Occultation Newsletter

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FROM THE PUBLISHER

This is the third issue of 1987. It is the fifth issue of Volume 4.

When renewing, please give your name and address exactly as they appear on your mailing label, so that we can locate your file; if the label should be revised, tell us how it should be changed.

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	Full price	Discount price
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for U.S.A., Canada, and Mexico	$12.50	$12.00
for all others (to cover higher postage costs)	17.71	17.00
Occultation Newsletter subscription[1] (1 year = 4 issues)		
by surface mail		
for U.S.A., Canada, and Mexico[2]	8.33	8.00
for all others	8.17	7.84
by air (AO) mail[3]		
for area "A"[4]	9.96	9.56
for area "B"[5]	11.38	10.92
for all other countries	12.79	12.28
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O.N. 1 (1) thru *O.N. 3* (13), each	1.04	1.00
O.N. 3 (14) thru *O.N. 4* (1), each	1.82	1.75
O.N. 4 (2) and later issues, each	2.08	2.00
Back issues of *O.N.* by air (AO) mail[3]		
O.N. 1 (1) thru *O.N. 3* (13), each	1.51	1.45
O.N. 3 (14) thru *O.N. 4* (1), each	2.29	2.20
O.N. 4 (2) and later issues, each	3.12	3.00
(There are 16 issues per volume, all still available)		

Although they are available to IOTA members without charge, non-members must pay for the following items:

Local circumstance (asteroidal appulse) predictions (entire current list for your area)	1.04	1.00
Graze limit and profile prediction (each graze)	1.56	1.50
Papers explaining the use of the predictions	2.60	2.50

Supplements for South America will be available at extra cost through Ignacio Ferrin (Apartado 700; Merida 5101-A; Venezuela), for Europe through Roland Boninsegna (Rue de Mariembourg, 33; B-6381 DOURBES; 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 2241; Wellington; New Zealand), for Japan, through Toshio Hirose (1-13 Shimomaruko 1-chome; Ota-ku, Tokyo 146, Japan). Supplements for all other areas will be available from Jim Stamm (Route 13, Box 109; London, KY 40741; U.S.A.) by surface mail at the low price of 1.23 1.18
or by air (AO) mail at 2.04 1.96

Observers from Europe and the British Isles should join IOTA/ES, sending DM 50.-- to the account IOTA/ES Bartold-Knaust Strasse 8, 3000 Hannover 91, Postgiro Hannover 555 829 - 303, bank-code-number (Bankleitzahl) 250 100 30. Full membership in IOTA/ES includes the supplement for European observers (total and grazing occultations).

[1] Single issue available at ¼ of price shown.
[2] Price includes any supplements for North American observers.
[3] Not available for U.S.A., Canada, or Mexico.
[4] Area "A" includes Central America, St. Pierre and Miquelon, Caribbean islands, Bahamas, Bermuda, Colombia, and Venezuela. If desired, area "A" observers may order the supplement for North American observers by surface mail @ 1.23 1.18
or by air (AO) mail @ 1.56 1.50
[5] 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

Paul Maley has made arrangements for this year's IOTA meeting to be held in the Houston, TX, area on Saturday, October 10th, as noted on p. 58 of the last issue. The meeting, open to the public, will start at 9 am in the Hess Room of the Lunar and Planetary Institute, 3303 NASA Road 1, just east of the Johnson Spaceflight Center and about 35 miles southeast of downtown Houston. The meeting will break for lunch at noon, and will adjourn at 3 pm, after which we may continue with some informal discussions at another location. An agenda will not be drawn up until shortly before the meeting, but it will certainly include (but not be limited to) a very short business meeting, reports of this year's solar eclipse trips, plans for future solar eclipses, showing of the better eclipse and occultation videotapes made during the past year, predictions and planning for lunar events (especially, Pleiades passages and grazes of 1st-magnitude stars) and asteroidal occultations during 1988, and status reports on the various computer projects. Unsuccessful attempts were made to secure a meeting room for Sunday, Oct. 11, to bring the meeting time closer to graze of 1.8-mag. El Nath (Beta Tauri), which will occur in the area around 4:18 am CDT Monday morning, Oct. 12. Those who can stay until then are invited to join local efforts to observe the graze; those travelling by plane may be able to arrange to borrow a local telescope to avoid bringing their own. But potential observers of this event are forewarned that the predicted profile is very smooth, promising multiple occultations only for a very narrow range whose location is hard to predict (that is, chances of seeing only 0 or 1 occultation are high). If you are interested in attending the meeting, information for out-of-town participants can be obtained from Paul Maley; 15807 Brookvilla; Houston, TX 77059; U.S.A.; telephone 713,488-6871. Also contact him if you want to give a presentation, or have a specific topic that you would like to see included in the agenda.

The "Universe '87" superconvention held at Pomona College in Claremont, CA, was very successful, and gave me a chance to meet some IOTA members for the first time, and see others whom I had not seen in many years. Members from all over the U.S.A. were present, with a total attendance of about 900 (nearly half of these were teachers who attended special teaching sessions during the weekend). One convention participant (Tom Cragg) came from Australia. I prepared a 10-minute videotape showing seven of the best grazes in my collection, along with my recordings of the 1983 occultation of 1 Vulpeculae by Pallas and the 1984 broken-annular eclipse. I showed this during one of my two talks, and discussed the Pallas occultation during the other. We also conducted a workshop on occultations, during which I went over the basics, Larry Dunn demonstrated his realistic occultation simulation-reaction time testing software on a Macintosh computer, and Joan discussed the status of the various IOTA PC projects (see p. 109). At the meeting, John Westfall passed out some copies of a "Pomona Edition" of The Weekly Planet, produced by the Association of Lunar and Planetary Observers. This includes daily charts of the Moon outlining the maria and major craters, and shows the terminator. Westfall produces these with his Apple computer, with input consisting of the date, time, and geographical coordinates for calculating topocentric librations. I think that this would be valuable for portraying important occultations, especially for locating reappearing stars, and Westfall said that he would send me a diskette with the software and database. The lunar features database probably can be transferred to an IBM PC, for which similar software could be written.

One of the topics to be discussed in Houston will be the time and location of the 1988 meeting. The official meeting must be held in Texas, but the date does not need to be decided until a few months beforehand, to publish in *o.N.* at least a month in advance. At the symposium in Paris in June (see p. 113), the possibility of holding a joint IOTA-IOTA/ES meeting was discussed. Iceland was suggested as a possible location, a compromise between Europe and North America. Bermuda, the Azores, and the Canary Islands might also be considered. But I don't know if there is sufficient interest for enough people to travel farther than usual just for a joint occultation meeting. Another possibility is to join a superconvention of other astronomical societies, such as the ones just held in Paris and in Claremont, CA, this year. It will probably be awhile before another superconvention is held, but if one is considered, a compromise location like one of the ones mentioned might encourage more international participation. Another possibility is to organize the meeting around a total solar eclipse, which many IOTA members might want to observe, anyway. But few will be attempting the eclipse in March next year. Possibilities might be to hold a joint meeting in Europe just before or after the 1990 July eclipse, or in the U.S.A. or Mexico near the 1991 July large-magnitude eclipse. Steven Edberg has already independently suggested an international superconvention in Mexico in 1991 July.

On p. 58 of the last issue, I reported that a proposal to close the Australian short-wave time signal station, VNG, had been dropped. Shortly after the issue went to press, I received a letter from S. C. Moon, secretary of Telecom Australia, which had polled seven Australian government departments about their use of VNG. Moon said:

"Only three out of the seven departments contacted responded indicating that VNG was currently being used. One indicated that their future needs could be met by other technology. The others advised a continuing need for VNG.

"In view of the use identified by the departments concerned, Telecom will continue with the VNG service for the time being. It will consult further with the departments which have indicated future requirements for the time and frequency service.

"However, Telecom's position is clear in that whilst it will continue to negotiate with interested departments, it cannot continue indefinitely meeting the costs of a service for which it has no use itself nor any charter to provide."

The section of Computer Sciences Corporation that I work for will be moving about 15 miles from Silver Spring to the Greenbelt-Seabrook area of Maryland late this year. Shortly after that happens, Joan and I plan to move to the same area, and we will close P.O. Box 7488, Silver Spring, MD 20907. You may keep using it for the time being, since our mail will be forwarded to our new address. As soon as a new address is determined, it will be published in *o.N.* and *Sky and Telescope*. Although his permanent address will remain unchanged, H. F. DaBoll will be at his summer home in Michigan's Upper Peninsula for a considerable fraction of each year. Whenever appropriate, first class mail will be forwarded, and phone calls to the St. Charles number will be referred to the Naubinway number by phone company recorded announcement.

We expect to publish the next issue of *Occultation Newsletter* in November.

LET'S REPORT OCCULTATION TIMINGS ON DISKETTES

David W. Dunham

Most occultation observers have experienced delays, and found errors in, the residual calculations they receive after reporting timings to the International Lunar Occultation Centre (ILOC) in Tokyo. Recognizing that these are caused primarily by ILOC's limited staff for putting the written reports into machine-readable form for computer processing, I suggested to Akio Senda that the observers themselves could do most of this job. He agreed, and sent me the format for their card-image formats for the observations, which can be sent to ILOC on IBM-compatible 3½-, 5¼-, and 8-inch diskettes (or ½-inch magnetic tape, but diskettes are much more common). Standard ASCII text files on 5¼-inch diskettes written with an Apple II+, or equivalent computer can be sent to me at P.O. Box 7488; Silver Spring, MD 20907. We can convert them to IBM-compatible files that we will send to ILOC and others who need them. We encourage as many observers as possible to report both total and grazing occultation data on diskette. In some countries and regions, we hope that observers can make arrangements so that those without computers can send their written reports to those who have PCs, to send as many reports as possible to ILOC in machine-readable form. If you have access to a PC and are willing to type reports for others in your area, contact me at the address above or telephone me at 301,585-0989, and we will publish your address in a future issue of *o.N.* for this purpose. The more reports that are sent to ILOC on diskette, the faster will be the turnaround time for returning residuals. Waiting for Earth-rotation observations (UT1 - UTC corrections) delays distribution of ILOC residuals, but for preliminary results, predicted values can be used that have much smaller errors than other errors (star position, limb corrections, visual timing) that affect the observations. Consequently, as an incentive to those who report data on diskette, ILOC hopes to set up its system so that preliminary residuals can be sent to the reporter soon after receipt of the diskette. Don Stockbauer has access to PCs, so we also encourage reporting of graze observations to IOTA on diskette (However, he can not read 8-inch diskettes, and 5¼-inch floppies are preferred). Do not report more than one graze in one file; use separate files for separate grazes. Those who start preparing their reports on diskette will find that the process is difficult at first, and one must be careful to avoid mistakes. They will gain an appreciation for the transcription job now done at ILOC for the written reports. After writing a few reports, observers will learn the format and the job will become easier, as they use copies of previously typed reports as templates for new reports. If you send me a 5¼- or 3½-inch diskette, I will send you a copy of the file printed in Fig. 1, which you can use as a template for your own observations (I will also include a copy of the file for those who need other data from Joan or me on diskette). One of the PC projects (see p. 109) that we recommend is the creation of a menu system to facilitate the job of entering the data to generate the reports, to check for errors and eliminate the need to keep track of columns.

Occultations and appulses by objects other than the Moon (primarily by asteroids, planets, and comets) can also be reported on diskette. But events involving these other objects should be sent to James Stamm; Route 13, Box 109; London, KY 40741; U.S.A.; with a copy sent to me for positive (actual occultation) events. Copies of these files should not be sent to ILOC or Stockbauer. Like Stockbauer, neither Stamm nor I can read 8-inch diskettes.

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COLUMN # 11111111112222222222333333333344444444445555555555666666666677777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890

PLACE NAME     HOLLYWOOD, MARYLAND, U.S.A.
ADDRESS        I.O.T.A.; P. O. BOX 7488; SILVER SPRING, MARYLAND 20907; U.S.A.
REPRESENTATIVE DAVID W. DUNHAM AND RICHARD TAIBI  FORMS REQUIRED       NO

TA  RAM  10.2  112      76 32 50.2  W   38 19 26.8  N   30.5NAD 1927
TB  CED  20.3  203      76 32 48.1  W   38 19 24.6  N   30.5NAD 1927
TC  NEM  25.4  142      76 32 44.8  W   38 19 21.5  N   30.5NAD 1927

OA  MAHIPAL VIRDY                               0.3
OB  DAVID W. DUNHAM                             0.3
OC  TERRY LOSONSKY

01  86 829080400   R     885            9T RE   5 1   112 9  6                  AA
02  86 8290803462  R     885            1V RE   1 1   112 9  6                  BB
03  86 8290803466  R     885            2V RE   1 1   112 9  6                  BB
04  86 8290803521  R     885            1V RE   1 1   112 9  6                  BB
05  86 8290803539  R     885            2V RE   1 1   112 9  6                  BB
06  86 8290803596  R     885            1V RE   1 1   112 9  6                  BB
07  86 8290804020  R     885            2V RE   1 1   112 9  6                  BB
08  86 8290823492  S   77621            2S RS4  1 1   112 9                     BB
09  86 8290854170  S   77639            2S RS5  2 1   112 9                     BB
10  86 8290933319  S   77662            2S RS5  2 1   112 9                     BB
11  86 8290803465  R     885            1T RU3  3 1   112 9  6                  CC
12  86 8290803500  R     885            2T RU3  3 1   112 9  6                  CC
13  86 8290803515  R     885            1T RU3  3 1   112 9  6                  CC
14  86 8290803550  R     885            2T RU3  3 1   112 9  6                  CC
15  86 8290803575  R     885            1T RU3  3 1   112 9  6                  CC
16  86 8290804025  R     885            2T RU3  3 1   112 9  6                  CC
17  86 8290804055  R     885            7T RU3  3 1   112 9  6                  CC
18  86 8290804355  R     885            1T RU3  3 1   112 9  6                  CC
19  86 8290804360  R     885            2T RU3  3 1   112 9  6                  CC
20  86 8290804420  R     885            7T RU3  3 1   112 9  6                  CC

M  HOLLYWOOD, MD                       1963 1:24,000    U.S.G.S.
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COLUMN # 11111111112222222222333333333344444444445555555555666666666677777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890
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Figure 1. Printing of machine-readable file for ILOC and IOTA.

