RS-232 ports if they cannot read one another's disks.

An example of conversion would be two mailing lists Pat Trueblood and I have been converting to PC-FILE+, a commercial, low-cost data base management system that executes on a PC. One list was David Dunham's mailing list originally used with a FORTRAN program that generated labels on mainframe computers. The other was a local astronomical group membership list which I had once maintained with an Apple II+ wordprocessing program. PC-FILE+, like many programs that do file or data set management, has "import" capabilities that allow it to accept data sets in a variety of formats, including ASCII fixed format, ASCII comma delimited (a comma between each entry), and ASCII carriage-return delimited, where each record is a separate input line.

We found that David's list had not been updated recently, so many of the entries needed correction. Also, the older mainframe printers he had used would only print upper case, so no lower case was used in the list. The data were stored on card in a format convenient for the FORTRAN program, but not easily imported into PC-FILE+. Pat very quickly concluded that she could type the data into PC-FILE+ faster than I could write and test programs to convert the mailing list to a form suitable for import into PC-FILE+.

The astronomical society mailing list, on the other hand, was nearly in a form suitable for import into PC-FILE+, but not on the right machine. Each entry (for each name) was structured the same as all the rest, with name, address, city, and state on separate lines, with the same number of lines total for each entry. There were a few exceptions, but only minor editing was necessary to make the exceptions conform to the rest. Such mailing lists are easy to convert to a mailing list program, spreadsheet, or a database. To convert this one, I did the following: The Apple word processor files were binary, not ASCII, so the word processor was commanded to print the list to an output RS232 port that was attached through a null modem to the PC. Crosstalk, a commercial communications program, was used to capture the file as it was received on the PC and store it on an ASCII file. There, it was edited to remove some extra lines, and make each address use only 2 lines. Then it was imported into a PC-FILE+ data base. The final import step took several tries, due to errors in my editing, but it was considerably faster than typing the entries in again.

Science Software. Science Software is a catalog and description of BASIC programs available for the Commodore 64, IBM PC, and AMIGA computers. The software described includes programs to explain fundamental concepts of astronomy and to help locate the Sun, Moon, planets, comets, and stars. One of the programs, ECLIPSE, computes lunar eclipses. Another, STAR, performs conversions between mean and apparent place. Other software computes locations of Earth-orbiting artificial satellites. There are programs to use for model rocketry and hot air ballooning. Another program, ASTROS, simulates tracking, control, and operation of the Amateur Space Telescope. The software is all moderately priced, with a demo disk available for \$5 USA/\$8 foreign. To order, and to request a catalog, send a check or money order to: Science Software; David Eagle; 7370 S. Jay Street; Littleton, CO 80123.

SOLAR SYSTEM OCCULTATIONS DURING 1988

David W. Dunham

This is a continuation of the article started on p. 148 of the last issue. Tables 1 and 2 of asteroidal and planetary occultations contain data for April through December, on alternating pages with the data for the same events on facing pages. Maps and finder charts (the latter mainly for North American and European events not included in the supplements by F. Goffin) are included for the next few months. World maps by Mitsuru Soma are included for some events in February and March, as well as for several following months. Soma's maps will be published for all events not predicted by Goffin, as well as for all of my listed events involving stars brighter than mag. 7.1, those whose paths are entirely north of latitude +65° or entirely south of -50° (i.e., not on my path maps), those involving double stars with each component listed in Table 1 and 2, and those in my priority lists below or published in the last issue. The similar maps by Goffin, plus my path maps, should suffice for other events.

Correction. The path for the April 1st occultation by Bamberga was inadvertently not included on the Western Hemisphere path map. In the description of local circumstance predictions distributed by Joseph Carroll, the miss distances are from the center of the occulting body; the value in kilometers is measured on the sky plane (or fundamental plane), and is always less than the distance on the Earth's surface.

Priority List. This is a continuation of the list started on p. 152 of the last issue. Some columns have been added to help astrometrists assess the relative importance of events. The asteroid's angular diameter is given under "ang.diam." The occultation magnitude drop and expected central duration in seconds are given under "Am" and "dur," respectively. The probable (nominal) area is given under "P," with A = Australia and/or New Zealand, E = Europe, O = Orient (China and/or Japan), R = U.S.S.R., S = southern Africa, and U = U.S.A. A question mark indicates that the event is only possible in the area, with the nominal path some distance away. A rating is given under "R," with "1" for the best events, while at least preliminary astrometry (to 0.05 accuracy or better, with possibly separate data for the asteroid and star) would be helpful for "2" events.

1988 Date	Minor Planet Name	ang.diam.	S T A R ID	mag.	Am	dur	P	R
Apr 1	Bamberga	0.12	Anonymous*	11.9	1.3	10 ⁵	U?	2
Apr 3	Tisiphone	0.08	SAO 137000	8.3	5.5	26	SG?	2
Apr 11	Vesta	0.37	SAO 79859	8.8	0.6	44	U?	1
Apr 14	Europa	0.13	Anonymous*	11.5	1.3	9	U	2
Apr 14	Tanete	0.10	SAO 120975	8.8	4.2	11	E?	2
Apr 21	Juwa	0.16	SAO 157598	8.9	2.7	18	AS?	2
Apr 23	Cybele	0.13	SAO 119368	8.5	4.0	23	A?	2
Apr 24	Elpis	0.11	L 2 1346	12.5	1.0	13	U?	2
Apr 26	Artemis	0.16	SAO 122154	10.2	1.6	12	SR?	2
Apr 30	Europa	0.12	Anonymous*	12.2	0.9	8	A?	2
May 1	Europa	0.12	Anonymous*	11.4	1.4	8	U?	2
(below, only * ones are listed; others will be in ON)								
May 14	Hygiea	0.23	Anonymous*	11.1	0.8	37	U?	2
Jun 3	Bamberga	0.09	Anonymous*	11.7	1.9	7	O?	2
Aug 11	Iris	0.12	AC+23°49334	10.1	1.2	5	R	2
Aug 11	Pallas	0.29	Anonymous*	10.0	0.8	29	E?	2
Sep 6	Hebe	0.10	Anonymous*	12.0	0.4	6	U	2
Sep 8	Myrrha	0.10	BD-21°6146*	9.6	4.0	14	U	1
Sep 11	Hebe	0.10	Anonymous*	12.1	0.4	6	E	2
Sep 21	Wratislavia	0.08	AC+22°50203	11.7	2.1	8	U	2
Oct 2	Hebe	0.11	Anonymous*	12.5	0.3	7	U?	2
Nov 6	Hebe	0.13	Anonymous*	11.4	0.5	14	U	2
Nov 8	Europa	0.13	Anonymous*	11.4	1.4	9	U	1
Nov 16	Europa	0.13	BD +7°2430	10.9	1.8	10	E	2
Dec 11	Wratislavia	0.12	SAO 96218	9.4	3.4	14	U?	2
Dec 15	Wratislavia	0.12	AC+17°51493	10.1	2.7	14	UO?	2

The positions of stars whose identifications (IDs) end with * are taken from old Astrographic Catalog data, or they are Yale Catalog stars with no proper motions available. For them, updates to the star positions from plates taken any time during the last several years would be valuable to see if the occultation paths might really cross areas with many observers and be worthy of the efforts of "last-minute" astrometry.

Notes about individual events. Wayne Warren supplied important information about some stars, especially doubles.

Apr. 1 and June 3: An occultation by Bamberga was observed last December, as described on p. 145 of the last issue.

Apr. 3: The star's angular diameter is 0.0004, requiring 0.14 second for the edge of the asteroid to cover for a central occultation.

Apr. 14, (772) Tanete and SAO 120975: the star's angular diameter is 0.0008, requiring 0.09 second to centrally cover.

Apr. 18: Mars' 8" disk will be 87% sunlit. The reappearances will be on the dark crescent, 1.0 wide at most.

Apr. 23: The star is number 1780 in the Zodiacal Catalog (Z.C.).

Apr. 26: The star's angular diameter is 0.0008, requiring 0.07 second to centrally cover.

May 3: The star's angular diameter is 0.0008, requiring 0.05 second to centrally cover.

May 7: Immersion will be on the dark side of Venus' 28%-sunlit disk, 37" in diameter. The southern-limit graze will be 8° from the cusp on the bright

side. The star is Z.C. 868 and is the 8.1-magnitude primary component of Aitken Double Star (ADS) 4308. The 10th-magnitude companion, 0.3" away in position angle (p.a.) 253°, will be lost in Venus' glare, as

will also an 11th-magnitude component 52" away.

May 8: The star is ADS 8383. The 11.8-magnitude companion is 4".6 away in p.a. 151° and will not be occulted, the path missing the Arctic by 0".7. The secondary is similar in brightness to Fortuna; if