The format specified below should be used for reports of 1987 events. After gaining some experience processing 1987 data reported on diskettes, ILOC and we may recommend some changes for reporting 1988 events, which we will publish in the first issue of *O.N.* in 1988.

An example of a lunar grazing occultation report (actually, just the first 3 stations of an actual report) in ILOC's format for machine-processing is shown in Figure 1. Note that besides the graze events, three total occultations were timed at station B.

The file should be a standard ASCII file readable by IBM, and equivalent, PCs; any word processor capable of creating such a file can be used. It is important to type all letters as capitals; if your computer has a Caps Lock key, keep it on as you type the report. ILOC's system correctly interprets numbers and capital letters, but it interprets small letters as Japanese Katakana characters that have no relation to what you typed. Hence, any small letter on the written form must be capitalized in the machine-readable file. A copy of part of the corresponding hand-written form is shown in Figure 2.

The first two lines and the last two lines of Fig. 1 specify the column numbers, to be read vertically, only to serve as a guide for specifying the columns for the data to be typed. You can include these lines in the file as you prepare it, but should delete them from the copy that you send to ILOC and/or IOTA. By "IOTA," we mean here graze reports sent to Stockbauer, or non-lunar event reports sent to Stamm

Fig. 2A

I O T A / I L O C (mainly G R A Z I N G)
O C C U L T A T I O N   O B S E R V A T I O N S

PLACE NAME HOLLYWOOD, MARYLAND, U.S.A.

Copy has been sent to circled place(s): IOTA ILOC Other______

ADDRESS I.O.T.A.; P.O. BOX 7488; SILVER SPRING, MARYLAND 20907 USA

TELESCOPES and POSITIONS

	Type	Aperture	Focal length	Mounting	Drive	Longitude ° ' "	E/W	Latitude ° ' "	N/S	*Acc "	Height m	Geodetic datum
a	R,N,C,O( )	10.2 cm	112 cm	E,A	D,M	76 32 50.2	E W	38 19 26.8	N S	0.3	30.5	NAD 1927
b	R,N,C,O( )	20.3 cm	203 cm	E,A	D,M	76 32 48.1	E W	38 19 24.6	N S	0.3	30.5	NAD 1927
c	R,N,C,O( )	25.4 cm	142 cm	E,A	D,M	76 32 44.8	E W	38 19 21.5	N S	0.3	30.5	NAD 1927

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 73 74 75 76 77 78 S1 S2 S3

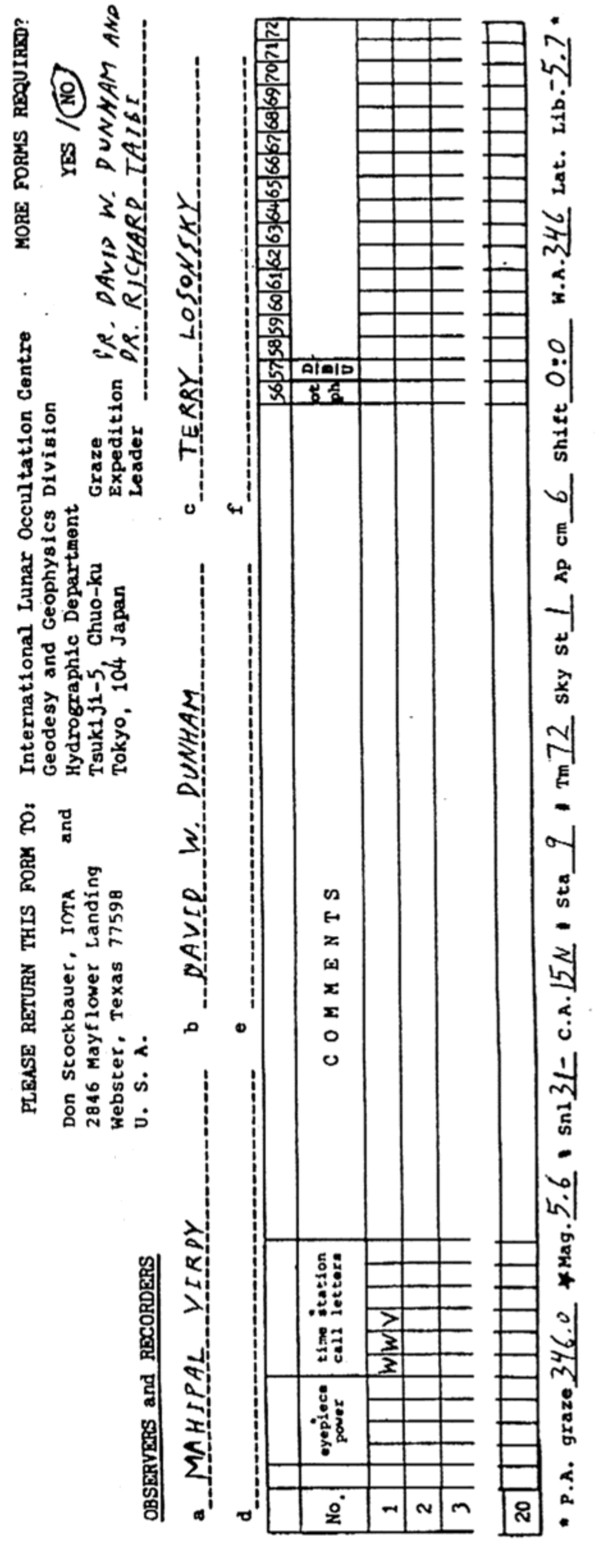
No.	Yr	Mth	Day	Hr	Min	Seconds	Ct	Decl	No.	Station	Tel	Obs	Rec	Ph	MR	MT	PE A	PE B	Accur	Ce	S/N	X	Sky St	Sky Tr	C	Temp	G	T	O	R
1	86	8	29	08	04		R		885					9	T	R	E		5	1			1	1	2	9	6	a	a	
2		8	29	08	03	462	R		885					1	V		E		1	1			1	1	2	9	6	b	b	
3		8	29	08	03	466	R		885					2	V		E		1	1			1	1	2	9	6	b	b	
4		8	29	08	03	521	R		885					1	V		E		1	1			1	1	2	9	6	b	b	
5		8	29	08	03	539	R		885					2	V		E		1	1			1	1	2	9	6	b	b	
6		8	29	08	03	596	R		885					1	V		E		1	1			1	1	2	9	6	b	b	
7		8	29	08	04	020	R		885					2	V		E		1	1			1	1	2	9	6	b	b	
8		8	29	08	23	492	S		77621					2	S		S	4	1	1			1	1	2	9		b	b	
9		8	29	08	54	170	S		77639					2	S		S	5	2	1			1	1	2	9		b	b	
10		8	29	09	33	319	S		77662					2	S		S	5	2	1			1	1	2	9		b	b	
11		8	29	08	03	465	R		885					1	T		U	3	3	1			1	1	2	9	6	c	c	
12		8	29	08	03	500	R		885					2	T		U	3	3	1			1	1	2	9	6	c	c	
13		8	29	08	03	515	R		885					1	T		U	3	3	1			1	1	2	9	6	c	c	
14		8	29	08	03	550	R		885					2	T		U	3	3	1			1	1	2	9	6	c	c	
15		8	29	08	03	575	R		885					1	T		U	3	3	1			1	1	2	9	6	c	c	
16		8	29	08	04	025	R		885					2	T		U	3	3	1			1	1	2	9	6	c	c	
17		8	29	08	04	055	R		885					7	T		U	3	3	1			1	1	2	9	6	c	c	
18		8	29	08	04	355	R		885					1	T		U	3	3	1			1	1	2	9	6	c	c	
19		8	29	08	04	360	R		885					2	T		U	3	3	1			1	1	2	9	6	c	c	
20		8	29	08	04	420	R		885					7	T		U	3	3	1			1	1	2	9	6	c	c	

* Map name or # HOLLYWOOD, MD. Year 1963 Publisher U.S.G.S. Scale 1:24000 * 85 Aug. Edition

and me. The rest of the data are arranged in five groups described below. The groups can be separated with blank lines, but these are not required.

1. *Heading Information.* The first line of the heading should contain "PLACE NAME" in columns 1-10 and the name of the place of observation in columns 16 to 80. "ADDRESS" is in columns 1-7 and the address of the report preparer ("representative"; your address, not IOTA's address or the address of the place of observation) is in columns 16 to 80 of the second line. "REPRESENTATIVE" is in columns 1-4 and the name of the representative (observer's name, or name of the graze expedition leader) is in columns 16 to 50 of the third line. "FORMS REQUIRED" is in columns 51 to 64 of the third line, "YES" or "NO" in columns 71 to 73. "REPORTED TO" is typed in columns 1 to 11 and the names of organizations (ILOC, IOTA, any others) to which a copy of the report is sent should be given in columns 16 to 80 of the fourth (last lunar header) line. For occultations by objects other than the Moon, type a fifth header line with "OBJECT" in columns 1-6 and the object's name starting in column 16. For asteroids, give the asteroid's number in columns 16-19 (right-justified; leave blank for unnumbered asteroids) and its name or designation starting in column 21.

Fig. 2B


OBSERVERS and RECORDERS

PLEASE RETURN THIS FORM TO: Don Stockbauer, IOTA, 2846 Mayflower Landing, Webster, Texas 77598, U. S. A. and International Lunar Occultation Centre, Geodesy and Geophysics Division, Hydrographic Department, Tsukiji-5, Chuo-ku, Tokyo, 104 Japan

MORE FORMS REQUIRED? YES / NO

Graze Expedition Leader DR. DAVID W. DUNHAM AND DR. RICHARD TAIBI

a MAHIPAL VIRDY b DAVID W. DUNHAM c TERRY LOSONSKY

d e f

No.	eyepiece power	time station call letters	COMMENTS	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
				ot ph	DBU															
1		WWV																		
2																				
3																				
20																				

• P.A. graze 346.0 *Mag. 5.6 • Snl 31- C.A. 15N • Sta 9 • Tm 72 Sky St 1 Ap cm 6 Shift 0:0 W.A. 346 Lat. Lib. -5.7 •

2. *Telescopes and Positions.* These are the telescope specifications and geographical coordinates given in the lower part of the heading of the front of the written form. These lines do not need to be specified if ILOC has assigned you a Station/Tel/Obs code. All numbers in the format below are right-justified:

Column	Description
1	Always the letter "T"
2	Identifying letter, start with "A", a capital letter corresponding to the small letters used in the heading and the "T" column of the written form. On the written form, spaces for only 3 telescope/positions are given, but in the machine-readable file, you can use A through Z for up to 26 telescope/positions in a file. Use two or more files if there are more than 26 telescopes used in an expedition.
5	Telescope type R = refractor N = Newtonian reflector C = Cassegrain reflector, including Schmidt-Cass. O = Other, describe on a second line with the same letters in col. 1 and 2, columns 3-5 blank, and the description in col. 6-80.
6	Telescope mounting E = equatorial A = alt-azimuth
7	Telescope drive D = clock-driven M = manual
9-13	Telescope aperture in centimeters, to .1 cm. Columns 12 and 13 can be blank if the aperture is given to the nearest cm.
15-20	Telescope focal length, in centimeters, to .1 cm. Columns 19 and 20 can be blank if the focal length is given to the nearest cm.
23-25	Degrees of longitude from Greenwich.
27-28	minutes of arc of longitude
30-34	seconds of arc of longitude (hundredths of an arc second can be specified, but tenths, as given in Fig. 1 with col. 34 blank, are sufficient; the value needs to be accurate to 1 arc second or better).
36	Longitude East or West of Greenwich.
39-40	Degrees of latitude.
42-43	minutes of arc of latitude.
45-49	seconds of arc of latitude.
51	Latitude North or South of the equator.
53-58	Height above sea level, in meters, to 0.1; should

be accurate to ± 30 meters or better.

59-70 Name or abbreviation of geodetic datum, or other type, of coordinates.
71-75 ILOC station code, if known.
76-80 ILOC telescope code, if known.

3. ***Observers and Recorders.*** These are the names of observers and assistants that are given at the top of the back of the written forms. These lines do not need to be specified if ILOC has assigned Station/Tel/Obs/Rec codes for the observer-recorder-station-telescope combinations in question. The format is given below:

Column 1: Always the letter "O."
Column 2: Identifying letter, start with "A," a capital letter corresponding to the small letters used on the written form. On the written form, spaces for only 6 names are given, but in the machine-readable form, you can use A through Z for up to 26 observers and assistants in a file. Use two or more files if there are more than 26 observers and assistants in the expedition.
Columns 5-30: The observer or recorder's (assistant's) name.
Columns 33-37: ILOC station code, if known.
Columns 38-41: ILOC observer code, if known.
Columns 43-47: Estimated accuracy of latitude, in arc seconds.

4. *Timings.* This is normally the largest group, including all of the event timings, given in the table of the written form. Sequential numbers of the events are given in columns 1 and 2 (integers, right-justified), corresponding to the numbers printed on the left side of ILOC's form for written timings. You are not limited to 20 lines, as on the written form; you can include up to 99 timings in one machine-readable file. Use 2 or more files to report 100 or more timings. For the data in columns 1 to 53 of the written form (column numbers given at the top of the table), add 4 to the written-form column number to obtain the corresponding column in the machine-readable file. So in the machine-readable file, the year is in columns 5 and 6, and the temperature is in columns 56 and 57. Column 73 (G, grazing occultation) of the written form is typed in column 60 of the machine-readable file, and columns S1, S2, and S3 of the written form are typed in columns 78, 79, and 80, respectively, of the machine-readable file. From the back of the written form, the optional columns 56 (other phenomenon) and 57 (lunar limb, D/B/U for dark/bright(sunlit)/umbra during lunar eclipse) should be typed in columns 58 and 59, respectively, in the machine-readable file. The data to be entered in these columns are explained adequately in ILOC's *Guide to Lunar Occultation Observations*. Remember that either Station/Tel/Obs codes (columns 28-36 of the machine-readable file) or T/O letters (in columns 78 and 79) must be specified, not both. If the codes are unknown, (as is the case for all new stations, especially temporary sites for grazes), you need to specify the T/O letters, and the corresponding Telescope/Position and Observer/Recorder lines.

In the written reports, repetitive data in some columns could be specified on the first line, and omitted from the following lines, as specified in ILOC's Guide. But in the machine-readable files, repetitive data must be specified on every line. The easiest procedure is to type the data on the first line. Then, use your word processor to copy this line several times, as many as are needed for all of the timings to be included in the file. Then, you just need to correct the data that change from line to line.

For comments, which can be specified on the back of the written form, type a second line with columns 1-4 blank. Type the comment (remember to use all capital letters) in columns 5-80. The time station call letters requested on IOTA's written form should be specified here only if they are different from those specified in the second footing line described at the end, and should be given as a comment only for the first timing period. IOTA is no longer asking for the eyepiece power on the machine-readable files sent to them.

5. *Footing Data.* This consists of two lines, which should be included in copies of any files sent to IOTA. ILOC does not use them, so they do not need to be included in the copies that you send to Tokyo.

The format of the first footing (map) line corresponds to the data at the bottom of the front of IOTA's form for reporting occultations, and has the following format:

Column	Description
1	Always the letter "M."
2	Blank if the positions for all stations were measured from the same map, in which case, you need only one map line. Otherwise, the Telescope/Position letter (same as the letter in col. 2 of the Telescope/Position line) must be specified here, and you need to have as many map lines as there are Telescope/Position lines.
4-34	Name or number of map from which the positions were measured.
36-39	Year of publication of the map.
41-51	Scale of map, left-justified, such as "1:24,000" or "1:50,000."
53-80	Map publisher, such as "U.S.G.S."

The format of the second footing (graze summary) line corresponds to the data at the bottom of the back of IOTA's form for reporting grazing occultations. It should not be included in any report that is not a lunar grazing occultation. The graze line has the following format:

Column	Description
1	Always the letter "G."
3- 7	Predicted position angle of central graze, to 0.1 degree.
9-12	Magnitude of star, to 0.1 magnitude.
14-16	Percent of Moon sunlit.
17	"+" for lunar waxing phase, "-" for waning phase, "E" for lunar eclipse.
19-21	Cusp angle of central graze; umbral distance during lunar eclipse.
22	"N" for cusp angle measured from the northern cusp, "S" if it is measured from the southern cusp, and "U" to indicate umbral distance during lunar eclipse.
24-26	Total number of stations in the graze expedition that obtained non-redundant data,

not just the number of stations in the file (in case there are more than 26 stations in the expedition).

27-30 Total number of contact timings made during the expedition, counting 1 for certainty code 1 (certain) events, ½ for certainty code 2 (probable but not certain) events, and zero for certainty 3 (possible, but probably spurious) events. It is not just the number of timings in the file (in case there are more than 99 timings in the expedition).

32 Maximum sky steadiness (column 53 of timing line in machine-readable file, or col. 49 of written form) of all contacts (or of central graze in the case of only one station having a miss) in the expedition.

34-36 Minimum telescope aperture, in centimeters, reporting any contacts with the maximum sky steadiness given in column 32.

38 "C" if the graze is in the "Cassini" region, that is, if most contacts during the graze occurred in regions of the ACLPPP predicted lunar profile defined by 2's, 3's, 4's, or 7's.

39-41 Observed shift from the current ACLPPP prediction, in arc seconds, to 0.1.

42 "N" if the observed shadow was north of the predicted shadow, and "S" if it was south of the predicted shadow (that is, the direction of the shift, which is always measured perpendicular to the predicted limit). Leave this column blank if no shift (0.0 shift) was observed.

44-46 Watts angle of center of observed events on the ACLPPP profile, to the nearest degree. It is the Watts angle of central graze if the observations are symmetric on the profile, which is usually the case with dark-limb grazes far from the cusp.

48-50 Predicted latitude libration of the graze. It is given to the nearest 0.1 degree, but the decimal is not typed, its location being understood to be between columns 49 and 50.

52-60 Time station call letters, left-justified, for the time station of ultimate reference (for example, give "WWV" and note in the comments a local AM station, if the latter was used with a master tape including WWV made elsewhere to obtain the timings).

ZODIACAL CATALOG J2000 PRINTED IN JAPAN

David W. Dunham

J. Robertson's Zodiacal Catalog was published by the U. S. Naval Observatory in 1939, but it has been out of print for the last several years. Last year, Isao Sato, a member of the Lunar Occultation Observers Group in Japan, republished the Z.C. after converting Robertson's data to the equinox J2000, but has added much new data, especially about double stars, which makes the catalog more useful for modern users. When I was in Japan in May, I bought 40 copies of Sato's Z.C., so that I can sell them to readers who want them (see end of this article).

Parts of two pages of Sato's catalog, covering part of the Pleiades, are reproduced in Figs. 1 and 2. The left-hand (even-numbered) pages of the catalog give right ascension information, while the right-hand (odd-numbered) pages give declination, in a format similar to Robertson's Z.C. But Sato's data are for the new equinox J2000, rather than the 1950 equinox used by Robertson. Since Sato's catalog is arranged in order of equinox 2000 right ascension, while Robertson's catalog was in 1950 R.A. order, the Z.C. numbers are in approximate, but not exact, numerical order. Consequently, Z.C. 544 is listed before Z.C. 543 by Sato. In addition, Sato includes ecliptic longitudes and latitudes, as well as SAO and AGK3 numbers. Sato's basic data are Robertson's, and he has reproduced one of Robertson's errors that we discovered during the last series of Pleiades occultations. Both catalogs incorrectly give the magnitude of Z.C. 549 (24 Tauri) as 8.1, when it is actually 6.3. Robertson apparently confused this star, near Alcyone, with two nearby 8th-magnitude non-Z.C. stars when he got its magnitude.

An entry under the last (N) column in Fig. 2 indicates a note (usually D for double), showing that more data about the star are given in an auxiliary table following the main table. The auxiliary table gives proper names, Aitken double star (ADS) numbers, component magnitudes, separations, and position angles, periods of doubles with orbits, variable star information, and a reference to the source of the additional data. Information on doubles discovered from photoelectric occultation observations that have been published during the last several years is included. Part of the auxiliary data table is reproduced in Fig. 3. Following this table are tables of zodiacal clusters, nebulae, galaxies, radio sources, and x-ray sources.

Following the tables are charts showing all of the stars and other objects given in the tables. The charts are plotted with J2000 ecliptic coordinates; the chart showing the Pleiades, Hyades, and Aldebaran is reproduced in Fig. 4. Sato's catalog can best be used with the new catalogs on equinox 2000, such as those by. W. Tirion. If you have only the old equinox 1950 catalogs, you can use Sato's charts, and the ecliptic coordinates in his tables, to use star patterns to find objects on the old chart.

In an introductory section and in appendices, Sato shows how to compute apparent positions, lunar eclipses, total and grazing occultations, and other information. Although the explanations are in Japanese, some readers familiar with such calculations from sources such as the Explanatory Supplement to the Astronomical Ephemeris and Meeus' Astronomical Tables will probably be able to follow many of the formulae Sato gives in these sections.

Sato used a computer to produce the data for his catalog, and it is available on floppy diskette for MS-DOS systems, along with software to perform the calculations explained in his introduction and appendices. In addition, he has programs to simulate total and grazing occultations using special datasets for events visible from Japan. But Sato uses a Japanese version of MS-DOS that utilizes Japanese characters even in the diskette directories, so I was unable to read them with American P.C.'s. We have sent Sato an English version of MS-DOS, which he said he will use to produce versions of his data and software that we can use on our machines and can be distributed to other readers who may be interested. When I complete updating the USNO XZ catalog (see p. 104), I will send a copy to Sato, which he

ZC No.	BD CD	No. No.	star name		Max mag	R. Asc. (J2000.0) h m s	μ (s/100y)	mean epoch
533	+19°	582	14	Tau	6.34	3 43 47.227	+0.833	1901.8
534	+20°	621	22H. I	Tau	6.03	3 44 28.203	+0.183	1905.2
535	+27°	556			6.71	3 44 37.235	-0.302	1914.9
536	+23°	505	16	Tau	5.43	3 44 48.197	+0.111	1899.3
537	+23°	507	17	Tau	3.81	3 44 52.538	+0.145	1900.8
538	+24°	546	18	Tau	5.63	3 45 9.681	+0.084	1903.6
539	+24°	547	19 q	Tau	4.37	3 45 12.527	+0.172	1898.5
540	+22°	544			8.1	3 45 39.934	+0.177	1911.8
541	+23°	516	20	Tau	4.02	3 45 49.581	+0.128	1899.0
542	+24°	553	21	Tau	5.85	3 45 54.429	+0.101	1898.4
544	+18°	537			8.4	3 46 1.186	+0.183	1911.5
543	+24°	556	22	Tau	6.46	3 46 2.930	+0.164	1905.6
545	+23°	522	23	Tau	4.25	3 46 19.586	+0.146	1897.1
547	+13°	594			6.80	3 46 26.289	+0.191	1911.1
546	+23°	523			6.96	3 46 27.263	+0.130	1914.9
548	+24°	562			6.68	3 46 59.381	+0.137	1916.1
550	+23°	537			6.82	3 47 20.951	+0.103	1923.6
549	+23°	536	24	Tau	8.1	3 47 21.030	+0.135	1891.4
551	+23°	538			7.10	3 47 24.373	+0.074	1913.4
552	+23°	541	25 η	Tau	2.96	3 47 29.083	+0.145	1900.0

Figure 1. Part of p. 30 of the main part of Sato's catalog, giving right ascension information.

ZC No.	Dec. (J2000.0)	μ′ ("/100y)	mean epoch	longitude (J2000.0)	latitude	sp. type	SAO No.	AGK3 No.		N
533	+19 39 54.82	-4.92	1891.5	58.176552°	-0.091041	G5	93568	+19°	289	D
534	+20 55 42.76	-1.99	1898.4	58.613487	+1.105085	B9	76121	+20°	335	D
535	+27 53 50.76	-7.65	1914.5	60.203058	+7.891720	F0	76122	+27°	370	D
536	+24 17 22.27	-4.39	1890.5	59.434978	+4.365292	B5	76126	+24°	326	
537	+24 6 48.38	-4.29	1895.9	59.411940	+4.189937	B5p	76131	+23°	302	D?
538	+24 50 21.09	-4.92	1894.1	59.636909	+4.883228	B8	76137	+24°	328	D
539	+24 28 2.33	-4.33	1888.5	59.564816	+4.518198	B5	76140	+24°	329	D
540	+22 41 41.39	-3.06	1912.6	59.274896	+2.766357	A0	76154	+22°	343	
541	+24 22 3.47	-4.91	1889.4	59.680252	+4.389921	B5	76155	+24°	335	
542	+24 33 16.07	-5.03	1884.2	59.739550	+4.568106	B8	76159	+24°	336	
544	+18 34 0.61	-0.41	1910.4	58.447984	-1.278864	B8	93587	+18°	288	
543	+24 31 40.65	-4.41	1896.3	59.765222	+4.535154	B9	76164	+24°	337	D
545	+23 56 54.10	-4.47	1889.6	59.699330	+3.955828	B5	76172	+23°	309	
547	+13 30 32.29	-2.74	1909.5	57.432015	-6.235171	A0	93590	+13°	297	
546	+24 15 18.21	-4.54	1910.6	59.795398	+4.248631	A0	76173	+24°	340	
548	+24 31 12.30	-4.77	1906.9	59.972912	+4.480504	B9	76183	+24°	341	D
550	+23 48 13.44	-2.97	1922.9	59.896267	+3.763540	A0	76193	+23°	321	
549	+24 6 58.85	-4.31	1883.2	59.964905	+4.068563	A0	76192	+23°	320	
551	+23 54 53.01	-3.84	1895.1	59.933278	+3.869018	B9	76197			D
552	+24 6 18.37	-4.59	1894.6	59.992411	+4.050912	B5p	76199			D

Figure 2. Part of p. 31 of Sato's catalog, giving declination information.