Table 1, Part B

1982 Universal DATE	P L A Time Name	M E T Δ, A, ΔJ	S SAO No.	Sp R.A. (1950) Dec.	Occultation Δ, Bur. df	P Possible Area	El Sun	M El	O %Sn	N Up	Ephem. Source
Apr 1 3 ^h 24 ^m	Bamberga	12.1 2.518	11.9	5 ^h 25 ^m 0 29 ^s 10'	0.9 10 ⁵	15 14 Mexico?; Peru	84° 82'	99+	all	MPC11724	
Apr 3 23-62	Trisiphone	13.1 2.380	137000 8.4 K0	9 34.4 -6 48	4.8 26	57 25 S. Africa, Bermuda, eUSA	131 65	97-	e 63W	MPC12305	
Apr 5 20 14-28	Eclis	12.1 2.036	12.2	13 23.3 -2 2	0.7 12	20 18 s.w.Austral., Kenya, Sahel	172 38	88-	e 9E	EMP 1979	
Apr 6 15 52	Chadasea	12.6 1.778	9.3 A0	6 43.5 14 1	3.3 5	11 24 Somalia, Singapore	84 143	82-	e 75E	MPC11621	
Apr 11 8 37	Vesta	7.6 2.121	29859 8.9 F0	7 57.7 25 46	0.3 44	22 5 central Canada	95 165	33-	none	EMP 1986	
Apr 14 0 26	Europa	11.8 3.168	11.5	5 29.7 20 12	0.9 9	11 16 se U.S.A., West Indies?	59 93	8-	none	MPC12188	
Apr 14 0 55-70	Tanete	12.3 1.802	120975 8.9 MA	15 21.2 2 12	2.5 11	23 20 Mideast, n. Africa, Haiti	150 121	8-	e 48E	EMP 1986	
Apr 14 19 28-40	Bononia	14.8 3.454	182831 9.0 K2	14 41.7 -22 2	5.8 12	24 28 Australia, s. Africa	159 137	4-	e138E	EMP 1980	
Apr 16 1 26-36	Marghanna	13.9 2.033	210378 7.5 B8	18 34.4 -34 35	6.4 6	21 39 n.w. Africa, s. Brazil	108 103	0-	none	EMP 1983	
Apr 18 15 45	Mars	0.4 1.236	9.1	20 40.4 -19 40	271 9	1 se Australia, N. Zealand	81 109	6+	none	NAO001	
Apr 18 17 12	Mars	0.4 1.236	8.3	20 40.6 -19 40	272 9	1 Antarctica	81 110	6+	none	NAO001	
Apr 20 18 11	Massalia	12.0 2.333	10.9	6 13.2 22 47	1.5 4	9 24 Egypt, Arabia	63 10	21+	all	MPC11982	
Apr 21 18 15-36	Juewa	10.8 1.373	157588 9.0 F5	12 53.2 -13 21	2.0 18	26 12 Australia, S. Africa	164 101	30+	w 45E	MPC12303	
Apr 23 10 00-13	Cybele	11.8 2.378	119368 8.6 G0	12 20.9 0 59	3.3 23	30 15 s. Pacific, n. Australia	151 67	45+	w159W	MPC12302	
Apr 24 3 25-40	Elois	12.2 2.062	12.6	13 9.3 -0 1	0.5 13	23 18 Namibia, Brazil, Mexico	161 70	52+	w 47W	EMP 1979	
Apr 26 0 12-26	Artemis	10.9 1.128	122154 10.2 G5	17 8.6 5 57	1.1 11	19 13 e. Africa, Mideast, wUSSR	132 104	69+	n 50N	MPC12190	
Apr 28 18 05	Minerva	13.4 3.550	59128 5.7 G0	6 25.4 30 32	7.8 6	12 30 South Africa?	58 85	90+	all	MPC11508	
Apr 30 7 46	Europa	11.8 3.344	12.2	5 54.2 20 53	0.6 8	10 17 e. Australia; N. Z. Is	49 111	97+	all	MPC12188	
May 1 4 08	Europa	11.8 3.352	11.4	5 55.6 20 55	1.0 8	10 17 Northwest Territories	48 122	99+	all	MPC12188	
May 3 22 07	Gyptis	12.5 2.470	145746 8.2 K5	21 53.1 -2 52	4.3 6	11 21 eastern Arabia, India	74 93	96-	all	Herget	
May 7 6 06-12	Venus	-4.5 0.451	77478 8.0 A0	5 41.2 27 43	1908 20	1 s.w. Canada, n.w. USA, HI	40 153	70-	none	NAO001	
May 7 14 08	Sappho	13.0 2.702	97681 7.3 G5	8 12.3 11 35	5.2 4	14 47 Tibet, Indochina, P.I.	76 167	67-	none	Herget73	
May 8 14 24-55	Fortuna	11.5 2.027	138526 8.6 G5	11 57.8 -0 23	2.8 56	69 13 W. Pacific, China	132 132	55-	e150E	EMP 1981	
May 9 9 24	Minerva	13.5 3.568	59402 8.6 K0	6 39.7 30 2	4.9 5	11 31 New Guinea	51 136	46-	none	MPC11508	
May 11 17 26-36	Venus	-4.5 0.420	77671 9.2 F5	5 50.0 27 37	2552 27	1 wUSSR, Mideast, n.w. Africa	37 92	21-	none	NAO001	
May 11 19 36-48	Venus	-4.5 0.420	77675 4.6 A0	5 50.2 27 35	2573 27	1 western Europe	37 91	20-	none	NAO001	
May 14 4 57	Hygiea	10.6 2.663	11.1	10 4.1 7 40	0.5 37	27 9 (Mexico, Cen. America)?	97 120	4-	none	Schmadel	
May 18 1 24	Mars	0.0 1.011	164817 8.0 K0	21 58.7 -14 34	344 10	1 Europe, n. Africa, Mideast	90 117	5+	none	NAO001	
May 23 22 17	Mnemosyne	12.7 3.404	109088 7.6 A7	0 12.4 8 32	5.1 3	11 43 s.w. Australia?	56 148	52+	none	MPC12189	
May 28 10 30-46	Dunham	17.1 1.541	159136 9.1 F8	15 13.3 -14 51	8.0 1	24 12 s. Mexico; HI?; Japan	163 21	90+	w110W	EMP 1986	
May 29 0 20-27	Brixia	13.7 2.312	11.8	17 33.3 -20 28	2.1 10	22 25 S. Africa?; Cape Horn	63 47	93+	all	EMP 1982	
May 31 7 11	Boliviana	13.0 2.316	127508 9.0 K5	22 21.8 4 48	4.1 7	16 26 northern Chile, Brazil	90 93	100+	e111E	EMP 1979	
Jun 2 15 16	Tersichore	14.0 2.430	207185 7.9 MA	15 55.5 -30 35	6.0 8	21 31 Japan, neChina, Mongolia	167 37	94-	none	MPC11724	
Jun 3 11 40	Bamberga	12.7 3.483	11.7	7 55.6 23 33	1.3 5	10 20 Kuril Islands; Japan's	44 176	88-	none	MPC11724	
Jun 8 12 50-63	Brixia	13.6 2.266	185407 9.3 K5	17 23.8 -20 42	4.3 9	20 24 s. Pacific, Australia	175 102	36-	e175W	EMP 1982	
Jun 8 23 32-46	Carlova	13.4 2.521	141501 8.8 G5	17 0.5 -8 57	4.6 9	21 27 Ceylon, cen. Afr., n.S. Amer.	166 114	31-	e25E	EMP 1984	
Jun 9 2 50	Hippo	13.6 3.036	98260 8.1 A0	8 55.1 11 0	5.6 4	10 35 Mexico, Central America	55 121	30-	none	MPC12305	
Jun 9 8 38	Sylvia	13.4 3.988	11.5	10 17.9 21 37	2.1 11	16 21 Alaska; Hawaii's	71 132	27-	none	MPC11507	
Jun 10 2 54	Diana	13.9 2.932	146732 8.8 A0	23 26.8 -3 52	5.2 9	21 30 western Europe?	88 35	20-	all	MPC12189	
Jun 10 22 29	Alexandra	12.6 2.858	10.1	F2 1 20.1 16 55	2.6 5	10 23 northern Indian Ocean	55 13	13-	e 70E	MPC11723	
Jun 11 9 55-66	Antiope	11.9 1.720	186402 9.6 B8	18 7.4 -24 28	2.5 15	27 18 Peru, Fiji, Torres Str.	168 132	10-	e 95W	MPC12190	
Jun 11 12 25	Sylvia	13.4 4.017	9.6 F8	10 19.5 21 23	3.9 11	16 21 Western Australia	69 103	9-	none	MPC11507	
Jun 13 6 54	Tokio	12.7 1.847	146962 7.1 K5	17 17.5 -9 34	5.6 3	12 37 northern South America	88 75	2-	none	Herget78	
Jun 23 16 22	Princeton	12.7 2.111	208706 9.3 G5	17 17.5 -36 1	3.4 11	23 22 (N.Z., Australia)?	163 66	52+	w140E	Landgraf	
Jun 25 0 23-30	Thyra	11.2 1.718	208420 8.9 B8	17 3.5 -35 49	2.4 8	21 26 n. Africa; Azores?	160 46	74+	w 13E	Linderf79	
Jun 25 18 21-40	Messalina	12.4 1.636	210683 8.9 K5	18 50.4 -38 2	3.5 11	27 23 Indonesia, n.e. Africa	164 58	81+	w122E	EMP 1982	
Jun 27 12 26-40	Hispania	11.2 1.592	229997 9.5 A0	19 58.3 -43 5	1.9 16	29 16 Hawaii?	152 49	93+	w142W	EMP 1986	
Jun 30 2 57-62	Doris	11.7 2.312	161893 6.4 K2	18 47.7 -13 38	5.3 15	22 17 s. Africa, cen. S. America	170 14	100-	all	MPC12186	
Jul 1 17 22 31	Palatia	13.5 2.526	94054 4.7 A3	4 36.4 15 49	8.8 2	7 40 India	45 90	14+	none	EMP 1986	
Jul 20 17 08	Jokaste	14.6 2.303	75238 5.6 F5	2 12.9 24 49	9.0 2	12 59 Indonesia, Caroline Is.	79 152	37+	none	MPC12433	
Jul 21 1 45-69	Ariadne	10.9 1.068	9.5	15 58.7 -20 2	1.7 16	43 20 Caribbean, Azores?	124 45	45+	w 50W	MPC11507	

June 13: The star's angular diameter is 0.0017, requiring 0.10 second to centrally cover.

June 25, (545) Messalina and SAO 210683: The star's angular diameter is 0.0021, requiring 0.27 second to centrally cover.

June 30: The star's angular diameter is 0.0011, requiring 0.13 second to centrally cover.

July 17: The star is Sigma 2 Tauri (Z.C. 704) in the Hyades.

July 21: I measured the position of this star from a Palomar Sky Survey plate to prepare a special catalog of faint stars occulted by the Moon during the

Table 2, Part C

1988 DATE	M I N O R No.	Name	P L A N E T km-diam.	R S O I Type	Motion °/Day	S SAO No.	T DM/ID No.	A R	Min. U. T.	Geocentric Sep.	COMPARISON DATA AGK3 No.	Shift Time	A P P A R E N T R.A.	Dec.
Jul 29	121	Hermione	201 0.12	1200 C	0.126 262.5	C2814527	2 ^h 0 ^m 16 ^s	1.315 H	21 9.5	1.17N AS	N13	647 -0.09	18 ^h 23.0 ^m	-28° 34'
Jul 30	3	Juno	267 0.13	1149 S	0.551 95.7	96189	+14° 14' 60"	1.17N AS	21 9.5	1.17N AS	N13	647 -0.09	6 50.3	13 53
Jul 31	2	Venus	12220 31.51		0.712 84.0	A1942301	3 32.8	5.03S C	3 32.8	2.53N RA	N20	1195 -0.23	5 38.0	18 46
Aug 3	13	Egeria	245 0.10	1182 C	0.475 117.3	81444	+20 25' 07"	1.35.8	2.53N RA	N20	1195 -0.23	-0.6	10 37.2	20 2
Aug 6	4	Vesta	576 0.25	4112 V	0.474 112.6	99392	+12 22' 84"	K 21 28.7	1.47N R3	N11	1279 0.01	0.0	10 59.1	11 46
Aug 9	626	Notburga	96 0.07	236 C	0.497 43.2	56117	+35 6' 16"	21 59.5	3.95N A	N36	304		3 2.9	36 24
Aug 10	6	Hebe	186 0.09	687 S	0.493 92.3	A2349334		3 23.7	2.50N C				6 24.6	13 16
Aug 11	7	Iris	222 0.12	808 S	0.564 96.6			1 57.2	0.81S C				6 37.1	23 17
Aug 11	2	Pallas	533 0.29	5419 U	0.237 227.0			2 54.0	5.33N XS				20 8.4	14 56
Aug 12	63	Ausonia	94 0.11	256 S	0.247 263.2	164745	-16 59' 72"	22 13.2	3.20S C				21 55.1	-15 43
Aug 12	6	Hebe	186 0.09	689 S	0.488 92.8	L 1 1552		18 7.1	5.86S HC			-1.05 -0.0	6 30.2	13 12
Aug 18	2	Venus	12220 24.84		0.931 89.6			18 39.5	0.23N C				6 43.7	19 40
Aug 19	7	Iris	222 0.12	814 S	0.551 98.9			21 55.9	20.83N S				6 58.1	22 37
Aug 22	2	Venus	12220 23.70		0.964 91.2	96380	+19 15' 75"	21 55.3	1.90S ZA	N25	452	0.24 -0.1	7 0.5	19 38
Aug 24	554	Peraga	104 0.07	276 C	0.439 82.4	76811	+25 74' 6"	2 54.9	2.06S ZA	N25	452	0.24 -0.1	4 52.9	25 21
Aug 24	554	Peraga	104 0.07	276 C	0.439 82.4	76811	+25 74' 6"	5 4.5	0.40N C				20 0.1	12 36
Aug 24	2	Pallas	533 0.28	5416 U	0.232 214.2			5 9.1	2.25N C				19 57.2	11 25
Aug 30	2	Pallas	533 0.28	5414 U	0.226 207.8			3 19.2	2.74S A	N30	629		6 3.0	30 33
Aug 31	566	Stereoskopia	147 0.08	707 C	0.057 85.3	+30 10' 94"		11 58.6	1.50N XA	N11	280	0.33 0.1	2 51.4	11 20
Sep 1	49	Pales	175 0.11	704 C	0.315 82.1	93151	+10 38' 0"	15 38.8	1.87N XA	N25	445	0.30 -0.4	4 49.5	25 20
Sep 1	134	Sophrosyne	107 0.10	346 C	0.152 290.3	76780	+25 73' 6"	16 5.8	1.71S XA	N 9	60	0.34 0.2	0 47.6	10 10
Sep 6	6	Hebe	186 0.10	706 S	0.440 97.2	109465	+ 9 89"	9 46.9	1.24N C				7 16.8	12 12
Sep 7	381	Myrrha	150 0.10	727 C	0.171 238.5	190834	-21 61' 50"	1 30.9	0.59N S				22 1.0	-20 47
Sep 8	381	Myrrha	150 0.10	727 C	0.167 238.7	-21 61' 45"		5 53.5	1.69N Y				22 0.3	-20 53
Sep 11	6	Hebe	186 0.10	709 S	0.429 98.0			2 4.3	2.79N C				7 25.0	11 56
Sep 16	415	Palatia	92 0.06	221 C	0.489 94.9	96257	+16 13' 25"	0 35.2	3.00N HX	N16	696	0.28 -0.1	6 53.8	16 33
Sep 17	545	Messalina	105 0.07	361 C	0.210 61.0	210318	C3015855	9 49.4	3.83N HG			0.38 -1.0	18 33.6	-30 54
Sep 19	43	Ariadne	78 0.07	163 S	0.471 91.5	185447	-21 46' 22"	21 13.4	0.63S XS				17 28.6	-21 14
Sep 20	275	Sapientia	105 0.05	372 C	0.315 97.4	96561	+19 16' 24"	K 17 10.0	1.82N HX	N19	679	0.32 0.8	7 8.6	19 4
Sep 21	690	Wratislavia	175 0.08	846 CEU	0.246 104.9	A2250203		10 31.9	0.81N C				6 39.8	22 1
Sep 23	150	Nuwa	137 0.11	541 CEU	0.218 277.4	214623	C3217567	8 3.0	0.66N S				23 33.0	-32 23
Sep 24	4	Mars	6782 23.77		0.150 241.5	146096	- 7 57' 84"	15 25.2	2.67S XS				22 26.7	-7 18
Sep 28	7	Iris	222 0.14	845 S	0.297 256.5	128806	- 2 69"	2 59.9	32.20N R7	S 2	8	-0.09 0.1	0 31.1	-1 51
Sep 30	579	Sidon	80 0.06	263 S	0.475 107.8			1 20.9	0.69N C				8 22.4	17 56
Oct 2	6	Hebe	186 0.11	724 S	0.202 253.5	147307	-15 84"	0 57.7	2.29N PY			-1.32 -1.9	0 29.3	-14 55
Oct 3	202	Chryseis	96 0.05	346 S	0.369 101.0			9 34.1	2.35N C				7 59.3	10 31
Oct 4	2	Venus	12220 16.34		0.231 99.9	96403	+15 14' 31"	5 46.2	0.72N PA	N15	722	-0.48 -1.1	7 1.7	15 21
Oct 5	70	Panopaea	153 0.09	523 C	1.154 107.5	98982	+12 21' 60"	19 10.7	7.63N AG	N11	1187	-0.06 0.1	10 9.8	11 38
Oct 8	66	Maja	92 0.10	251 C	0.439 92.8	208693	C3212617	8 54.2	0.13N S				17 19.2	-32 32
Oct 10	121	Hermione	201 0.09	1166 C	0.157 264.6			5 38.5	5.01S XA	N16	222	0.01 0.2	2 28.2	16 40
Oct 13	626	Notburga	96 0.10	240 C	0.215 84.6	187125	C2814863	14 27.0	0.01N HX			-0.16 -0.2	18 40.4	-28 16
Oct 14	381	Myrrha	150 0.08	736 C	0.305 359.3	24519	+58 72' 6"	8 13.7	4.06N RA	N58	402	0.03 -0.1	4 16.8	59 5
Oct 16	43	Ariadne	78 0.06	165 S	0.020 66.4	190672	C2215596	1 58.6	0.69S S				21 49.8	-22 16
Oct 16	43	Ariadne	78 0.06	165 S	0.527 86.7			2 37.1	2.55S HC			-2.09 -0.4	18 25.0	-21 3
Oct 16	3	Juno	267 0.15	1237 S	0.527 86.7	-21 49' 92"	B	2 37.6	3.26S HC			-2.09 -0.4	18 25.0	-21 3
Oct 18	70	Panopaea	153 0.09	521 C	0.413 108.5	117639	+ 6 21' 61"	16 7.4	0.71S AS	N 5	1399	-0.13 -0.2	9 22.6	5 35
Oct 25	3	Juno	267 0.15	1249 S	0.469 89.9	209277	C3213346	12 14.6	2.46N G				17 47.5	-32 40
Oct 26	195	Artemis	129 0.08	401 C	0.386 109.4			17 8.2	2.70S C				9 36.3	4 25
Oct 30	566	Stereoskopia	147 0.10	711 C	0.493 100.5	142597	- 5 47' 51"	19 33.9	1.95N S				18 45.4	-5 40
Oct 30	566	Stereoskopia	147 0.10	711 C	0.195 256.8	110565	+ 8 38' 5"	A 19 37.7	2.91S NP	N 9	234	1.07 0.1	2 29.0	9 31
Oct 30	566	Stereoskopia	147 0.10	711 C	0.195 256.8	110565	+ 8 38' 5"	B 19 36.4	1.435 NP	N 9	234	1.07 0.1	2 29.0	9 31