ZC	BD	No.	star name		N	DATA
533	+19°	582	14	Tau	D	
534	+20°	621	22H. I	Tau	D	
535	+27°	556			D	ADS2735 6-6 d=127" P=43° (1920)
536	+23°	505	16	Tau		Celaeno
537	+23°	507	17	Tau	D?	Electra
538	+24°	546	18	Tau	D	6.4-6.4 d=0.05" (1974)
539	+24°	547	19 q	Tau	D	Taygeta 4.4-9 d=69" P=330°
541	+23°	516	20	Tau		Maia
542	+24°	553	21	Tau		Asterope
543	+24°	556	22	Tau	D	7.3-7.3 d=0.1" P=80° (1934)
545	+23°	522	23	Tau		Merope
548	+24°	562			D	6.8-9.8 d=0.299" P=173° (1971)
551	+23°	538			D	ADS2767 7-9 d=6.1" P=265° (1952)
552	+23°	541	25 η	Tau	D	Alcyone 3.0-4.6 d=0.031" P=207° (1971)
556	+22°	563	104B.	Tau	D	5.7-7.7 d=0.05" (1974)

Figure 3. Part of p. 132 of Sato's catalog, including part of the table of auxiliary data.

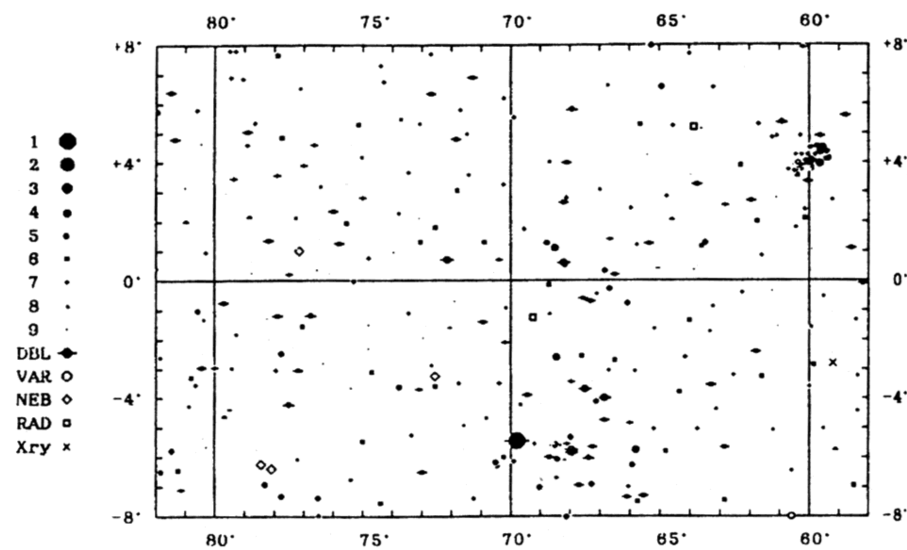


Figure 4. Ecliptic-coordinate map showing the Pleiades and Hyades, from p. 152 of Sato's catalog.

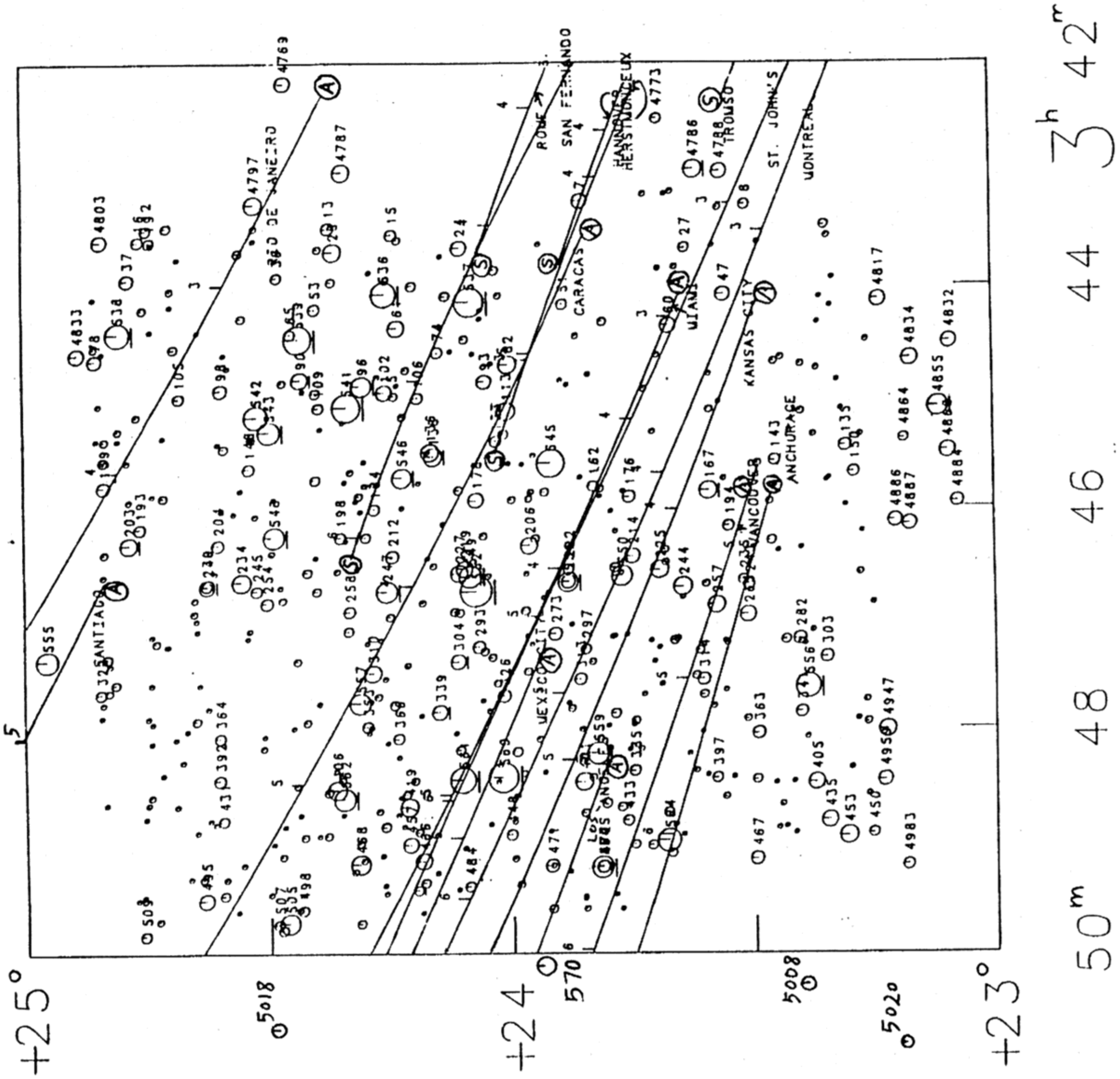
will use to extract the best current data for the Z.C. stars for his database.

Sato sells his catalog for 2000 yen. Unfortunately, I was in Japan when the dollar/yen conversion was the most unfavorable for Americans for many years, so I need to sell my copies for $14.70. I bought them, not IOTA, so checks should be payable to me in American currency. Several of my copies were sent from the American Embassy in Tokyo to USNO, and some were damaged in transit (mostly, frayed and soiled edges). Although none of the information in these copies was destroyed or made illegible, I am selling 6 lightly damaged copies for $13.50, and 3 moderately damaged copies for $10.00. I will probably return to Japan in October, and can then buy some more copies from Sato, if my current supply is sold out or runs low. He still has about 200 more copies.

THE SEPTEMBER 13TH PLEIADES PASSAGE

David W. Dunham

The last issue was devoted to the Pleiades, with a major article starting on p. 58. Readers are referred to that article for general information about the current series of passages, especially the sections on value, predictions, observing considerations, Pleiades charts, and double stars. Pleiades passages occur each month, and a list of this year's passages was published on p. 69 of last January's issue of *Sky and Telescope*. But *O.N.* readers can learn about passages visible in their area by examining the Alcyone (Z.C. 552) graze paths in the Grazing Occultation Supplement that was distributed with *O.N. 4* (3) late last year. This time, there should be more time to request special predictions, such as for detailed USNO total occultation predictions for planned graze expedition sites. For such requests, send approximate coordinates to me at P.O. Box 7488; Silver Spring, MD 20907; phone 301,585-0989. During the September 13th passage, the Moon will be slightly gibbous, 61% sunlit. Those with 8-inch (and perhaps 6-inch) telescopes will probably still be able to time occultations of 9th-mag. stars if conditions are good, but a USNO observability (O) code of 2 is needed to ensure all of these events will be predicted at this phase (the O-code calculations penalize moderate gibbous phases more than they should). So if you have USNO predictions, you should check your O-code limit to see if you might



need a lower limit for this passage. If you rely on Walter Morgan's total occultation predictions using the a and b factors, they are limited to an O-code of 6, which includes stars only down to about mag. 7.6 at the 61% sunlit phase of this passage.

Grazing Occultation Expeditions. Please send or phone me information about any graze expeditions planned in your area, so that I can put this information on the IOTA occultation line telephone message center, 301,495-9062. *Sky and Telescope* will publish an article about the passage in their September issue, and will give this number as a source of more information. There will probably be expeditions for grazes of Alcyone near Houston, TX; in northern AL; central KY; near Pittsburgh, PA; and near Montreal, Que. Other probable expeditions will be north of Detroit for Merope and north of Washington, DC for 24 Tauri. I need to have information to contact expedition leaders for these, and other planned, graze expeditions to include on the IOTA occultation line, which you are also encouraged to call for information about plans in your area.

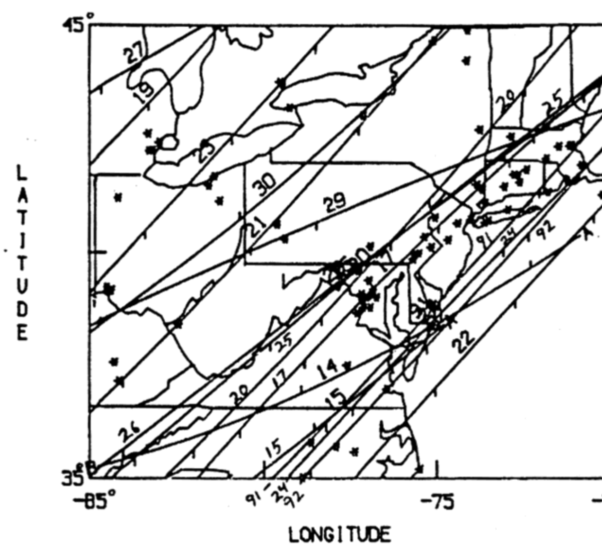
Results from the March Passage. As far as I know, a large Pacific storm prevented any observations from being made anywhere west of the Rocky Mountains during last March's favorable passage. But many observers in the central and eastern U.S.A. were quite successful, in spite of the poorer geometry for them. I travelled to Tyrone, CO, east of the Sand Dunes National Monument, since clouds from the approaching storm threatened the latter area. Near Tyrone, I tried to videorecord the Merope (Z.C. 545) graze, but failed when the camera came loose while attempting a minor adjustment just before the graze began. I succeeded with Atlas (Z.C. 560) near Hoehne, 15 miles down the road, 1.5 hours later, and experienced a 0".25 south shift, close to what was expected (see p. 89 of the last issue). But a zero shift occurred for Paul Maley's large expedition south of Corpus Christi for the Alcyone (Z.C. 552) graze, videorecorded from a few of the stations. Although I failed for Merope, Benny Roberts succeeded and had a 0".1 north shift, as noted in the table on p. 103. It is clear that the expected 0".25 south shift is not universal, with the bright stars so far averaging closer to zero. Errors of the proper motions in Eichhorn's catalog, now over 30 years old, seem to be accumulating, so that we will need to keep track of the observed shifts for individual stars to get very accurate (to 0".1) predictions for future grazes of Pleiads. A new survey like Eichhorn's would be useful for further refinement of the cluster positions.

Pleiades Chart. The apparent-place chart of the Pleiades, showing topocentric paths of the Moon's center for several cities, is similar to the chart on p. 61 of the last issue, and described on pages 59-61. The scale of the chart has been modified slightly so that the Moon figure on p. 60 of the last issue can be used. During the September 13th passage, the Moon's apparent radius will be 15'.37 when its altitude is 20° above the horizon. For orienting the Moon figure, the position angle of the lunar north pole (0° on left side of the figure) will be 348°. The position angle of the north cusp will be 346° (the same as in March) and the center of the sunlit limb will be at 76°.

The Moon will pass centrally across the cluster for observers in northern South America, as shown by the path for Caracas. The circled A shows the Moon's center at moonrise, while a circled S terminates a path at sunrise. The passage will end near sunrise for western Europeans; the paths for Rome; Hannover, German Federal Republic; and Tromso, Norway are especially short. The path for St. John's, Newfoundland lies close to that for Miami, Fl.

Graze Predictions. The northern limits for the occultations of Merope (23 Tauri), Alcyone (Eta Tauri), Pleione (27 Tauri), and Atlas (28 Tauri) are shown on the map on p. 68 of the January issue of *Sky and Telescope*. Shifts expected for the three brightest stars are noted above. The limits for three other Pleiades grazes of sixth-magnitude stars are shown in the RASC *Observer's Handbook*. But eight grazes of Pleiades stars, as long as other favorable grazes during September, are shown in the map, and accompanying table, of the northeastern

1987 GRAZES, SEPTEMBER



NO.	YEAR	MO	DAY	D	USNO	SAO	D	MAG	%SNL	L	W.U.T.	LONG	LAT	STAR NAME	MAG1	MAG2	SEP	PA
14	1987	SEP	1		2334	184262		7.5	49+	S	$1^h33^m.1$	-78°	37°					
15	1987	SEP	2		2496	185278		6.8	60+	S	2 58.8	-78	37					
17	1987	SEP	12		435	75662		5.8	76-	N	6 46.7	-76	40	47 ARIETIS				
19	1987	SEP	13		545	76172		4.2	67-	N	4 3.0	-83	44	MEROPE (23 TAURI)				
91	1987	SEP	13	X	4895	76188		8.3	67-	N	4 23.0	-75	39					
92	1987	SEP	13	X	4899	76191		8.2	67-	N	4 24.7	-75	39					
20	1987	SEP	13		549	76192	U	6.3	67-	N	4 24.0	-77	40	24 TAURI	7.1	8.2	0".01	205°
21	1987	SEP	13		552	76199	K	3.0	67-	N	4 28.9	-80	41	ALCYONE (ETA TAURI)	3.0	4.6	0.03	207
22	1987	SEP	13		562	76236	X	6.6	67-	N	5 30.2	-74	38		7.4	7.4	0.1	90
23	1987	SEP	13	X	4981	76249		7.3	67-	N	5 46.9	-81	42					
24	1987	SEP	13	X	4995	76259		7.3	66-	N	6 5.9	-75	39					
25	1987	SEP	15	X	7352	77397		8.0	47-	N	6 39.2	-77	40					
26	1987	SEP	16	X	9379	78530	M	8.0	37-	N	6 19.5	-78	40		8.5	9.0	0.30	19
27	1987	SEP	16		1022	78593	M	5.8	37-	N	8 19.6	-83	44	54 AURIGAE	6.0	7.8	0.90	36
29	1987	SEP	18	X	12718	80165		7.3	19-	N	8 35.9	-78	41					
30	1987	SEP	30	X	24482	186186		7.6	45+	S	0 39.6	-80	41					

U.S.A., which is favored during this passage. The favorable graze of 6.3-mag. Z.C. 549 (24 Tauri) is not included in the RASC *Handbook* map, since it is based on the Zodiacal Catalog, which incorrectly lists it at 8th mag., fainter than the 7.5-mag. limit for their map. Z.C. 549 is incorrectly listed as a variable star, with mag. at minimum = 8.1, in USNO's XZ catalog. Messages about the bogus variability are consequently given in USNO's total occultation predictions; Morgan's, Bode's, and Fabrin's predictions based on them; and in IOTA's graze predictions. The 8.1-mag. minimum was put in the XZ due to the Z.C. error, but it is wrong, and the correct, constant magnitude of the star is 6.3.

The northern limits of Electra, Taygeta, and Maia are shown in western Europe in the *O.N.* Eastern Hemisphere grazing occultation supplement. Notice that the northern limit for Taygeta intersects the southern limit for Alcyone (with graze near sunrise, and on the bright limb) in southern Spain, a good place to be.

ILOC/LOOG NEWS

David W. Dunham

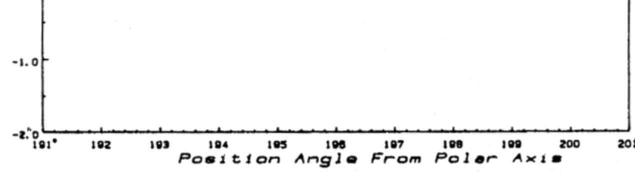
My business trips to Japan last November and March were briefly noted in previous issues. In May, I needed to make even a third business trip to Japan. Altogether, I made six week-long business trips, four of them overseas, during the first half of 1987. This unusual activity in my job made it very difficult to keep up with even the most essential occultation work, and I have not had time to answer many letters received during the past several months. But the distant journeys gave me opportunities to meet many foreign occultation observers and have long discussions with them. The trips to Japan have been most rewarding, and have resulted in two other important articles in this issue, on reporting occultation timings in machine-readable form (see p. 92) and on a newly published Zodiacal Catalog (see p. 97). Other aspects of these trips are described below.

During each of the trips, I was able to spend at least half a day at the Geodesy and Geophysics Division of the Hydrographic Department, which includes the International Lunar Occultation Centre (ILOC). In March, I gave a presentation there about observing occultations and grazes with video equipment. Members of the division described their work with solar eclipses, and gave me a manuscript of an article analyzing their photoelectric observations of a lunar occultation of Vesta. We also discussed some of the items discussed by D. Büttner in *O.N. 4* (2), p. 35. Concerning item 4, I gave ILOC a copy of my double star files on magnetic tape, also including a zodiacal subset of comprehensive double star data maintained at USNO. But as of May, they did not have time to work with the numerous inhomogeneous datasets; Don Stockbauer's work described on p. 104 should help get this underway. Concerning item 9, ILOC stressed that they want to collect grazing occultation observations, but confirmed that they were not very useful for their main task of determining Delta-T (Dynamical Time - Universal Time) from all reported timings. Their support for grazes is demonstrated by their continued production of graze maps for various publications, such as the annual RASC *Observer's Handbook*. But they do not have the manpower to produce reduction profiles of observed grazes, as was done by HMNAO, so IOTA's efforts in this direction are important.

Mitsuru Sôma was especially helpful during my visits, leading me through the intricacies of the Tokyo train system to get to various destinations on time. In November, we visited the Tokyo Astronomical Observatory, where I gave a presentation about IOTA's work. Sôma gave us a comprehensive tour of the photoelectric meridian telescope, where he works.

In March, I timed my arrival in Tokyo to be nearly half a day before a graze of Spica in Okinawa, which I hoped to videorecord. Toshio Hirose met me at Narita Airport, but I noticed that clouds thickened as my flight approached Japan. Hirose drove me to Haneda Airport, where I was to catch a flight to Okinawa to join Sôma and many other members of the mainly amateur Lunar Occultation Observer Group (LOOG), Japan's version of IOTA. But heavy rain accompanied our arrival at Haneda, and a phone check of the weather forecast was discouraging. So I decided not to fly to Okinawa, which is not such an interesting place to visit when it is raining. Sôma later reported that 33 stations were set up for the Spica graze, the largest effort to date for any graze in Japan, but he also confirmed the forecast; it rained at central graze time.

We had better luck for the March 20th graze of 5.1-mag. Z.C. 2298 near Mito, about 100 km northeast of Tokyo. Brian Marsden had recently arrived in Tokyo, and we were both treated to a special dinner honoring those for whom asteroids had been named, in a rooftop restaurant overlooking the grounds of the Imperial Palace, the evening before the graze. Prof. Tomita drove me to Mito, where a 20-cm Schmidt-Cass. telescope was set up for use with my video equipment. All but one of the 15 stations succeeded in timing the graze; Hirose's reduction profile is reproduced here. It was Tomita's first graze observation. I obtained the first videorecording of a graze in Japan, but there was a north shift. The star was occulted twice in only 14 seconds at my site, making it the shortest videotaped lunar occultation, from first D to last R, as far as I know. When we met after the graze, a tape recorder was passed around as each observer gave his or her impressions (number of events, special circumstances, any difficulties, etc.) of the graze. Graze expedition leaders in other countries may want to adopt this practice.



The chart of the graze of Z.C. 2298 observed in March near Mito City, Japan, was provided by Toshio Hirose.

After only a few hours of sleep following the graze, Tomita met me again, so that we could travel with Brian Marsden on the bullet train to Shizuoka, 200 km southwest of Tokyo, to attend the 17th annual meeting of Japanese comet observers. At Shizuoka, we were met by the mayor and other local dignitaries. In the afternoon, under a banner proclaiming "Welcome Dr. Marsden," Brian gave a talk on comet orbit determination. The next morning, I gave a brief talk emphasizing the astrometric and observational contributions that attendees could make towards asteroidal occultations. Both Marsden's and my talks were translated, and I learned later that brief parts of both were shown on the noon news on national television! Later that day, I was given the opportunity to play parts of my occultation videotape of various grazes (including the one at Mito) on a large-screen monitor. There were about 200 in the room at the time; it remains the largest and most enthusiastic audience that I have had for my video presentations. Overall, I was very impressed at the high level of accomplishments by the Japanese amateurs at the meeting. Besides discovering numerous comets, many of them routinely take and measure astrometric plates. Several of them have computer programs to calculate orbits, including three with numerical integration programs to take into account planetary perturbations for precise orbit work. There is virtually no American amateur counterpart to this activity, especially in astrometry. But this is perhaps balanced by a greater emphasis on photoelectric and CCD work by American amateurs, mainly on variable stars and some on asteroidal lightcurves.

LETTER TO THE EDITOR

Dear Mr. DaBoll,

Having recently received the ILOC *Report of Lunar Occultation Observations for 1984* after earlier receiving their reductions of my own observations for that year, I have been making comparisons between the two, and with the reductions I carry out myself for the RASNZ Occultation Section. This has shown up some discrepancies which are of sufficient magnitude to prompt me to write about them to ILOC. I thought the matter might be of interest to IOTA and possibly the membership, so enclose a copy of my letter to ILOC.

Graham Blow has let me have a copy of the 1983 report, which I wasn't sent directly by ILOC. Interestingly, this also contains discrepancies with the reductions of my own observations which ILOC sent me, although of a different nature. I have only made brief mention of them, as I suspect they may have been picked up already. I did not carry out my own reductions of 1983 observations, so cannot make a comparison in that direction.

Sincerely, Brian Loader

To the Director, ILOC,

Reduction of Lunar Occultations 1984

Thank you for the reductions of my 1984 lunar occultation observations (station number SN 211) which arrived earlier this year, and the *Report of Lunar Occultation Observations for 1984*, which was received last week.

There are some discrepancies between the two which I wish to discuss. I will refer to the individual reductions as reduction R1 and the report reductions as R2. Also, I do carry out reductions for the Occultation Section of the Royal Astronomical Society of New Zealand; the reductions I produced for my own 1984 observations I will refer to as R3.

I have made fairly detailed comparisons of the following items:

(a) Residual distances including limb correction, O-C.
(b) Watts' limb corrections, or vertical profile of the lunar limb, (HW in R1, WH in R2).
(c) Simple residues, that is, without limb correction, calculated for ILOC reductions by adding the limb profile value to O-C.
(d) Position angles of events (KM in R1, K in R2).

1. Differences Arising from a Possible Discrepancy in Declination.

The individual reductions, R1, were received before the report, R2, so I made fairly detailed comparisons of R1 with the reductions (R3) I had carried out. This showed that all items compared, (a), (b), (c), and (d) are in moderate agreement (if the same star catalogue has been used). However, detailed comparisons showed that there is a position angle (d) difference which is declination-dependent. This is zero for zero declination, but about 0°15 at declination 25° and -0°15 at declination -25° for disappearances, in the sense R1 - R3, and similar differences with opposite signs for reappearances.

Also, the small differences in the simple residues (c) show a position angle dependence (graphing suggests the difference is proportional to the sine of the position angle, as might be suspected).

However, comparisons of R2 with R3 show that these differences no longer exist, and that there are similar differences between R1 and R2 as there are between R1 and R3.

Both of the differences can be accounted for by assuming that the calculated declinations of the Moon are the same for a zero declination, but are up to about 2" farther north in R1 than R2 for extreme northerly declinations and a similar amount farther south for extreme southerly declinations.