total lunar eclipse of 1975 May 25. This is the first of these stars predicted to be occulted by an asteroid, and the first use of source code "M" (measured from Mount Palomar plate).

Table 1, Part D

1988 Universal DATE	Time	P	L	A	N	E	T	S	T	A	R	Occultation Δm Dur df	P	Possible Area	El	M	O	O	N	Up	Ephem. Source
Nov 1	15 ^h 00 ^m 05 ^s	Hersilia	12.4	1.712	109982	8.8	F5	1 ^h 31 ^m 5	3°52'	163°109'	48-	e	67E	MPC12304							
Nov 3	19 41	Athamantis	12.4	2.845	161197	8.9	M	18 10.8	-17 10	52 115	28-	none	MPC11508								
Nov 6	10 33-40	Hebe	10.0	2.005	11.4	8	38.8	8 25	0.3 14	21 16	9-	e101W	Branham								
Nov 8	9 59	Europa	11.8	3.186	11.4	11	4.1	8 10	1.0 9	11 16	1-	none	MPC12188								
Nov 9	2 51-60	Kalypso	12.9	1.575	9.9	8	1.6	15 4	3.1 10	23 21	0-	none	MPC12188								
Nov 10	5 41	Hebe	10.0	1.966	117080	8.9	A0	8 41.8	8 16	1.5 16	1+	none	Branham								
Nov 13	0 51	Ariadne	12.5	2.175	8.3	M2	19 27.2	-19 29	4.2 2	8 40	13+	w100W	MPC11507								
Nov 13	19 42	Julia	11.4	2.573	187992	5.5	A5	19 17.6	-22 30	5.9 5	7 19+	all	MPC12190								
Nov 14	4 17-36	Ligura	11.6	1.501	10.5	F8	8 2.3	32 19	1.4 22	33 14	22+	none	Herget78								
Nov 16	2 04	Europa	11.8	3.095	10.9	11	13.4	7 28	1.3 10	12 15	41+	none	MPC12188								
Nov 17	13 28-49	Iphigenia	12.6	1.341	76140	4.3	B5	3 42.2	24 19	8.3 6	58+	w160E	MPC12191								
Nov 24	2 09	Iris	9.7	1.756	10.9	10.9	9 41.7	9 32	0.3 17	20 11	100-	all	MPC11982								
Nov 24	6 53-84	Maja	12.1	1.282	92660	8.6	G0	1 48.6	14 31	3.6 20	99-	all	EMP 1986								
Nov 25	9 06-28	Notburga	11.7	1.225	12704	4.8	B3p	3 15.6	65 28	6.9 13	43	96-	e120E	Goffin87							
Nov 28	8 27-36	Phocaea	11.7	1.796	112763	8.8	B9	5 23.8	0 45	3.0 5	49	77-	e170W	MPC12188							
Nov 29	10 40	Antiope	13.5	3.223	188509	7.4	F2	19 41.6	-22 59	6.1 3	46	156	67-	none	MPC12190						
Dec 2	6 10	Athamantis	12.4	3.068	162201	5.9	B8	19 4.0	-16 18	6.5 3	115	41-	none	MPC11508							
Dec 4	0 04	Wratislavia	12.2	2.086	10.5	10.5	6 54.7	17 11	1.8 17	27 17	26-	none	EMP 1981								
Dec 4	23 42	Andromache	13.2	2.362	78770	6.6	A2	6 46.0	27 15	6.6 7	18-	e	30E	MPC12303							
Dec 11	6 08-22	Wratislavia	12.1	2.053	96218	9.4	F5	6 49.5	16 48	2.8 15	170+	5+	none	Goffin87							
Dec 15	14 40-55	Wratislavia	12.0	2.040	10.1	6	45.9	16 36	2.1 14	22 17	43+	w127E	Goffin87								
Dec 15	21 50	Tisiphone	14.2	3.817	205533	7.9	K0	14 22.1	-30 34	6.3 4	125	46+	none	MPC12305							
Dec 18	20 55-69	Diocima	11.9	2.220	11.4	K2	6 49.0	30 26	1.1 15	21 15	78+	w	80E	MPC12305							
Dec 19	6 07-24	Pales	11.0	1.509	76856	9.3	F8	4 54.1	24 53	1.9 19	38	82+	w	60W	Herget77						
Dec 21	10 38	Klymene	14.6	4.150	158836	5.2	F5	14 47.9	-15 47	9.5 4	78+	w	82W	MPC12190							
Dec 21	16 36	Antiope	13.5	3.412	189246	8.2	K0	20 21.4	-21 5	5.4 3	97+	all	MPC12190								
Dec 21	16 35-46	Daphne	11.9	2.046	135063	7.8	A0	7 42.8	-0 17	4.1 19	97+	all	Herget78								
Dec 23	23 35	Dynamene	13.3	2.330	128240	8.3	M0	23 30.4	3 6	5.0 6	106	99-	all	Herget78							
Dec 25	12 00-10	Sapientia	12.3	1.593	9.3	K5	7 51.5	17 36	3.0 12	30 22	74-	all	EMP 1981								
Dec 26	14 35-55	Tercidina	11.3	1.223	113209	8.3	B9	5 48.6	8 29	3.0 12	50	88-	e	84E	EMP 1981						
Dec 29	0 53-66	Hebe	9.3	1.543	10.0	10.0	8 46.2	9 28	0.5 21	28 12	70-	all	Branham								

July 31: Emersion will be on the dark side of Venus' 36%-sunlit disk, 31" in diameter. The northern-limit graze will be 1° from the cusp on the bright side.

Aug. 6: The star is Z.C. 1598. A gradual lunar occultation reported in 1929 indicates that the star may be double.

Aug. 18: Emersion will be on the dark side of Venus' 48%-sunlit disk, 25" in diameter. The northern-limit graze will be 1° from the cusp on the dark side.

Aug. 22: Emersion will be on the dark side of Venus' 50%-sunlit disk, 24" in diameter. The southern-limit graze will be 2° from the cusp on the bright side.

Aug. 24, (554) Peraga and SAO 76811: The star is Z.C. 733 or ADS 3501; the secondary (B-component) is 0".5 away from the primary (A-component) in p.a. 280°. Separate predictions are given for the two components. The Δm values in the table assume that the seeing will be good enough to clearly resolve the components, which is seldom the case for 0".5 separation. If the seeing is so poor that the components can not be resolved at all, the apparent Δm will be 1.4 if the primary is occulted, and only 0.3 if the secondary is occulted. If the image is good enough to be elongated, a piece of it will disappear when the secondary is occulted, so that seeing an event involving the secondary might not be as difficult for a visual observer as the 0.3 Δm would suggest. If the double star information is correct, the two components should be occulted in separate paths 245 km apart, and each about 115 km wide, with the path for the secondary south of that for the primary. But some error is possible, so that one observer might see both components occulted, with the secondary being covered about 25 seconds before the primary.

Aug. 31, (566) Stereokopia and SAO 93151: The star's angular diameter is 0".0002, requiring 0.11 second to centrally cover.

Sept. 1, (134) Sophrosyne and SAO 109465: The star's angular diameter is 0".0004, requiring 0.06 second to centrally cover.

Sept. 19: The star, SAO 185447, is probably a close double, with equal components less than 0".1 apart, based on a lunar occultation observed by Richard Nolthenius on 1975 October 13 reported in *Occultation Newsletter* 1 (7), page 60.

Sept. 20: The star, SAO 96561, is possibly a close double, based on a lunar occultation photoelectrically recorded at McDonald Observatory by J. Africano on 1975 Jan. 26, reported in *O.N.* 1 (4), p. 36. If the recorded step was not due to seeing, the components were magnitude 8.8 and 11.2, and were 0".077 apart in direction 317°.

Sept. 24: Mars' 24" disk will be 99.8% sunlit. Disappearance will be on the dark crescent, 0".05 wide at most. But since atmospheric seeing is much more than this, even central disappearances will appear to be bright-side events. The star is Z.C. 66.

Oct. 3: The star is Z.C. 1071. Its angular diameter is 0".0014, requiring 0.15 second to centrally cover.

Table 2, Part D

1988 DATE	M I N O R No.	Name	km-diam.	P L A N E T RSOI Type	Motion °/Day	P. A.	S A O No	S	T	A	R	Min.	Geocentric U. T.	S	COMPARISON DATA AGK3 No	Shift Time	A P P A R E N T R. A.	Dec.	
Nov 1	206	Hersilia	111	0.09	403 C	0.202	248.9	109982	+ 3° 21'6	15	204	19 38.7	41.87N	RX N 3	187	0.03	005	13305	4° 5'
Nov 3	230	Athamantis	130	0.06	451 S	0.428	88.6	161197	-17 5074			10 41.0	1.31N	HX		0.49	-0.2	18 13.1	-17 10
Nov 6	6	Hebe	186	0.13	750 S	0.215	102.7					10 1.6	0.94N	C			8 40.9	8 17	
Nov 8	52	Europa	291	0.13	1824 C	0.322	107.2					2 58.8	1.27N	C			11 6.2	7 57	
Nov 9	53	Kalypso	110	0.10	311 C	0.230	104.1					5 45.6	3.29N	H			8 3.8	14 58	
Nov 10	6	Hebe	186	0.13	753 S	0.193	102.2	117080	+ 8 2110			0 49.6	4.23S	HA N 8	1173	-0.19	-1.9	8 43.9	8 7
Nov 13	43	Ariadne	78	0.05	168 S	0.559	81.0	-19 5452				19 29.5	4.31N	Y			19 29.5	-19 25	
Nov 13	89	Julia	168	0.09	615 S	0.456	72.4	187992	-22 5063			19 40.7	2.72S	7P		0.08	0.2	19 20.0	-22 26
Nov 14	356	Ligura	157	0.14	536 C	0.161	77.0		+32 1673			4 31.4	0.79N	A	N32	828		8 4.8	32 12
Nov 16	52	Europa	291	0.13	1827 C	0.304	106.7		+ 7 2430			2 5.6	2.08N	C			11 15.4	7 15	
Nov 17	112	Iphigenia	67	0.07	164 C	0.255	256.9	76140	+24 547	X	13	38.4	0.11N	E	N24	329		3 44.6	24 26
Nov 24	7	Iris	222	0.17	902 S	0.246	122.6					2 9.5	3.92S	C			9 43.8	9 21	
Nov 24	66	Maja	92	0.10	248 C	0.116	253.9	92660	+14 285			7 10.4	4.37S	XA N14	158	0.31	0.4	1 50.7	14 42
Nov 25	626	Notburga	96	0.11	247 C	0.205	254.3	12704	+65 340			9 17.0	2.80N	AG N65	210	-0.18	-0.8	3 19.0	65 37
Nov 28	25	Phocaea	73	0.06	218 S	0.279	242.1	112763	+ 0 1063			8 31.2	3.56N	AS N 0	543	0.23	-0.3	5 25.8	0 48
Nov 29	90	Antiope	138	0.06	551 C	0.412	79.9	188509	C2315691			10 38.8	3.21S	ZS			19 43.9	-22 53	
Dec 2	230	Athamantis	130	0.06	448 S	0.466	83.2	162201	-16 5153	A	6	8.9	2.06N	ZY		-0.51	-0.3	19 6.2	-15 15
Dec 4	690	Wratislavia	175	0.12	885 CEU	0.165	250.9		L 1 2096			0 3.9	5.15N	H			6 57.0	17 8	
Dec 4	175	Andromache	80	0.05	301 U	0.164	280.0	78770	+27 1236			23 41.9	3.23S	ZA N27	725	-0.29	-0.5	6 48.5	27 12
Dec 11	690	Wratislavia	175	0.12	889 CEU	0.194	255.4	96213	+16 1316			6 15.7	0.70N	HX N16	592	0.21	-0.1	6 51.2	16 46
Dec 15	690	Wratislavia	175	0.12	891 CEU	0.207	257.3	A751493				14 48.0	1.59N	C			6 48.2	15 33	
Dec 15	466	Tisiphone	139	0.05	668 CU	0.344	114.3	205533	C3011403			21 52.3	0.37N	PS		0.87	2.6	14 24.4	-30 45
Dec 18	423	Diotima	209	0.13	1237 C	0.205	290.4		+30 1347			21 2.0	0.61S	A	N30	739		6 51.5	30 23
Dec 19	49	Pales	175	0.16	739 C	0.198	255.8	76856	+24 712			6 15.7	3.73S	XA N24	439	-0.08	0.5	4 56.5	24 56
Dec 21	104	Klymene	134	0.04	704 C	0.284	108.0	158836	-15 3965	K	10	41.3	0.60N	F		-0.07	0.1	14 50.1	-15 57
Dec 21	90	Antiope	138	0.06	552 C	0.434	76.5	189246	-21 5707			16 35.0	2.54N	HX		0.56	-0.2	20 23.7	-20 57
Dec 21	41	Daphne	204	0.14	1092 C	0.169	263.4	135063	- 0 1808			16 40.8	4.32N	AS S 0	1081	0.90	-0.5	7 44.8	-0 25
Dec 23	200	Dynamene	137	0.08	498 C	0.311	68.7	128240	+ 2 4680			23 32.7	0.58S	RZ N 3	3016	0.23	0.2	23 32.3	3 19
Dec 25	275	Sappientia	105	0.09	350 C	0.175	286.9		L 4 3045			12 2.1	3.98S	H			7 53.7	17 29	
Dec 26	345	Tercidina	109	0.12	320 C	0.255	262.3	113209	+ 8 1091			14 45.0	1.98N	RA N 8	562	-0.05	0.6	5 50.8	8 29
Dec 29	6	Hebe	186	0.17	789 S	0.187	304.7		L 1 4688			0 58.3	4.05N	H			8 48.4	9 19	