2. Differences in Vertical Limb Profile.

As mentioned above, there is fairly close agreement in limb profile corrections between R1 and R3, although it was felt they could have been closer. Differences are generally less than 0"2 in magnitude, and frequently less than 0"1. These may partly arise from the position angle differences. Limb corrections for R3 were obtained by manual look-up in "The Marginal Zone of the Moon," by C. B. Watts, published by the Nautical Almanac Office , U.S.N.O., 1963.

However, there are gross discrepancies between the limb corrections used in R1 and R2 (and therefore, R2 and R3). There appears to be no correlation between them at all. As an example, the limb corrections given for the first few observations at SN 211 in 1984 are:

Date	Star	HW as in R1	WH as in R2
Jan 9	S 146940	0″.84	-0″.04
Jan 9	S 146943	0″.70	0″.02
Jan 9	S 146944	0″.82	-0″.05
Jan 12	S 110328	0″.23	0″.03
Jan 13	S 93179	-0″.53	-0″.49
Jan 13	S 93183	-0″.68	-0″.95
Jan 16	S 77513	1″.30	1″.44

As a result, there are considerable differences between the O-C values (a) in R1 and R2 (and also R2 and R3). However, there are only small differences between the simple residues (c) in R1 and R2. These would appear to relate at least in part to the change in position angles noted on part 1.

I can see no obvious reason for the large and apparently random differences in the limb correction values between R1 and R2, and wonder if they are in error in the *Report of Lunar Occultation Observations for 1984*.

1983 Reductions and Report

In 1983, there appears to be close agreement of the limb profile corrections between R1 and R2. However, the O-C values show considerable differences, as do the values for K-R, the position angle of the event referred to the direction of the Moon's motion.

Yours sincerely, B. Loader

GRAZING OCCULTATIONS

Don Stockbauer

Reports of successful lunar grazing occultations should be sent to me at 2846 Mayflower Landing; Webster, TX 77598; U.S.A. Also sending a copy to ILOC is greatly appreciated; their address is: International Lunar Occultation Centre; Geodesy and Geophysics Division; Hydrographic Department; Tsukiji-5, Chuo-ku; Tokyo, 104 Japan.

Copies of Pleiades graze reports should be sent to me and, if possible, ILOC. Reports of Pleiades total occultations need only be sent to ILOC if all stars are in the SAO; if any are not, David Dunham (P.O. Box 7488; Silver Spring, MD 20907; U.S.A.) should also receive a copy.

Date	V P	Star #	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap Cm	Organizer	C	St	WA	b
1986															
0727		0184	6.2	62-	17N	Hubbell, NE	2	6	1	15	Richard P. Wilds			342	12
0728		0290	6.1	53-	10N	Pleasanton, CA	9	53	2	8	Rick Baldridge		3N	349	-1
0803		1093	6.4	5-	20N	Bruceville, CA	8	47	2	8	Rick Baldridge		1N	350	-61
0827		076493	8.3	49-	16N	Redwood City, CA	3	21	1	20	Steve Ballaron			343	-42
0831		1181	6.8	14-	14N	Manteca, CA	11	58	2	15	Rick Baldridge		4S	352	-65
1030		X17749	10.0	12-	6S	Tisvildeleje, Den.	1	4	2	31	N. P. Wieth-Knudsen			190	-22
1109		3160	7.0	52+	15S	King City, CA	4	9	1	8	Rick Baldridge		5S	164	66
1111		3419	4.5	73+	12S	Willits, CA	2	20	1	20	Rick Baldridge		0	165	46
1112		3535	5.2	82+	11S	Morgan Hill, CA	6	20	1	20	Rick Baldridge		2N	165	32
1987															
0102		3175	4.8	11+	22S	Jackson, MS	2	13	1	20	Benny Roberts		1S	163	58
0125		2366	1.2	22--	18N	Baker, CA	2	18	2	20	David Paul Werner		2N	16	61
0204		0232	8.5	34+	9S	Afton, MN	3	14	1	15	James H. Fox			170	-12
0210		1105	6.5	91+		Dinant, Belgium	1	5	1	20	Yvon Thirionet				
0218		1925	1.2	79-	14S	St. George, UT	2	15	1	20	David Paul Werner		0	196	20
0305		076001	8.5	35+	3N	Tisvildeleje, Den.	1	10	1	31	N. P. Wieth-Knudsen		1N	1	-42
0306		076103	8.1	36+	1N	Perronville, MI	1	7	1	20	Homer DaBoll		1S	0	-47
0306		0545	4.2	37+	6N	Sidon, MS	4	30	1	15	Benny Roberts		1N	4	-49
0306		0550	6.8	37+	N	Concord, NY	1	5	1	15	Adrienne Morris				
0310		1206	5.9	80+	6N	Hundested, Denmark	1	5	2	6	N. P. Wieth-Knudsen		2N	10	-60
0320		2251	7.5	75-	13S	Pleasanton, CA	2	13	2	20	Rick Baldridge		2S	197	56
0320		2298	5.1	72-	13S	Izumosaki, Japan	1	2	2	9	Masashi Hiroki		2N	196	60
0320		2298	5.1	72-	13S	Mito City, Japan	7	40	2	7	Hideo Takahashi		2N	196	60
0320		2298	5.1	72-	13S	Mito City, Japan	11	84	1	10	David W. Dunham		2N	196	60
0405		078042	7.8	39+	11N	Lomita, CA	1	0	1	20	David Paul Werner		>1S		-66
0501		076841	7.5	9+	N	Rio Vista, CA	1	0	1	20	Tony Freeman				

Many observers send copies of the limit and profile predictions with their reports; this is always greatly appreciated.

The shift requested on the report form is defined as the shift of the observed shadow from the shadow shown on the original predicted profile. Empirical corrections as suggested by David Dunham or others should not be applied to the predicted profile before calculating the final shift. Please send me a corrected shift if this was done for any of your expeditions.

Several people have asked me to send them the residuals of their grazes. ILOC routinely mails residuals to the address entered on their form with each graze contact treated as a total occultation, but it takes quite a while due to their work load. A better method is to plot the contacts on the predicted profile, thus quickly establishing the consistency and quality of the observations. Residuals can be seen immediately, and the important "overall residual" (the shift value) can be easily measured and reported. I have a paper detailing the whole process which I will provide free upon request.

Some reports have arrived which test the empirical corrections detailed on p. 89 of the last issue. In the article "Corrections to 80H Grazing Occultation Predictions," David Dunham suggests that northern-limit profiles should be adjusted 0″.3 south for stars at the northernmost declinations, 0″.2 north for the southernmost declinations, linearly going to no correction at the celestial equator. I generalized his guidelines, but these rules match his closely. It seems that shifts for stars in Taurus, Gemini, Aries, and Cancer have either been close to the 80H predictions or have shown slight (0".1) north shifts. Unfortunately, this affected expedition leaders who positioned stations too deeply into the shadow during the Pleiades passage on March 6. In my opinion, given the current state of the art, it is unrealistic to expect graze predictions to be more accurate than 0".2, even with trend factors (empirical corrections) applied. Spacing stations closely together has many advantages if all goes well; those advantages become liabilities if a routine shift occurs.

If the Moon's observed profile as determined from a graze expedition contains an improbable feature, try removing all vertical exaggeration from the plot. USNO profiles are typically elongated 30-fold vertically, and some expedition leaders even increase that in order to show more separation between closely spaced stations. If, for example, a tiny outcropping of rock on the observed plot becomes a razor-thin ledge a hundred feet thick and several miles long, on an undistorted graph, it would probably be best to assign the questionable timings certainty code 2 ("possibly spurious") as a flag to those ultimately reducing the data. Other types of of anomalies include large tunnels bored scores of miles through the Moon's interior, or long, thin arches of lunar rock. Such features must be justified by their purported origin and current stability; if they really exist, then future lunar explorers will behold some truly magnificent scenery.

I am designing a program which will read the USNO double star file and automatically provide this information to the graze program. Formerly, graze computors had to enter the data by hand; I hope to have it ready for the 1988 predictions. Don Oliver is designing software to read Thomas Van Flandern's tape of occultation observations and complete the machine-readable graze list project for the pre-*Occultation Newsletter* era.

Corrections — in *O.N. 3* (13), p. 274, the graze on Feb. 6, 1984 involved Z.C. 1061, not Z.C. 0106. In *O.N. 4* (4), p. 63, the shift for SAO 184191 observed Sept. 10, 1986 should be 1.1S, not 1.6S.

Thanks for the reports received. Their volume has dropped off quite severely over the past year or two, so every one received is more valuable than ever.

GRAZE PREDICTIONS AND XZ CATALOG IMPROVEMENTS

David W. Dunham

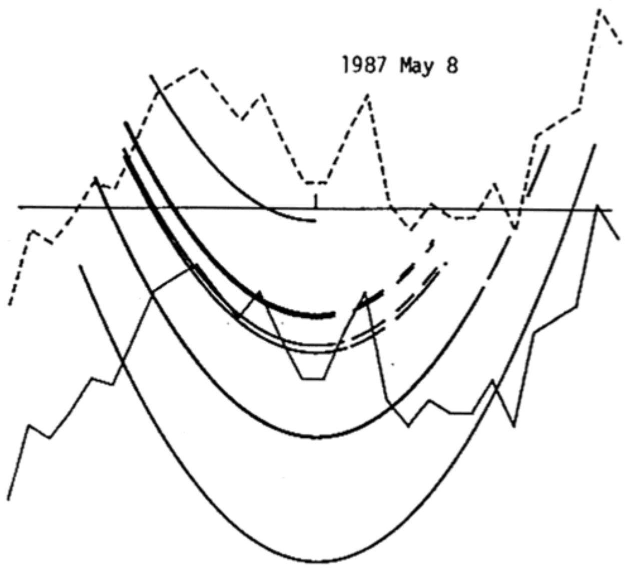
Graze prediction schedule. Most of the grazing occultation predictions for IOTA members for the second half of 1987 were computed in May, but I purposely held up the calculations of the limb correction data needed to produce the ACLPPP profiles, hoping that I could complete my updates to the XZ catalog before doing them. At the beginning of June, it became clear that I could not finish the XZ catalog work, described below, before my June 6th departure on a week-long business trip (see p. 112). The limb-correction data were consequently generated with the current version (80H) of OCC at the U. S. Naval Observatory, and sent to computors June 4-8. Unfortunately, considering mailing times, time to compute the profiles and prepare the mailing for all of the predictions, and business and vacation schedules of the various computors, the mailing was much too late, and many observers received their predictions for July - December well after July 1st. I apologize for this; don't blame the individual computors. Perhaps one advantage of the situation is that we have one consistent prediction system for all of 1987. Although the catalog changes will improve the prediction accuracy for many mainly southern stars, it is probably not a good idea to change the prediction basis in the middle of the year. I promise to provide more lead time in the future.

The graze data for 1988 were generated at USNO early in July, and will be sent to the computors in early August. We will send the computors IOTA station data and address labels early in October, to give them more time to make the prediction runs. Some have reported that map orders to U.S.G.S. often take more than a month, so detailed predictions for the first half of 1988 should be distributed by mid-November. In any case, you should have 1:250,000-scale maps covering your region, since careful plots on them usually suffice for preparation of graze expeditions, although more detailed maps are needed for reporting accurate coordinates. If you want to change your travel radii or if your address has changed, please send a correction to Mr. DaBoll at the address in the masthead as soon as possible.

Corrections to graze predictions. Small corrections to the current system, the 80H prediction basis ACLPPP profiles, 1986 December version, were recommended for northern-limit grazes on p. 89 of the last issue. The small shifts listed in the table on p. 103 show that there is no strong observational evidence for my proposed corrections, so for the time being, I now propose that no corrections be applied, except for observed shifts reported during previous grazes of the same star (see, for example, p. 100 for Pleiades stars). I thank observers who have reported recent graze observations promptly to Stockbauer and me. In particular, I thank Gunther Neue for his preliminary report of timings of the May 8th graze of the FK4 star Sigma Leonis (Z.C. 1644) near Dortmund, German Federal Republic, and his reduction profile of the observations, shown here. My analysis showed a north shift of 0".26; the latitude libration was -2°.05. Also, Dr. N. P. Wieth-Knudsen sent a report of his two timings of the graze of Beta Virginis (Z.C. 1712) made in Spain on June 5th. His timings indicated a 0".17 north shift, at latitude libration -0°.79.

Z.C. magnitude errors. On June 22nd, Harold Povenmire observed a graze of Z.C. 439 = SAO 93221. The catalogs list 8.0 as the magnitude of the F0 spectral type star, giving the graze a marginal rating. But Povenmire said the graze was favorable, and estimated the star's true magnitude as 7.2. Wayne Warren, at the Astronomical Data Center at Goddard Space Flight Center, found the star in the French SIMBAD on-line computer database, which listed an article by Eric Craine and Werner Scharlach, "VI Photometry of Selected SAO Stars," in *Publ. Astron. Soc. Pacific 94*, p. 67 (1982 February issue). They list a photoelectric V magnitude for SAO 93221 as 7.33, in good agreement with Povenmire's estimate, and I plan to update this magnitude in the XZ during my catalog improvement work described below. Z.C. 549 is a Pleiades star whose erroneous Z.C. magnitude was corrected in USNO's database during the last series of Pleiades passages; see p. 101.

XZ catalog improvement. Late in May, I completed a computer comparison of USNO's zodiacal XZ with the Perth 70 catalog. I found 394 southern Perth 70 stars that are also in the XZ, but which were not matched in the original comparison done several years ago. This gives a total of 2833 southern stars that are in both catalogs, and a new version of the XZ including the Perth 70 positional data was written. I am working slowly on a more difficult program that will merge Yale Catalog (for the poor position G.C. stars) and Lick Voyager catalog positional data into the XZ; see discussion of the combined catalog for asteroidal predictions in *O.N.* 4 (3), p. 46-48. When this is completed, probably sometime this month, I will update the XZ stellar database at USNO to create the 80I version of the OCC program, which will be used to compute the limb corrections and final prediction adjustments for ACLPPP profiles for the 1988 graze predicted profiles. I will also then finally send copies of this improved XZ catalog to those who requested it from me, some over a year ago (sorry for the delay).



The reduction profile for the graze of 4.1-mag. Sigma Leonis = Z.C. 1644 near Dortmund, German Federal Republic, was sent by Günther Neue.

EXPLANATION OF LUNAR OCCULTATION OBSERVATION REDUCTIONS

Dietmar Büttner

This article should provide any facts for making the reduction results of lunar occultation observations more understandable. The symbols used refer to reductions by the ILOC; deviating ones in parentheses denote symbols used by the HMNAO.

O-C: residual; difference 'observation - computation'
- theoretical radial distance between the star and the real lunar limb at the reported time of observation
- lunar limb profile is considered
- O-C is given in seconds of arc
- positive values denote the star to be outside of lunar limb and negative values denote star inside of lunar limb
- complex function of lunar ephemeris, star position, limb correction, observer's position and timing result of observation
- many other influences: e.g., shape and size of Earth's body, mean radius of Moon, etc.

At the moment of occultation, the following geometrical exactly defined relation between the positions of star, observer, and lunar limb (from position of lunar disc's center, radius of the Moon and limb correction) is valid: As seen from the observer, the star is situated just at the limb of the Moon.
- henceforth, true distance of the star to the lunar limb is equal to zero
- residual is the theoretical distance and gives the summary error of all above components
- ideal case: Residual equal to zero, if all components are free of error (not achievable practically) or if all errors compensate together accidentally
- typical values: -2" to +2"

Interpretation of residuals:
- single large O-C does not denote a timing error in every case, as bad star position or poor limb correction may also be the cause
- in case of very large O-C (e.g., 9".99): Mostly error in star number, date, or time (e.g., difference between UT and local standard time)
- many O-C of one observer large: Probably error in geographical coordinates of observer
- single residuals can be checked for coarse errors only (see above)
- evaluation useful only with statistical methods for determining numerous corrections of influencing quantities; statistical evaluation needs many observations (some 1000 or 10000)

HW or WH (LC): Limb correction
- height of real lunar limb at the point of occultation above mean limb in case of positive value, or depth below mean limb for negative value. The mean limb represents the zero line in Watts' charts of the moon's marginal zone and exists theoretically only for an ideal circular outline of the Moon's disc. Both abbreviations (HW and WH) are used with identical meaning by the ILOC.
- input data for reading HW from Watts' charts: topocentric libration in longitude and latitude and Watts angle (WA)
- given to 0".01 (like O-C), corresponding to about 19 m at Moon's limb (for mean distance)
- mean uncertainty ±0".05, in some cases uncertain by ±0".5; * denotes uncertainties greater than ±0".3
- errors in profile corrections are mainly known from comparisons of observed and theoretical limb in case of grazing occultations (see reduction profiles published in *O.N.*)
- typical values of HW: -2" to +2"

KM (PA): Position angle of contact point
- counted starting at north point of Moon's disc through E, S, W, to N
- corresponds to PA in USNO total occultation predictions

K-R (not given by HMNAO):
angle between the direction of the Moon's motion and the point of occultation
- 0° for central disappearance, 180° for central reappearance, 90° for southern limb graze, and 270° for northern limb graze
- K-R is comparable with CNTCT ANGLE in USNO predictions (for photoelectric observers only); however,

CNTCT ANGLE is expressed in another way: Positive values from 0 to 180° for occultations north of the Moon's center and negative values from 0 to 180° for points south of this path (0° central disappearance, ±180° central reappearance, -90° southern graze, +90° northern graze)

Both KM and K-R are counted from 0 to 360° counterclockwise.

REPORTS OF ASTEROIDAL APPULSES AND OCCULTATIONS

Jim Stamm

Reports of *all* appulses and occultations should be sent to me at Rt 13 Box 109; London, KY 40741; U.S.A. If the target star was monitored near the predicted time of an event, then the observation was valid, and a report should be sent to IOTA — even if nothing was seen. We use the negative reports more than we do the positive ones.

Table 1. Asteroidal appulses and occultations observed from July through December 1986.

Minor Planet		Star	Date	Observers	Notes
(306)	Unitas	SAO 161893	Jul 04	Rb	
(187)	Lamberta	AGK3 +09 1363	Jul 04	CpCm	
(287)	Nephthys	SAO 141631	Jul 10	HtAn	
(19)	Fortuna	AGK3 +14 0219	Jul 12	HtAn	
(415)	Palatia	SAO 159637	Jul 12	NtMoPoPi	
(741)	Botolphia	SAO 187699	Jul 16	LdBwDdMfWh	
(679)	Pax	SAO 189278	Jul 18	ScAnKyHt	
(741)	Botolphia	SAO 187571	Jul 23	LdWh	
(46)	Hestia	AGK3 +15 0246	Jul 26	OvGyMeFsVb	
(697)	Galilea	AGK3 +10 0227	Jul 27	SmGyDkSpLkMbVb	
(52)	Europa	SAO 146840	Jul 31	Mt	
(377)	Campania	AGK3 +18 0265	Aug 02	24 Observers	1
(41)	Daphne	AGK3 +03 2032	Aug 06	LdMxBaNsScAn	
(409)	Aspasia	AGK3 +24 0406	Aug 07	TgScAn	2
(232)	Russia	SAO 163645	Aug 10	PvCuLwWhScAn	
(213)	Lilea	SAO 185266	Aug 21	AmGaGcLbPlRn	
(145)	Adeona	SAO 111430	Aug 29	Mo	
(705)	Erminia	AGK3 +41 0840	Sep 06	TpRnOrNpPoMoLpGv	
(1115)	Sabauda	SAO 211769	Sep 07	ScAnHtRg	
(393)	Lampetia	AGK3 +04 2577	Sep 07	ScAn	
(385)	Ilmatar	SAO 208293	Sep 13	14 Observers	3
(104)	Klymene	AGK3 +23 0457	Sep 17	DlElNp	
(932)	Hooveria	AGK3 +28 0489	Sep 17	ScAnHt	
(332)	Siri	SAO 146545	Sep 21	22 Observers	4
(2363	Cebriones	AGK3 +11 2151	Sep 23	StFr	
(431)	Nephele	AGK3 +21 0763	Sep 24	AnHt	
(190)	Ismene	SAO 162468	Sep 29	StFr	
(148)	Gallia	SAO 167259	Sep 29	FrLn	
(598)	Octavia	SAO 166016	Oct 01	StLx	
(38)	Leda	SAO 75363	Oct 04	StLyFrLnRbMpMy	
(487)	Venetia	AGK3 +13 0491	Oct 13	CsDyGbLpMoPmNp PoTfWkZm	5
(613)	Ginerva	AGK3 +13 0491	Oct 18	DbPm	
(676)	Melitta	SAO 164583	Oct 21	StRb	
(405)	Thia	SAO 161462	Oct 22	ElOvSm	
(417)	Suevia	SAO 164275	Oct 22	BuCdGiGjGxGeNcRpRuTiTf	
(597)	Bandusia	AGK3 +19 0229	Oct 26	BcBhBnGbRnTh	
(818)	Kapteynia	SAO 210004	Oct 27	Cm	
(597)	Bandusia	AGK3 +19 0227	Oct 27	Sc	
(93)	Minerva	AGK3 +02 0008	Oct 27	22 Observers	6
(222)	Lucia	AGK3 +19 0870	Oct 29	EtFzMvNpTiZw	
(94)	Aurora	SAO 79994	Nov 04	StLyKhWrMpMyAzWz	
(583)	Klotilde	AGK3 +02 1392	Nov 04	An	
(297)	Caecilia	SAO 164457	Nov 06	LyMpMy	
(597)	Bandusia	AGK3 +19 0211	Nov 07	El	
(373)	Melusina	SAO 189336	Nov 07	ScHtAn	
(191)	Kolga	SAO 163997	Nov 08	ElOvCp	
(349)	Dembowska	SAO 190516	Nov 10	ScHtAn	
(397)	Aquitania	SAO 191017	Nov 10	ScHtAn	
(779)	Nina	AGK3 +34 0176	Nov 12	Fr	
(9)	Metis	AGK3 +20 0417	Nov 13	BcDyDmGwGsLpMoMjRhWk	
(261)	Prymo	AGK3 +18 0830	Nov 14	Th	
(191)	Kolga	SAO 164199	Nov 21	OvSmGyCp	
(778)	Theobalda	AGK3 +24 0073	Nov 27	ElGyCp	
(210)	Isabella	SAO 189826	Nov 28	Sc	
(104)	Klymene	AGK3 +24 0437	Nov 28	Ly	
(125)	Liberatrix	AGK3 +06 0220	Dec 02	21 Observers	7
(233)	Asterope	SAO 157658	Dec 04	DmKlMjMo	
(11)	Parthenope	SAO 96444	Dec 04	St	
(676)	Melitta	SAO 165128	Dec 13	StLy	
(509)	Iolanda	AGK3 +05 0712	Dec 14	CbCrMsMzMoPo	
(145)	Adeona	AGK3 +11 0301	Dec 17	Gg?a	
(877)	Walkure	SAO 93900	Dec 22	Ly	
(242)	Kriemhild	AGK3 +08 0362	Dec 23	SjSlMkMpMy	
(17)	Thetis	AGK3 +17 0486	Dec 24	Sm	
(87)	Sylvia	SAO 77917	Dec 28	SaMpMyFr	
(43)	Ariadne	AGK3 +21 0753	Dec 28	Sa	
(946)	Poesia	SAO 80322	Dec 30	MpMyLyFr	

Notes: Events from July through December, 1986, referenced in Table 1.

1) Observers monitoring this event were BhBgCnGzCsCo DcDgMiGlGuGsJgLcLhMtNpRdTsThTdVsVvZm. Zimmermann recorded a blink of 0.4 to 0.5 sec. duration.
2) Tregaskis reported a "definite" disappearance at 19:46:47.1, and a reappearance at approximately 19:46:49, under good sky conditions. This observation indicates a southward shift of about 0".5.
3) Observers were OvKtKgMcHlMbElBjFtVnMeSmGyFs.
4) Observers were AgBhBrBfBnDlGsInLpMsMzMoPmRnSbTpHl CpSmElOvBj. The two French observatories reported that the event occurred one hour sooner than predicted. None of the other observers reported a different time.
5) A 2-magnitude drop from 1:28:31.5 to 1:28:38.9 was reported, along with some fluctuations around 1:25 by Lipski. The observatories reported that the shift placed the path over central Africa, and that it was about 10 minutes later than predicted.
6) Observers were BrCsCvGmGbGpGfInLtMhMrMtMuMmMwNzPn RzSiSsSrVf. The asteroid passed north of the star at Stuttgart, German Federal Republic, and south of the star at Mostoles, Spain and Locarno, Switzerland. Germann reported a "non-instantaneous disparition at 19:26:47.5 during 16 seconds." See R. Boninsegna's article.
7) Observers were AjBhBrBiCsCbDyGoInIvLpMsMqMzMoMwNp OzPmRnVf. Ortiz reported a possible occultation beginning at 18:27:09.5 and lasting 7.6 seconds. Pic du Midi reported that the minor planet passed north of the star. See R. Boninsegna's article.
8) This event was the first from which Australasian and Lowell observatory updates were to be obtained. Lowell had problems, but Craig Bowers at Perth Observatory obtained plates on December 9, 15, and 16. Warwick Kissling in Wellington computed a path shift of 3".4 N from the Dec. 9th plate, and 2".8 N from the other two plates. Graham Blow and David Herald notified a large number of observers in the area. A definite miss was reported from Hobart, Tasmania, and Martin George in Launceston reported a 0.2-sec. blink with 50% certainty, at 12:31:25.5 — which is near the updated time and position. All other locations were clouded out.

Table 2. Observers and locations of events reported from July through December 1986.