Oct. 4: Emergence will be on the dark side of Venus' 70%-sunlit disk, 16" in diameter. The southern-limit graze will be 3" from the cusp on the bright side.

Oct. 10: The star's angular diameter is 0".0005, requiring 0.05 second to centrally cover.

Oct. 14: The star's angular diameter is 0".00014, requiring 0.17 second to centrally cover.

Oct. 16, (43) Ariadne and B.D. -21° 4992: The star is L 3 7033 or ADS 11330; the B-component is 2".8 away from the primary (A-component) in p.a. 42°. Separate predictions are given for the two components. The Δm values in the table assume that the seeing will be good enough to clearly resolve the components, which is not always the case for 2".8 separation. If the seeing is so poor that the components can not be resolved at all, the apparent Δm will be 0.8 if the primary is occulted, and 0.6 if the secondary is occulted. If the image is good enough to be elongated, a piece of it will disappear when a component is occulted, so that seeing an event might not be as difficult for a visual observer as the relatively small Δm would suggest. An 11.5-magnitude C-component is 67".6 from A in p.a. 280°. It in turn has an 11.8-mag. D-component 9".8 away in p.a. 160°. Neither C nor D will be occulted by Ariadne.

Oct. 30, (566) Stereoskopia and SAO 110565: The star is Z.C. 368 or ADS 1896. The A-component's angular diameter is 0".0010, requiring 0.12 second to centrally cover. The B-component is 1".6 away from the primary (A-component) in p.a. 144°. Separate predictions are given for the two components. The Δm values in the table assume that the seeing will be good enough to clearly resolve the components, which is not often the case for 1".6 separation. If the seeing is so poor that the components can not be resolved at all, the apparent Δm will be 4.3 if the primary is occulted, and only 0.02 if the secondary is occulted. If the image is good enough to be elongated, a piece of it will disappear when the secondary is occulted,

so that seeing an event might not be as difficult for a visual observer as the very small Δm would suggest. But this will rarely be the case for such a faint star so close to such a bright one; observation of an occultation of the B-component will be virtually impossible.

Nov. 13, (89) Julia and SAO 187992: The star is Z.C. 2822. The star's angular diameter is $0''.0014$, requiring 0.07 second to centrally cover.

Nov. 17: The star is 19 Tauri, Z.C. 539, or Taygeta in the Pleiades. 1969 lunar occultation data suggest a 6th-magnitude companion only about $0''.01$ away.

Nov. 25: The star is BK Camelopardalis. The star is a spectroscopic binary with a 4.5-year period, so step events are likely during this occultation. The star varies by only 0.1 magnitude.

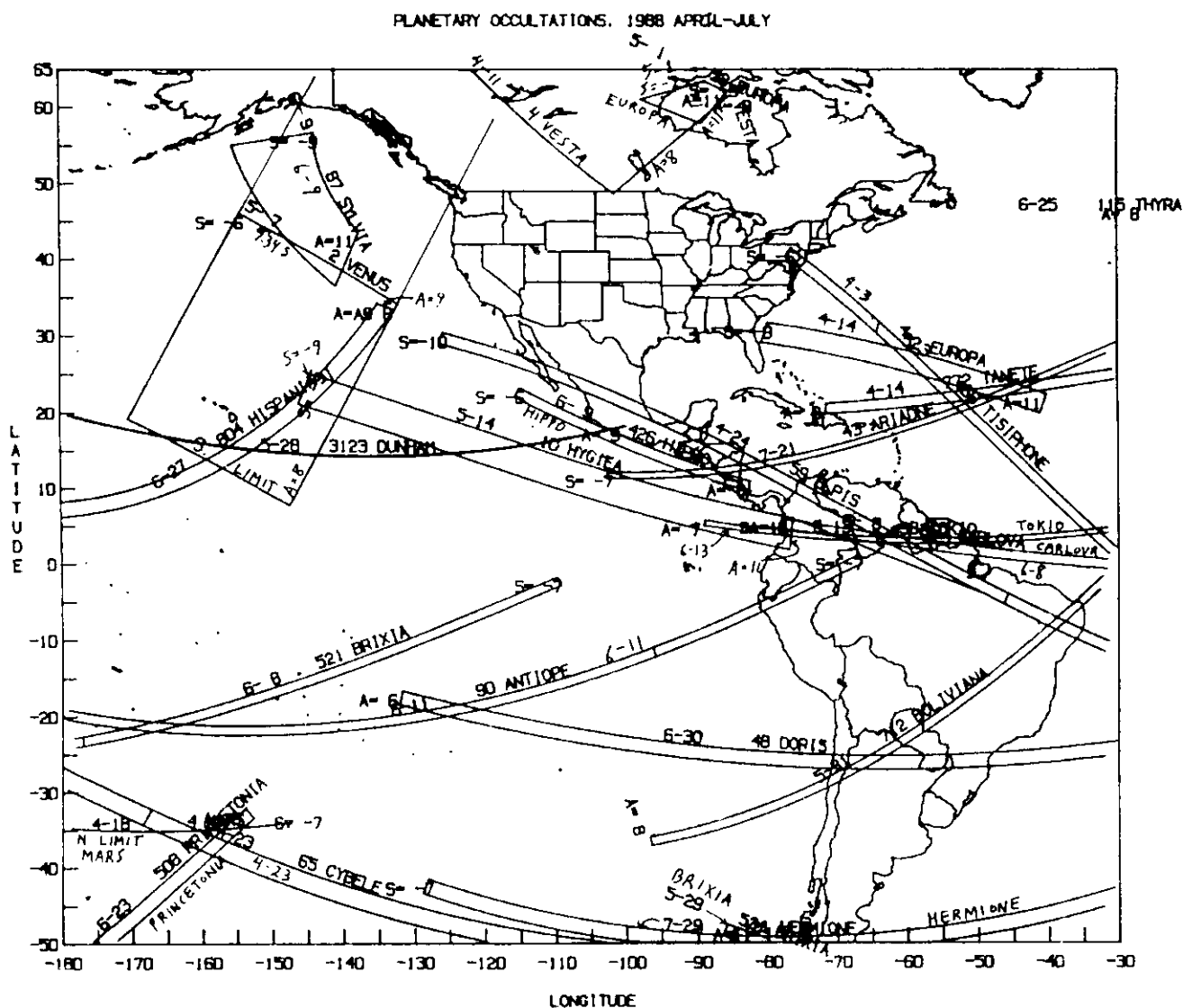
Nov. 29: The star is Z.C. 2884.

Dec. 2: The star is Z.C. 2786 or ADS 12039. The 9.9-mag. secondary is $6''.4$ away in p.a. 2° ; its path misses the Earth by $1''.4$ over Antarctica.

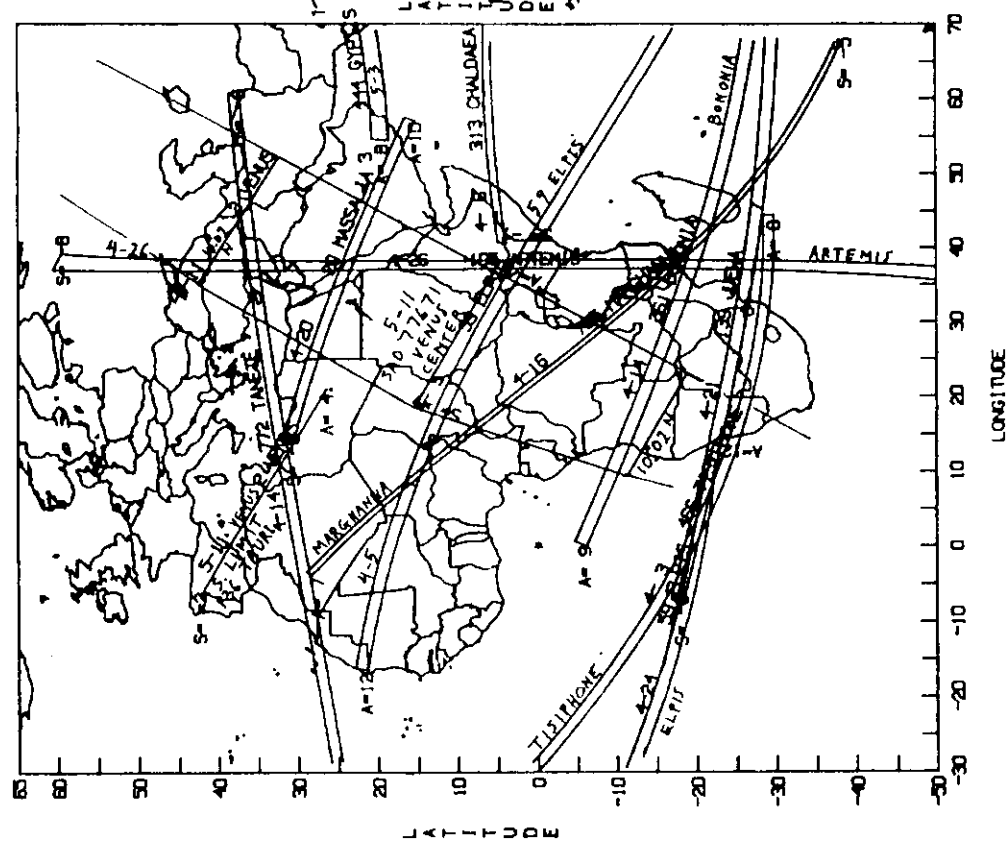
Dec. 4, (175) Andromache and SAO 78770: The star is Z.C. 1042.

Dec. 21, (104) Klymene and SAO 158836: The star is 8 Librae or Z.C. 2117 or Alpha 1 Librae. On 1985 January 15, 269 timings were made by 65 observers in Paul Maley's expedition near Houston, Texas, the most productive single lunar graze expedition to date; see *o.n.* 3 (11), 231 and 3 (12), 244. During the graze, there was no evidence seen of the star's possible duplicity suspected from earlier lunar occultation observations. Interestingly, the predicted path for this asteroidal occultation also passes over Houston.

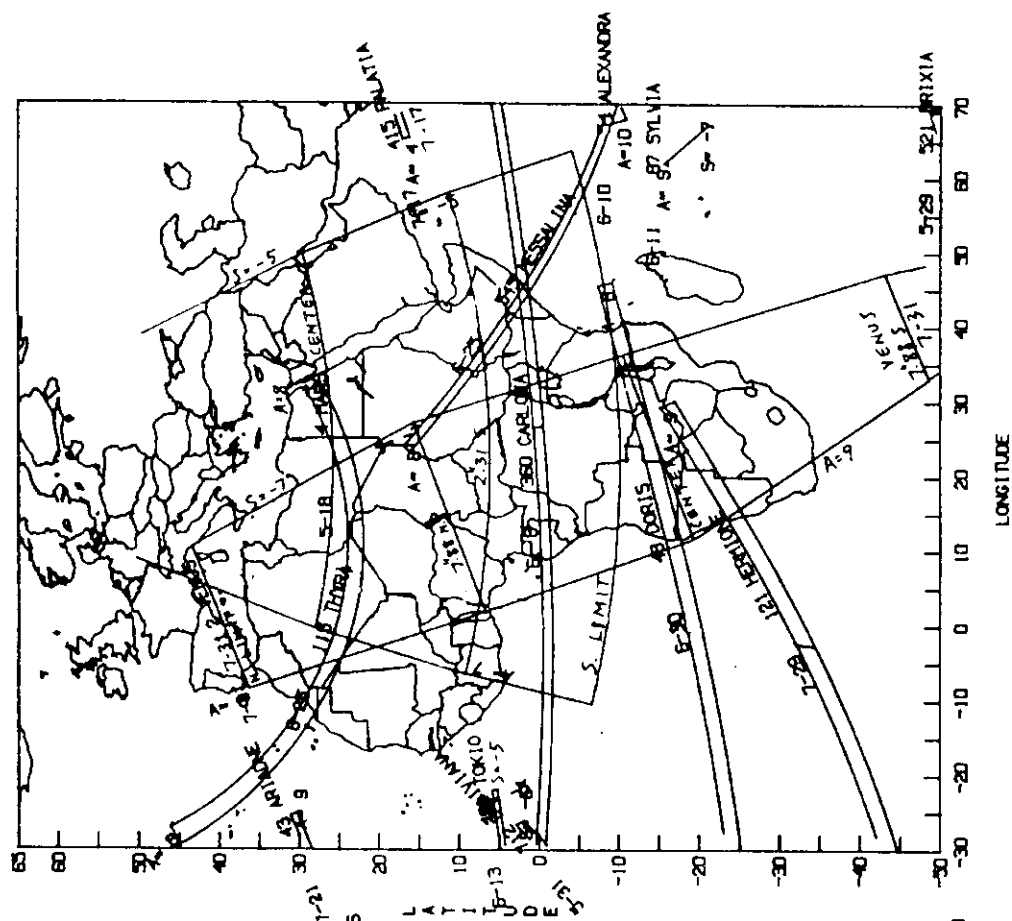
Dec. 23: The star is Z.C. 3471. The star's angular diameter is $0''.0010$, requiring 0.08 second to centrally cover.

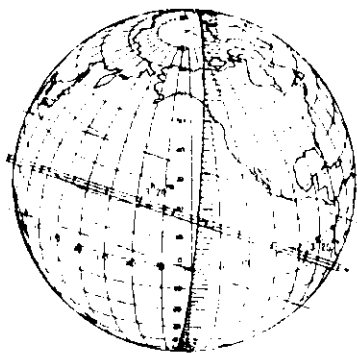
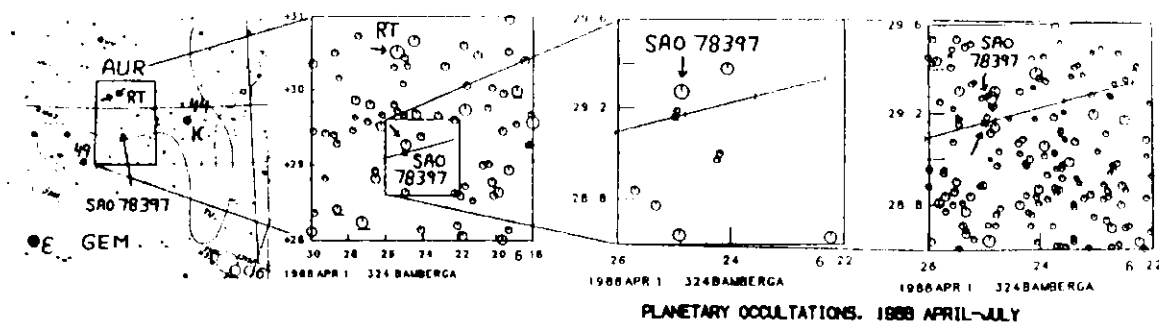


PLANETARY OCCULTATIONS. 1988 4/1 -5/12

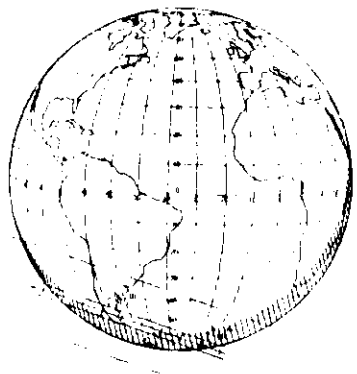


PLANETARY OCCULTATIONS. 1988 5/13 - 7/31

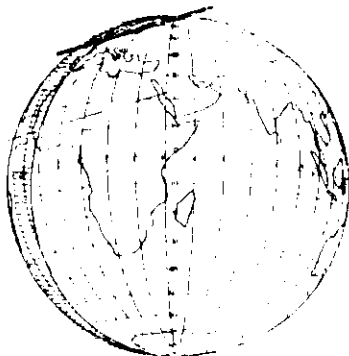
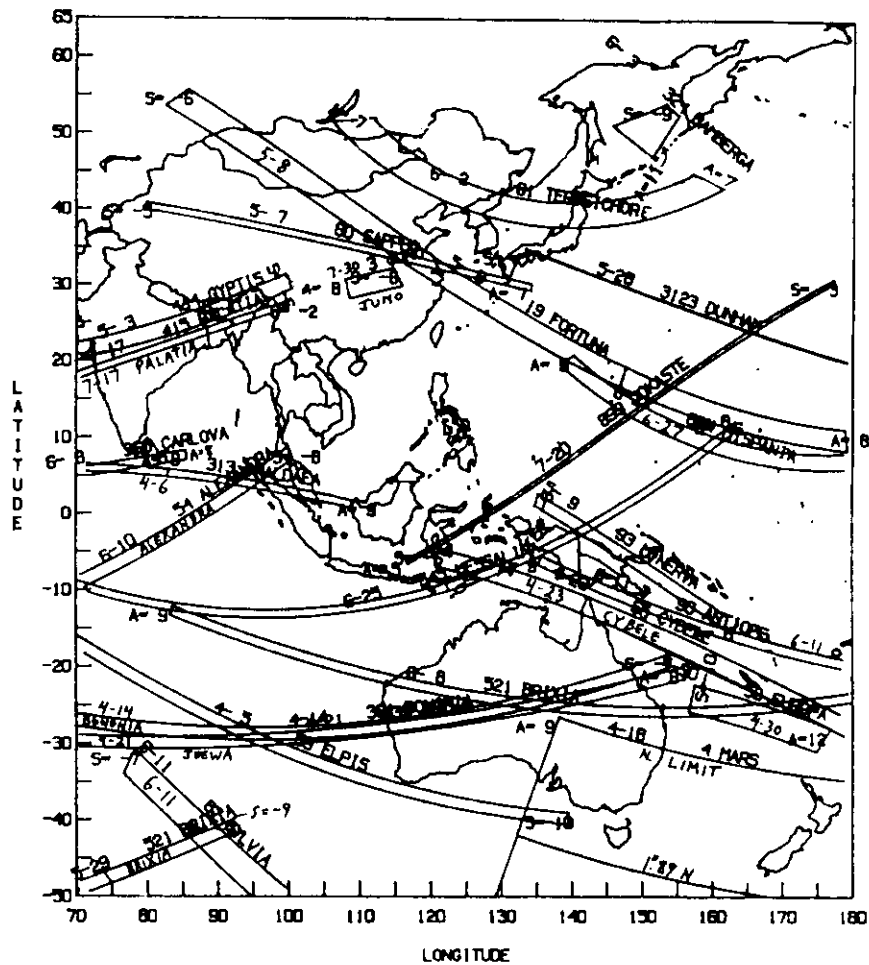




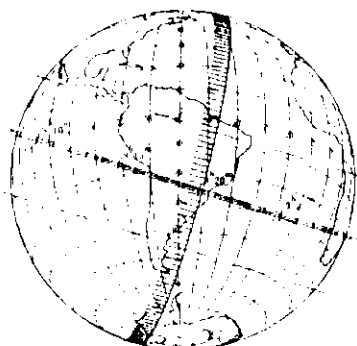
Anonymous by Bamberg 1988 Apr 1



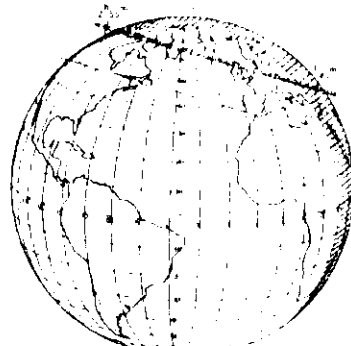
SAO 118291 by Hygiea 1988 Feb 22



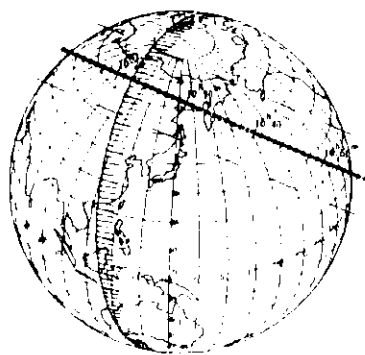
SAO 163378 by Boliviana '88 Feb 22



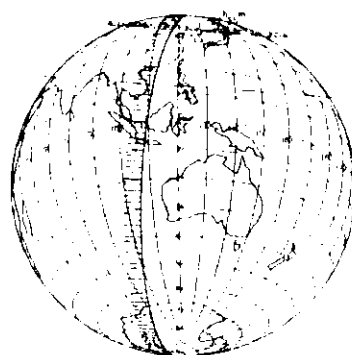
SAO 183657 by Isolida 1988 Feb 24



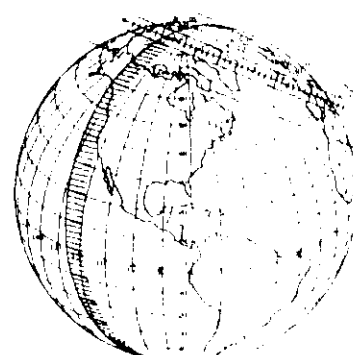
SAO 99328 by Dido 1988 Feb 27



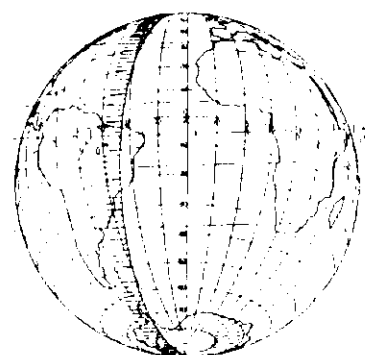
SAO 59244 by Erita 1988 Feb 28



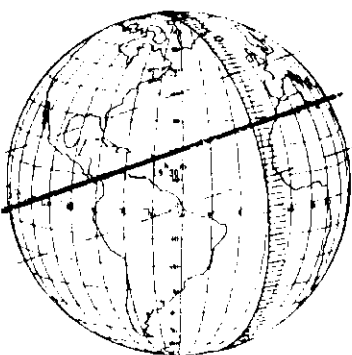
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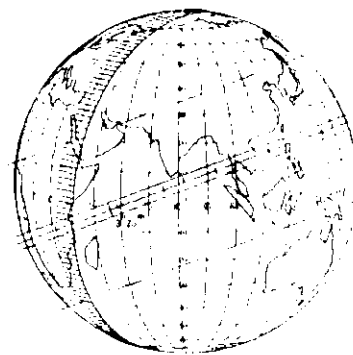
SAO 79685 by Vesta 1988 Mar 1



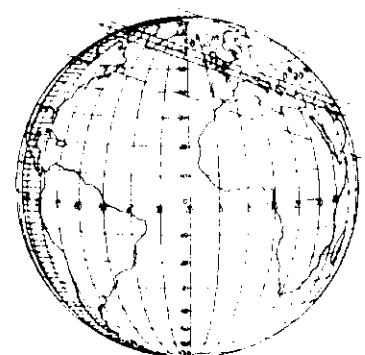
SAO 187025 by Mars 1988 Mar 5



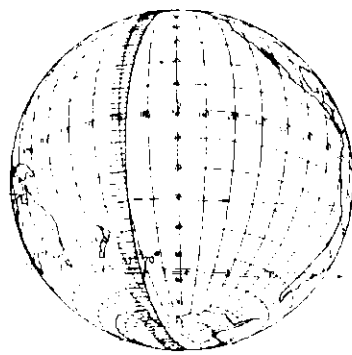
Anonymous by Nemausa 1988 Mar 5



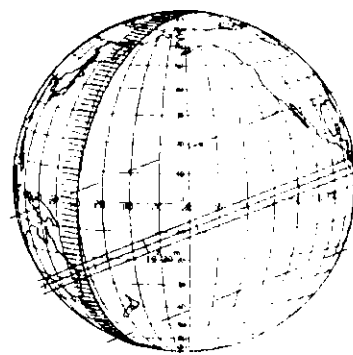
Anonymous by Pallas 1988 Mar 6



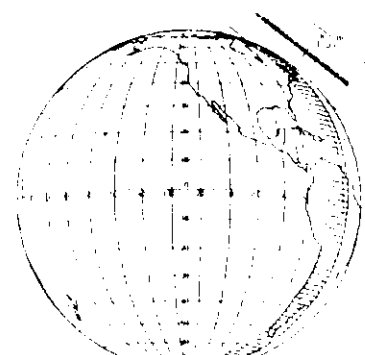
+6°2274 by Hygiea 1988 Mar 8



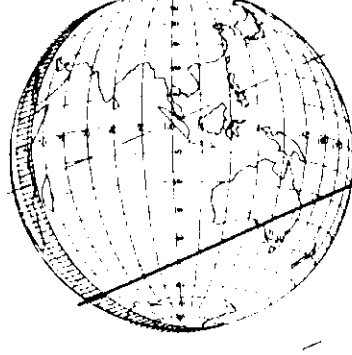
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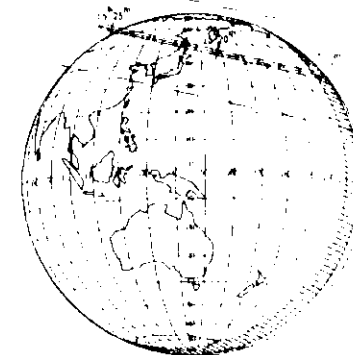
SAO 125328 by Pallas 1988 Mar 10



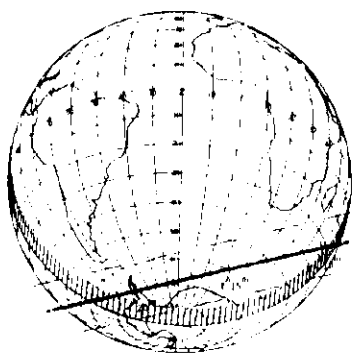
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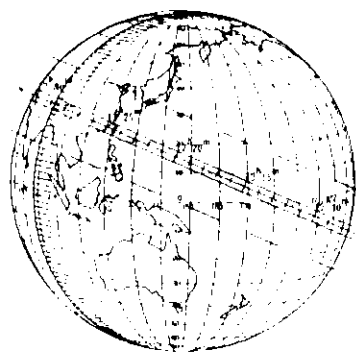
SAO 164663 by P/SM-WM-1 '88 Mar 16



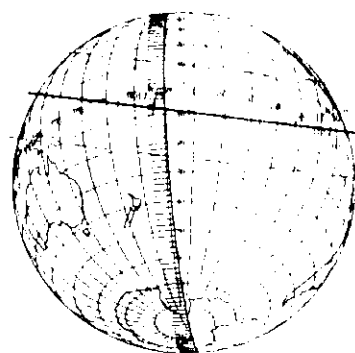
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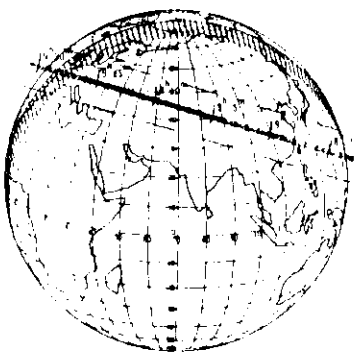
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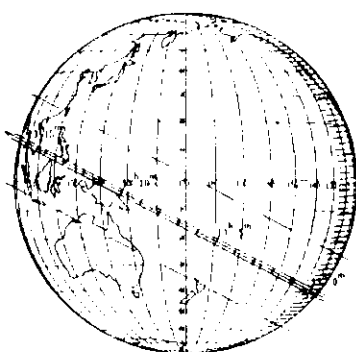
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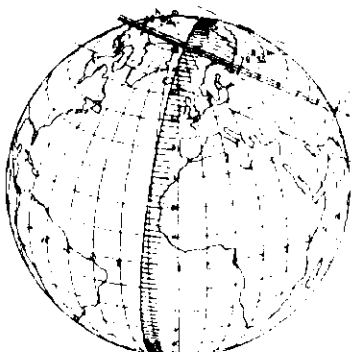
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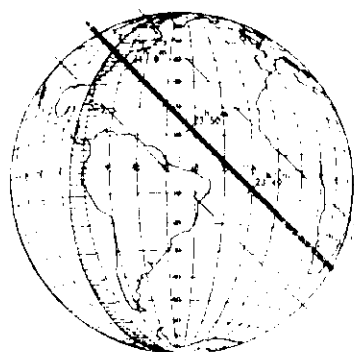
SAO 99847 by Irene 1988 Mar 24



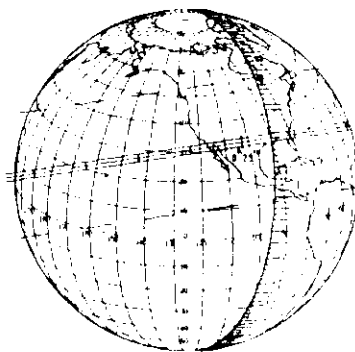
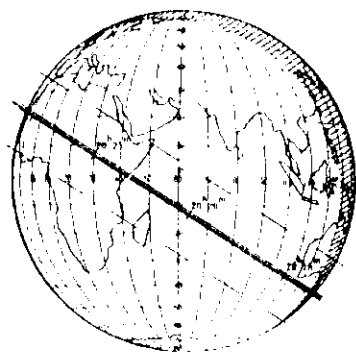
SAO 138918 by Cybele 1988 Mar 25



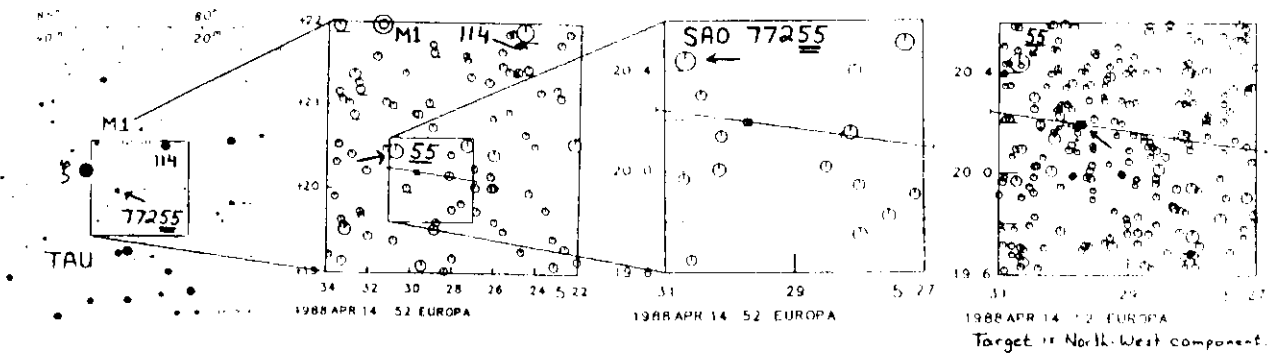
Anonymous by Amphitrite '88 Mar 29

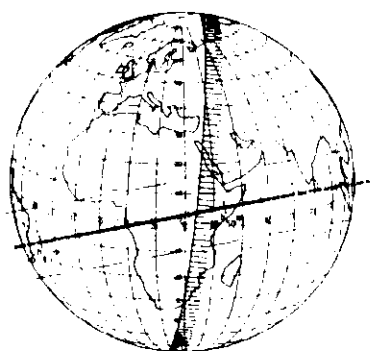
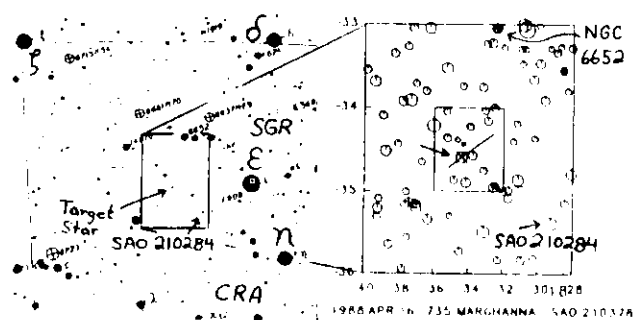
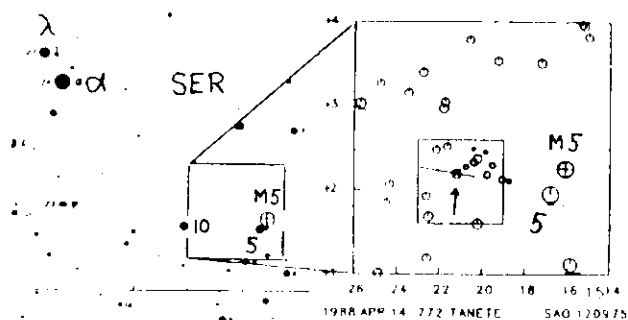


SAO 137000 by Tisiphone 1988 Apr 3 L 2 2140 by Elpis 1988 Apr 5

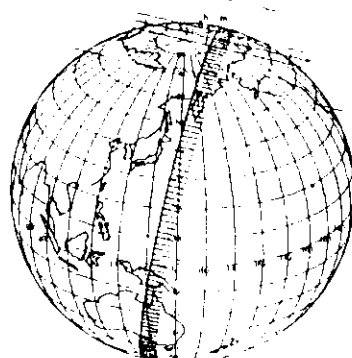


Anonymous by Europa 1988 Apr 14

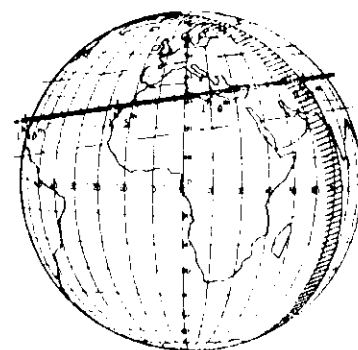




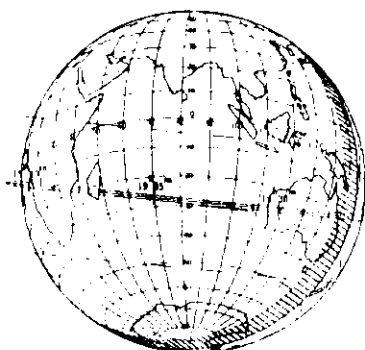
+14°14'28" by Chaldea 1988 Apr 6



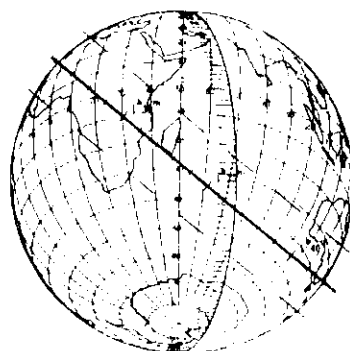
SAO 79859 by Vesta 1988 Apr 11



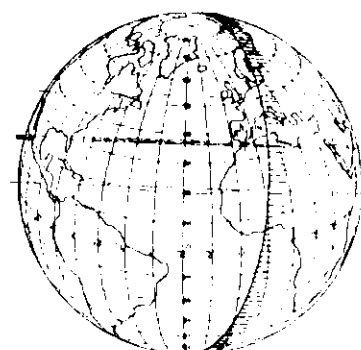
SAO 120975 by Tanete 1988 Apr 14



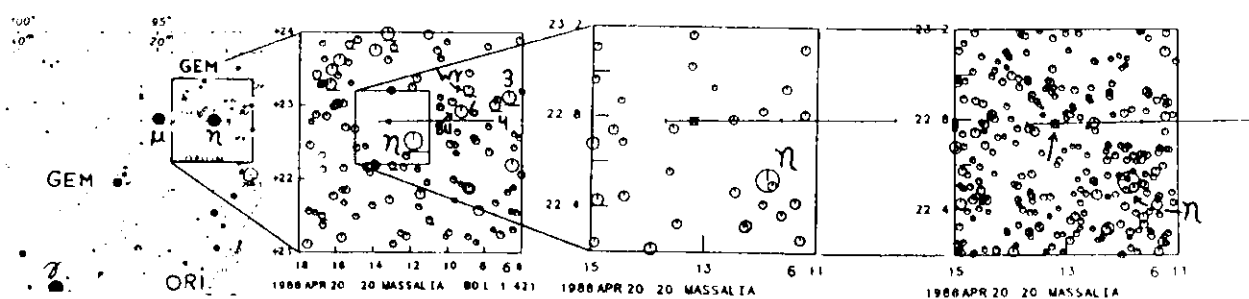
SAO 182831 by Bononia 1988 Apr 14

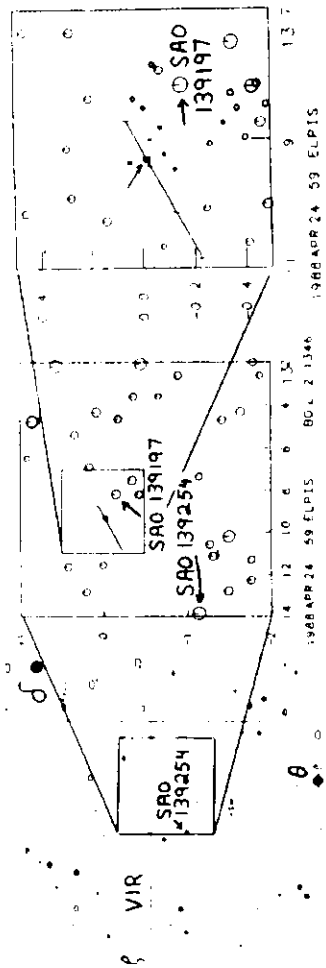
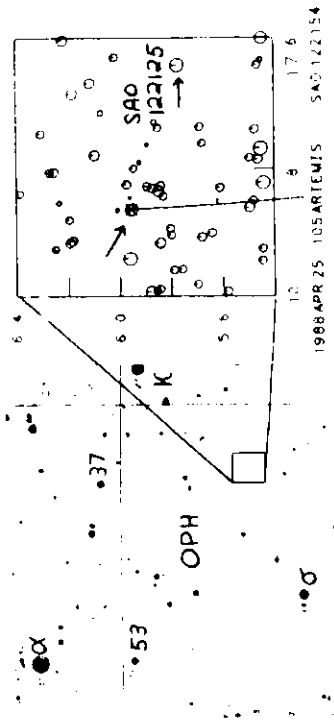


SAO 210378 by Marghanna '88 Apr 16



L L 421 by Massalia 1988 Apr 20



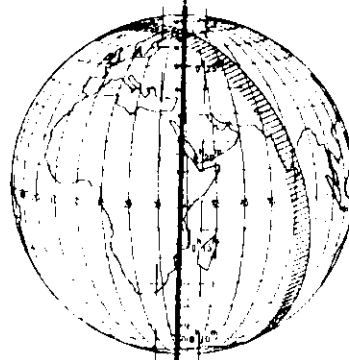
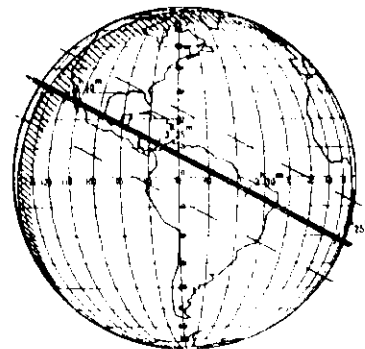
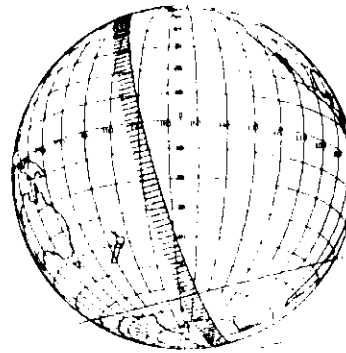
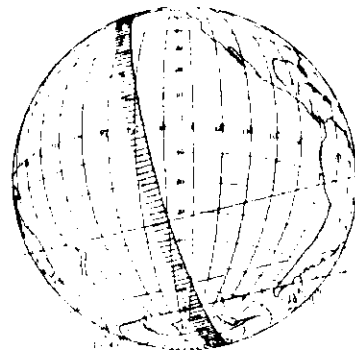


L 5 4361 by Mars 1988 Apr 18

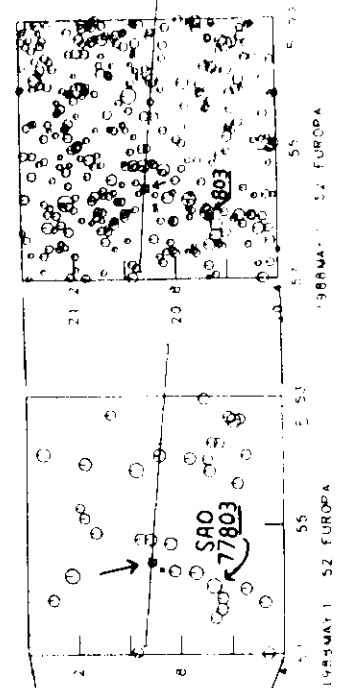
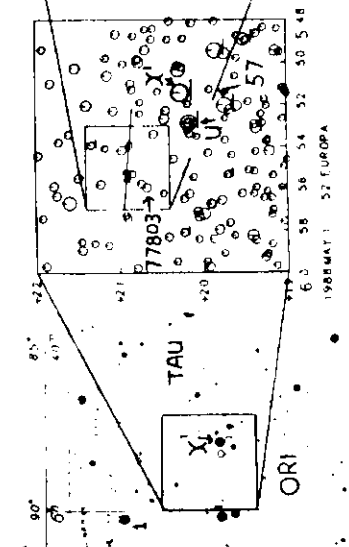
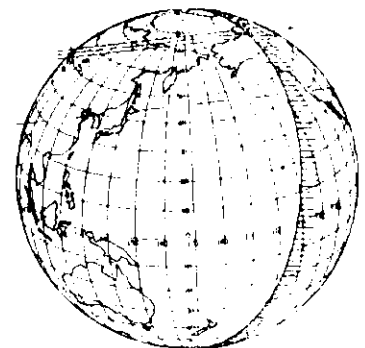
L 5 4371 by Mars 1988 Apr 18

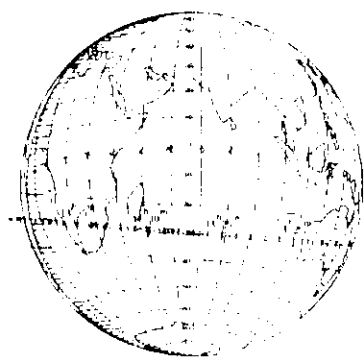
L 2 1346 by Elpis 1988 Apr 24

SAO 122154 by Artemis 1988 Apr 26

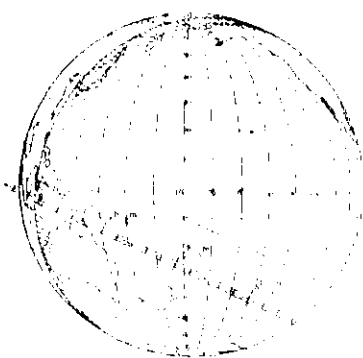


Anonymous by Europa 1988 May 1

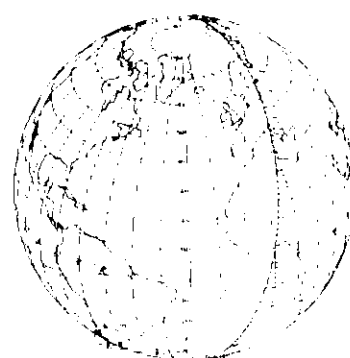




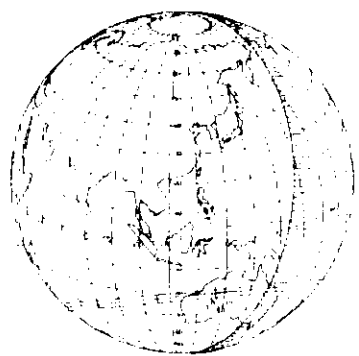
SAO 157598 by Juwaa 1988 Apr 21



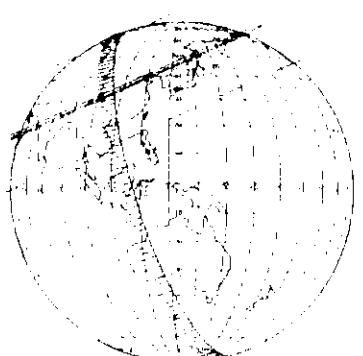
SAO 119368 by Cybele 1988 Apr 23



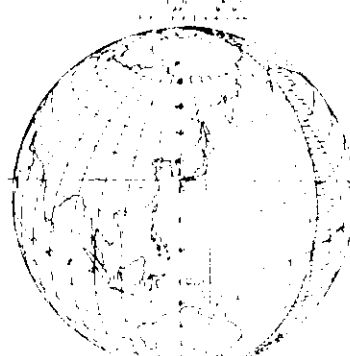
SAO 59128 by Minerva 1988 Apr 26



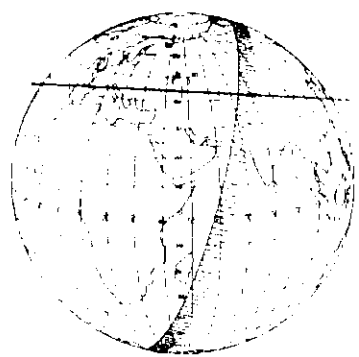
Anonymous by Europa 1988 Apr 30



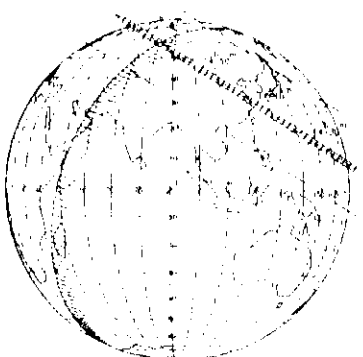
SAO 145748 by Gypris 1988 May 3



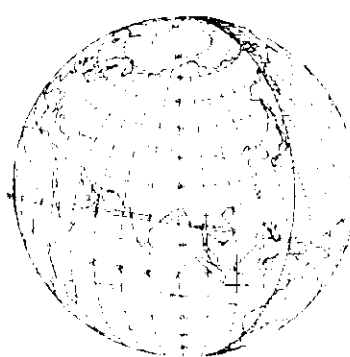
SAO 77478 by Venus 1988 May 7



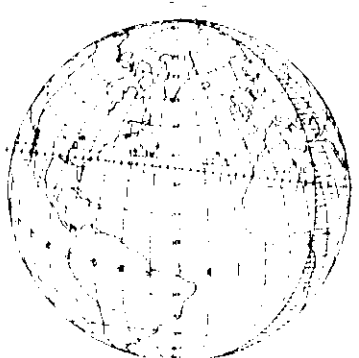
SAO 97081 by Sappho 1988 May 7



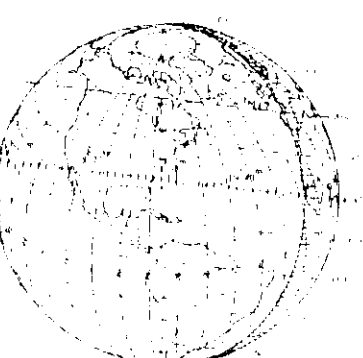
SAO 138526 by Fortuna 1988 May 8



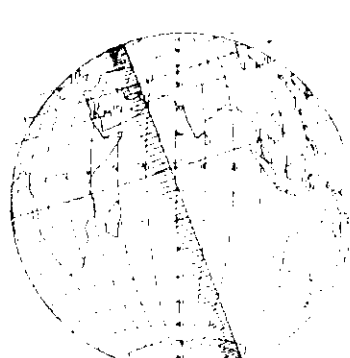
SAO 59402 by Minerva 1988 May 9



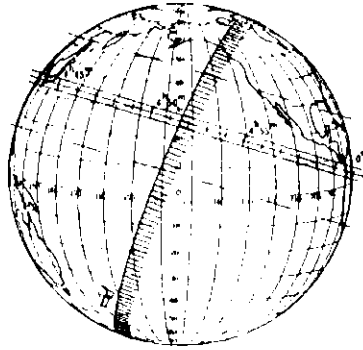
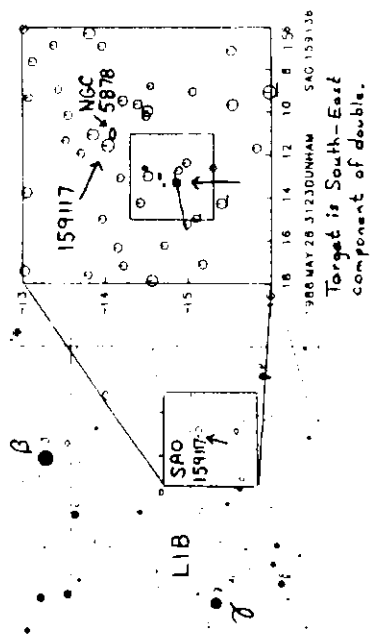
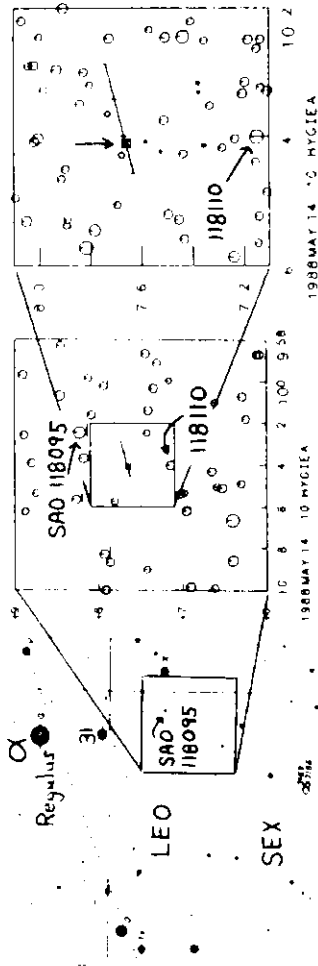
SAO 77671 by Venus 1988 May 11



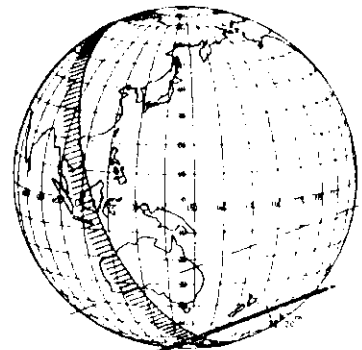
SAO 77675 by Venus 1988 May 11



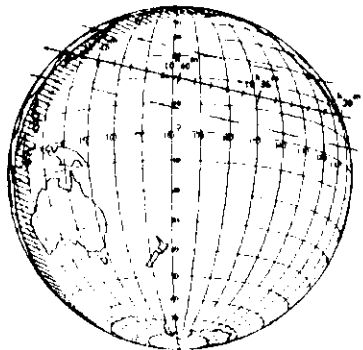
SAO 164817 by Mars 1988 May 18



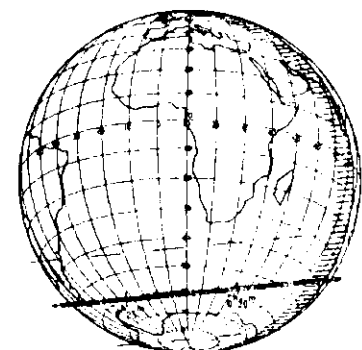
Anonymous by Hygiea 1988 May 14



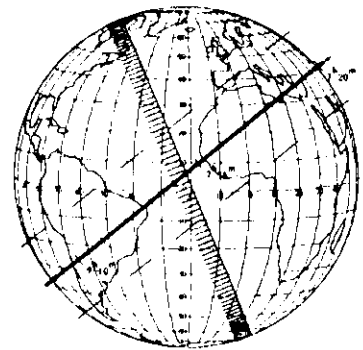
SAO 109088 by Mnesosyne '88 May 23



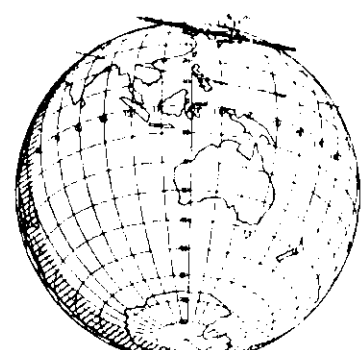
SAO 159136 by Dunham 1988 May 28



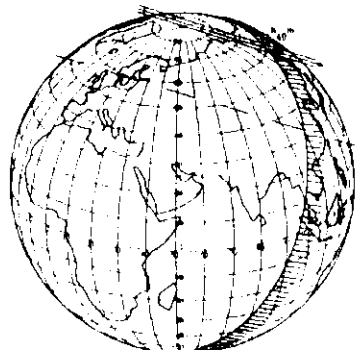
B2166613 by Brixia 1988 May 29



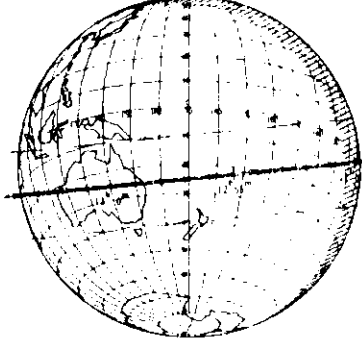
SAO 127508 by Boliviana '88 May 31



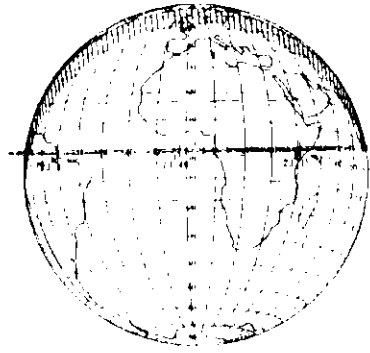
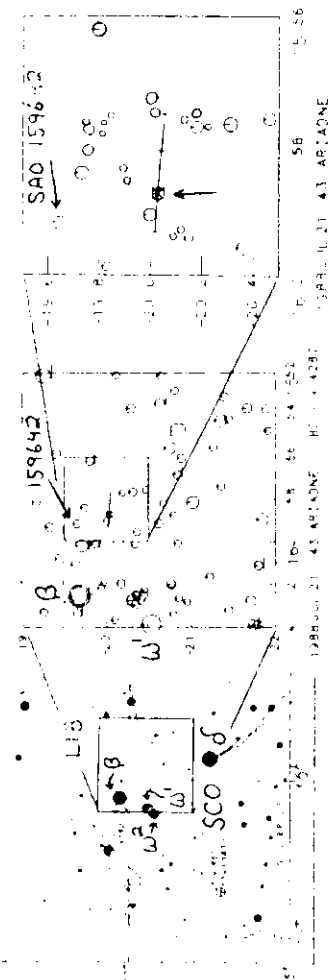
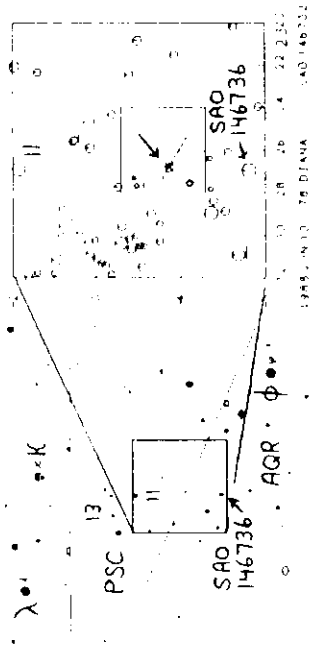
SAO 207185 by Terpsichore 88 Jun 2



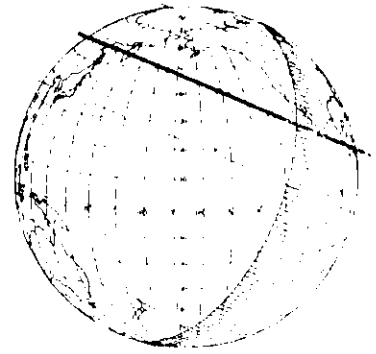
Anonymous by Bambergia 1988 Jun 3



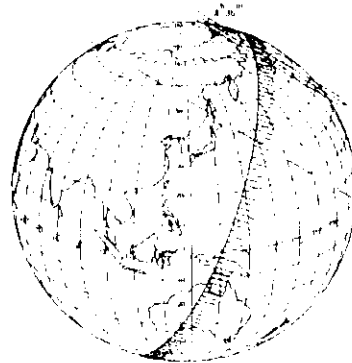
SAO 185407 by Brixia 1988 Jun 8



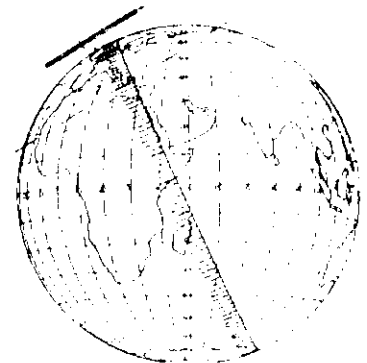
SAO 141501 by Carlova 1988 Jun 8



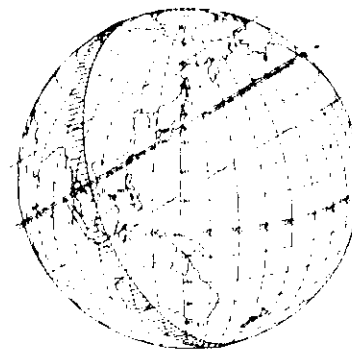
SAO 98260 by Hippo 1988 Jun 9



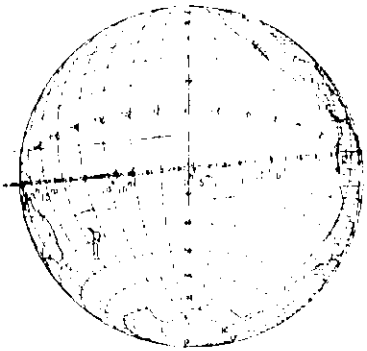
Anonymous by Sylvia 1988 Jun 9



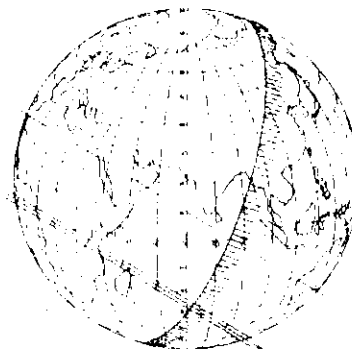
SAO 146732 by Diana 1988 Jun 10



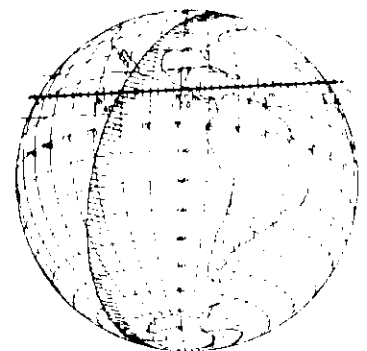
SAO 141501 by Alexandra 1988 Jun 10



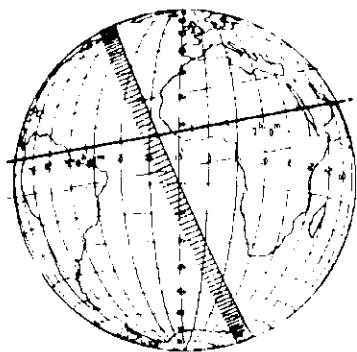
SAO 136402 by Antiope 1988 Jun 11



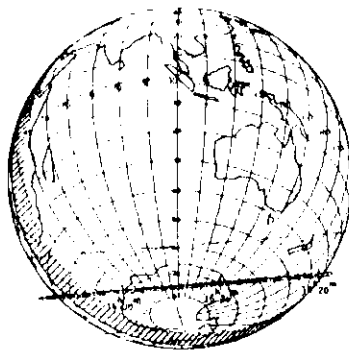
SAO 212181 by Sylvia 1988 Jun 11



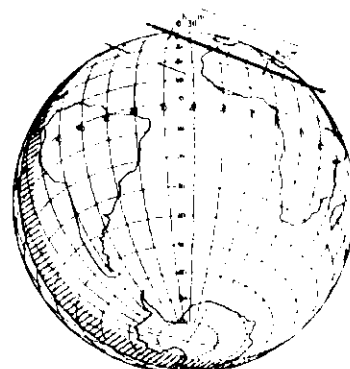
SAO 14287 by Ariadne 1988 Jul 21



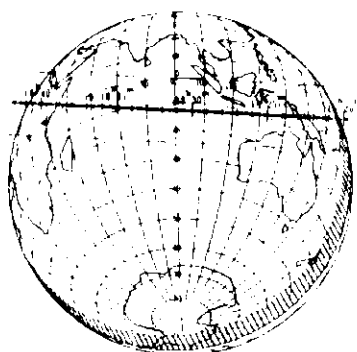
SAO 146962 by Tokio 1988 Jun 13



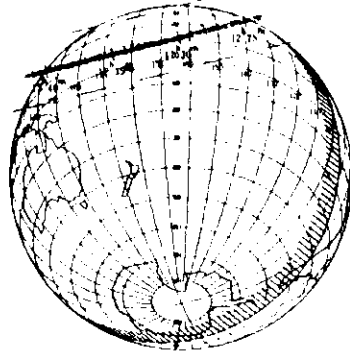
SAO 208706 by Princetonia 88 Jun 23



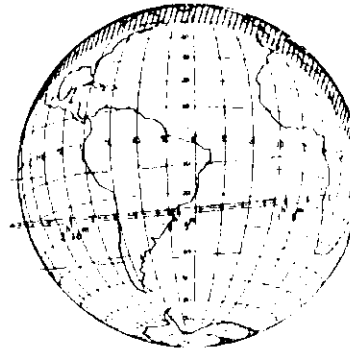
SAO 208420 by Thyra 1988 Jun 25



SAO 210683 by Messalina '88 Jun 25



SAO 229997 by Hispania 1988 Jun 27



SAO 161893 by Doris 1988 Jun 30

SOLAR ECLIPSE NEWS

David W. Dunham

1987 September 23. Five stations were set up by members of the LOOG (see p. 165) on Aka and Fukaji islands straddling the southern limit of annularity southwest of Okinawa. Successful visual and photographic observations were made at three of the stations. Isao Sato was exactly on my predicted southern limit, and had broken annularity at maximum eclipse, with the horns separated by only about 1" on his best photograph. This is in good agreement with my video observation in China a few hundred meters south of the southern limit; both indicate a very small north shift of the shadow, perhaps only 200 feet. I hope to make a preliminary reduction of the IOTA observations obtained in China in a few months, although positional uncertainties remain. An astronomer from Shanghai Observatory wants to make arrangements to work with Alan Fiala and me at USNO in July to reduce their video observations made at both limits, in Tianchang County in Anhui Province and in Funing County in Jiangsu Province.

1988 March 18. This total eclipse is the next in the saros series after the 1970 March eclipse, my first total eclipse, observed in North Carolina. I would like to try to observe this eclipse, but do not expect to, due to a combination of expense, other pressing commitments, weather prospects, and safety concerns. The only IOTA expedition to observe near the limits is being organized by David Herald, who will be joined by two other Australians, Byron Soulsby and A. James, and by James Vail from Massachusetts. They plan to observe from both lim-

its near the east coast of Banka Island. Hans-Joachim Bode and 4 or more other members of IOTA/ES plan to observe from the southern limit near the east coast of Kalimantan (Borneo). Dr. Eberhard Bredner and 3 other members of the Astrag VHS Hamm are going to Mindanao, to observe near the central line from Davao or, if possible, General Santos. They will be staying at the Davao Insular Inter-Continental Hotel from March 15th on; anyone interested in this effort can contact him at the hotel in Davao, or telephone him in the German Federal Republic at 02381,82988.

1991 July 11. T. Hirose, I. Sato, and M. Sôma plan to observe this eclipse from the limits in Mexico, and have asked me for local information. This eclipse is looking more like an excellent opportunity for an international meeting of amateur (and professional?) astronomers.

TRAVEL EXPENSE REPORTS

Homer F. DaBo11

U.S. observers are reminded that if they itemize deductions, reporting requirements are more stringent for 1987 income tax. Blank travel expense reports (IOTA form 001) are available on request to: IOTA; 6 N 106 White Oak Lane; St. Charles, IL 60175, or you may request by telephone: 312,584-1162 -- if no answer, try 906,477-6957. There is no answering machine at either location, so if you don't reach Audrey or me, it's a toll-free try. The second number is our summer home in Michigan's Upper Peninsula, and first-class mail will be forwarded if we plan to be there more than a week or so.