Observer	ID	Location	Reports Rec'd
F. Aljama	Aj	Sabadell, Spain	1
M. Aluiji	Ag	Genova, Italy	1
C. Amengual	Am	Palau-Sabardera, Spain	1
Peter Anderson	An	The Gap, Queensland, Australia	14
John Asztalos	Az	Milwaukee, WI	1
Lindsay Ball	Ba	Coopers Plains, Qnslnd, Austrl.	1
J. Barthes	Bh	Castres, France	4
P. Barufetti	Br	Massa, Italy	3
F. Bassini	Bf	Bologna, Italy	1
A. Battarelli	Bi	Trento, Italy	1
J. Begbie	Bj	Harare, South Africa	2
C. Blanchart	Bc	Brussels, Belgium	2
Graham Blow	Bw	Wellington, New Zealand	1
Roland Boninsegna	Bn	Dourbes, Belgium	2
J. Bourgeois	Bg	Conneux, Belgium	1
J. Bourgeois	Bu	Bagneres, France	1
J. Cano	Cn	Puigcerda, Spain	1
N. Cardiel	Cd	Madrid, Spain	1
R. Casas	Cs	Sabadell, Spain	4
M. Cavagna	Cv	Calvignano, Italy	1
Joe Churms	Cm	Cape Town, South Africa	2
A. Colomba	Cb	Reggio Calabria, Italy	2
F. Comeron	Co	Argentona, Spain	1
Tim Cooper	Cp	Sasolburg, South Africa	5
F. Courbin	Cr	Vernon, France	1
Don Currie	Cu	Bundaberg, Qnslnd, Australia	1
G. DeBenedetto	Db	Reggio Calabria, Italy	1
M. Deconinck	Dc	Limal, Belgium	1
F. Delahaye	Dy	Bordeaux, France	3
J. Delgado	Dg	Puigcerda, Spain	1
J. de Klerk	Dk	Potchefstroom, South Africa	1
M. Dentel	Dm	Bernau, German Democratic Rep.	2
R. Di Luca	Dl	Bologna, Italy	2
Tony Dodson	Dd	Wellington, New Zealand	1
G. Earle	El	East Rand, South Africa	6
A. Elliott	Et	Leeds, United Kingdom	2
Filipowicz	Fz	Otwock, Poland	1
R. Fleet	Ft	Harare, South Africa	1
B. Fraser	Fs	Johannesburg, South Africa	2
Tony Freeman	Fr	Berkeley, CA	7
C. Gallart	Gl	Puigcerda, Spain	1
C. Gallart	Gi	Igualada, Spain	1
J. Gallego	Gj	Madrid, Spain	1
J. Garcia	Ga	Lisboa, Portugal	1
M. Genovese	Gv	Prafonevoso, Italy	1
M. Genovese	Go	Torino, Italy	1
Martin George	Gg	Launceston, Tasmania	1
R. Germann	Gm	Wald, Switzerland	1
M. Geyser	Gy	Pretoria, South Africa	5
A. Gomez	Gx	Madrid, Spain	2
J. Gomez	Gz	Puigcerda, Spain	1
R. Goncalves	Gc	Lisboa, Portugal	1
C. Gros	Gb	Besancon, France	3
C. Grunnet	Gw	Virum, Denmark	1
Gruppo Ast. Savonesi	Gp	Savona, Italy	1
A. Grycan	Gf	Toulouse, France	1
J. Guarro	Gu	Puigcerda, Spain	1
J.-D. Guerisse	Gs	Brussels, Belgium	3
A. Hilton	Hl	Johannesburg, South Africa	2
Steve Hutcheon	Ht	Sheldon, Queensland, Australia	9
M. Inghirami	In	Massa, Italy	3
Z. Ivica	Iv	Rijeka, Yugoslavia	1
Jungfraujoch Obs.	Jg	Jungfraujoch, Switzerland	1
Philip Kearney	Ky	Bundaberg, Qnslnd, Australia	1
L. Keith	Kh	Milwaukee, WI	1
J. Knight	Kt	East Rand, South Africa	1
S. Knight	Kg	East Rand, South Africa	1
M. Kohl	Kl	Uster, Switzerland	1
C. Lake	Lk	Pietermaritzburg, South Africa	1
Thomas Langhans	Ln	San Bruno, CA	2
J.-F. Leborgne	Lb	S. F. de Guixois, Spain	1
J. Lecacheux	Lc	Obertraun, Austria	1
J. Lecacheux	Lt	Meudon, France	1
H. Le Tallec	Lt	Toulouse, France	1
A. Lheureux	Lh	Brussels, Belgium	1
P. Lipski	Lp	Dresden, German Democratic Rep.	5
Brian Loader	Ld	Blenheim, New Zealand	3
Dennis Lowe	Lw	Bundaberg, Qnslnd, Australia	1
Greg Lyzenga	Ly	Altadena, CA	7
Alistair MacDonald	Mx	Townsville, Australia	1
C. Mahot	Mv	Vauvenargues, France	1
S. Maksymowicz	Ms	Chapet, France	2
Patrick Manly	My	Tempe, AZ	6
Peter Manly	Mp	Tempe, AZ	6
M. March	Mh	Mataro, Spain	1
B. Margesin	Mq	Trento, Italy	1
W. Marinello	Mr	Brescia, Italy	1
J. Marti	Mt	Mataro, Spain	3
H. Marx	Mu	Stuttgart, German Federal Rep.	1
P. Mazalrey	Mz	Vernon, France	3
F. Mazzanti	Mi	Puigcerda, Spain	1
A. McRae	Mc	Johannesburg, South Africa	1
Jeff Medkeff	Mk	Hartville, OH	1
Meudon Obs.	Mo	Meudon, France	9
D. Michie	Me	Johannesburg, South Africa	2
J.-P. Michon	Mj	Herment, France	2
Milano Obs.	Mm	Merate, Italy	1
E. Mirco	Mw	Trento, Italy	2
A. Morrisby	Mb	Bulawayo, South Africa	2
Noel Munford	Mf	Palmerston North, New Zealand	1
G. Napolitano	Np	S. Maria D. Mole, Italy	6
Nat'l. Astro. Lab.	Nt	Itajuba, Brazil	1
E. Nazry	Nz	Toulouse, France	1
Nice Obs.	Nc	Nice, France	1
Gary Nielsen	Ns	Coopers Plains, Qnslnd, Austrl	1
L. Orsi	Or	Bologna, Italy	1
E. Ortiz	Oz	Vitoria, Spain	1
Danie Overbeek	Ov	East Rand, South Africa	6
Paris Obs.	Po	Paris, France	4
R. Pello	Pl	S. F. de Guixois, Spain	1
S. Piana	Pn	Varallo, Italy	1
Pic du Midi Obs.	Pm	Pic du Midi, France	4
J. Piriti	Pi	Nagykanizsa, Hungary	1
Norm Plever	Pv	West Footscray, Australia	1
G. Raspadori	Rp	Bologna, Italy	1
G. Regheere	Rh	Grenoble, France	1
A. Renou	Rn	Brissac, France	5
Benny Roberts	Rb	Jackson, MS	3
D. Rodriguez	Ru	Villaba, Spain	1
D. Rodriguez	Rz	Mostoles, Spain	1
J. Rodriguez	Rd	Guadalajara, Spain	1
D. Rogers	Rg	Wynnum West Brisbane, Australia	1
D. Schieb	Sb	Mulhouse, France	1
D. Schieb	Si	Illfurth, France	1
J. Smit	Sm	Pretoria, South Africa	6
Charlie Smith	Sc	Woodridge, Qnslnd, Australia	12
Specola S. Ticinese	Ss	Locarno, Switzerland	1
J. Spoelstra	Sp	Potchefstroom, South Africa	1
Billy Stamm	Sl	Cuyahoga Falls, OH	1
Jim Stamm	St	London, KY	8
Jim Stamm	Sj	Akron, OH	1
Jim Stamm	Sa	Westfield, MA	2
L. Strabia	Sr	Brescia, Italy	1
E. Tassi	Ts	Forli, Italy	1
Y. Thirionet	Th	Brussels, Belgium	3
P. Todini	Td	Siena, Italy	1
P. Todini	Ti	Isola d'Arbia, Italy	2
Bruce Tregaskis	Tg	Mt. Eliza, Victoria, Australia	1
F. Tulipani	Tp	Bologna, Italy	2

F. Tulipani	Tf	Tizzano, Italy	2
F. Vaissiere	Vf	St. Genest-Lerp, France	2
P. van Blommestein	Vb	Cape Town, South Africa	2
E. Velasco	Vs	Guadalajara, Spain	1
J. Villaverda	Vv	Puigcerda, Spain	1
J. Vincent	Vn	Harare, South Africa	1
Sally Waraczynski	Wz	Milwaukee, WI	1
David Paul Werner	Wr	Lakewood, CA	1
David Wheeler	Wh	Corrimal, N. S. W., Australia	3
N. P. Wieth-Knudsen	Wk	Tisvildeleje, Denmark	2
Zawilski	Zw	Lodz, Poland	1
L. Zimmermann	Zm	Brussells, Belgium	2
	?a	Hobart, Tasmania	1

MORE INFORMATION ON TWO ASTEROIDAL APPULSES

Roland Boninsegna

The positions of the stations presented in the figures have been moved onto a single line, in the fundamental plane, perpendicular to the motion of the minor planets.

1. (93) Minerva and AGK3 +2°0008, 1986 October 27.

Most of the stations are presented in Fig. 1. One total occultation was recorded by station 3, lasting about 16 seconds. The diameter of (93) Minerva is well-known (see Millis, R. L., 1985, *Icarus 61*, 124 or Note Circulaire GEOS 450): 170.8 ± 1.4 km.

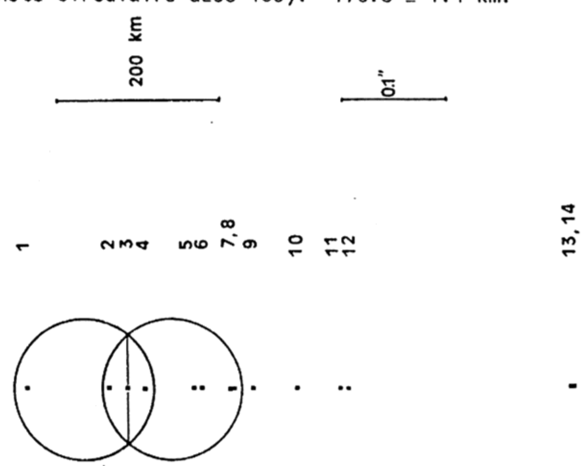


Figure 1

The chord reported by station 3 is presented as the position of Minerva assuming a north or south chord. As the figure shows, other stations should have reported the occultation, especially if the track of Minerva was the southern one. The observer at station 2 interrupted his observation during some instants around the moment of station 3's event. So only two stations contradict R. German's report, if the track of Minerva was the northern one. All the observers were further questioned; they were all sure of star identification. Last important detail: Station 6 and Diego Rodriguez (148 km below station 14) reported that Minerva passed south of the star, while station 1 reported it north.

	1	H. Marx (D - Stuttgart)
	2	D. Schieb (F - Illfurth)
	3	R. German (CH - Nahren)
	4	C. Gros (F - Besançon)
	5	E. Mirco (I - Trento)
pp	6	Specola Sol. Loc. (CH - Locarno)
	7	S. Piana (I - Varallo Sesia)
pp	8	Milano Obs. (I - Merate)
	9	W. Marinello - L. Strabla (I - Manerbio)
	10	M. Cavagna (I - Calvignano)
	11	Gruppo Astrof. Sav. (I - Savona)
	12	P. Barufetti - M. Inghirami (I - Massa)
	13	M. March - J. Marti (E - Mataro)
	14	R. Casas (E - Sabadell)

2. (125) Liberatrix and AGK3 +6 0220, 1986 Dec. 2.

Again, a total occultation was reported by only one observer. Here, the case is more critical: The diameter of Liberatrix is not accurately known, varying from 103 km (Gehrels) to 47 km (Pilcher).

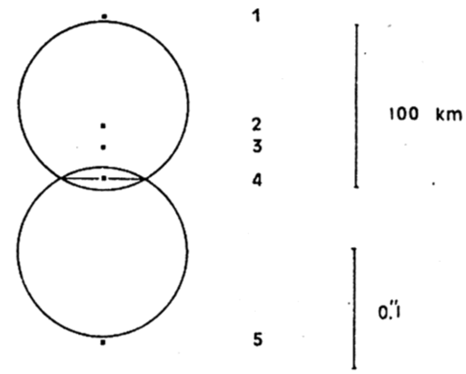


Figure 2

The chord reported by station 4 is presented in Fig. 2, with the position of Liberatrix assuming a north or south chord and a 103-km diameter. If the northern track is more unlikely, we cannot rule out the reality of the southern one: No station could contradict E. Ortiz' observation. It is noteworthy that Pic-du-Midi Observatory reported a north shift using visual control.

	1	J. Barthes (F - Castres)
	2	G. Napolitano (I - St Maria Della Mole)
tv	3	Pic-du-Midi Observatory (F - Bagnères)
	4	E. Ortiz (E - Vitoria)
	5	F. Aljama (E - Sabadell)

Conclusions.

None can really be drawn, especially for the Liberatrix event. Double stations would have improved the conclusion. Be careful in reporting information on a minor planet's position relative to a star, during appulse: It is not so easy when the path is nearby.

For the complete list of observers for these events, see Note Circulaire GEOS 518.

CORRECTION

David W. Dunham

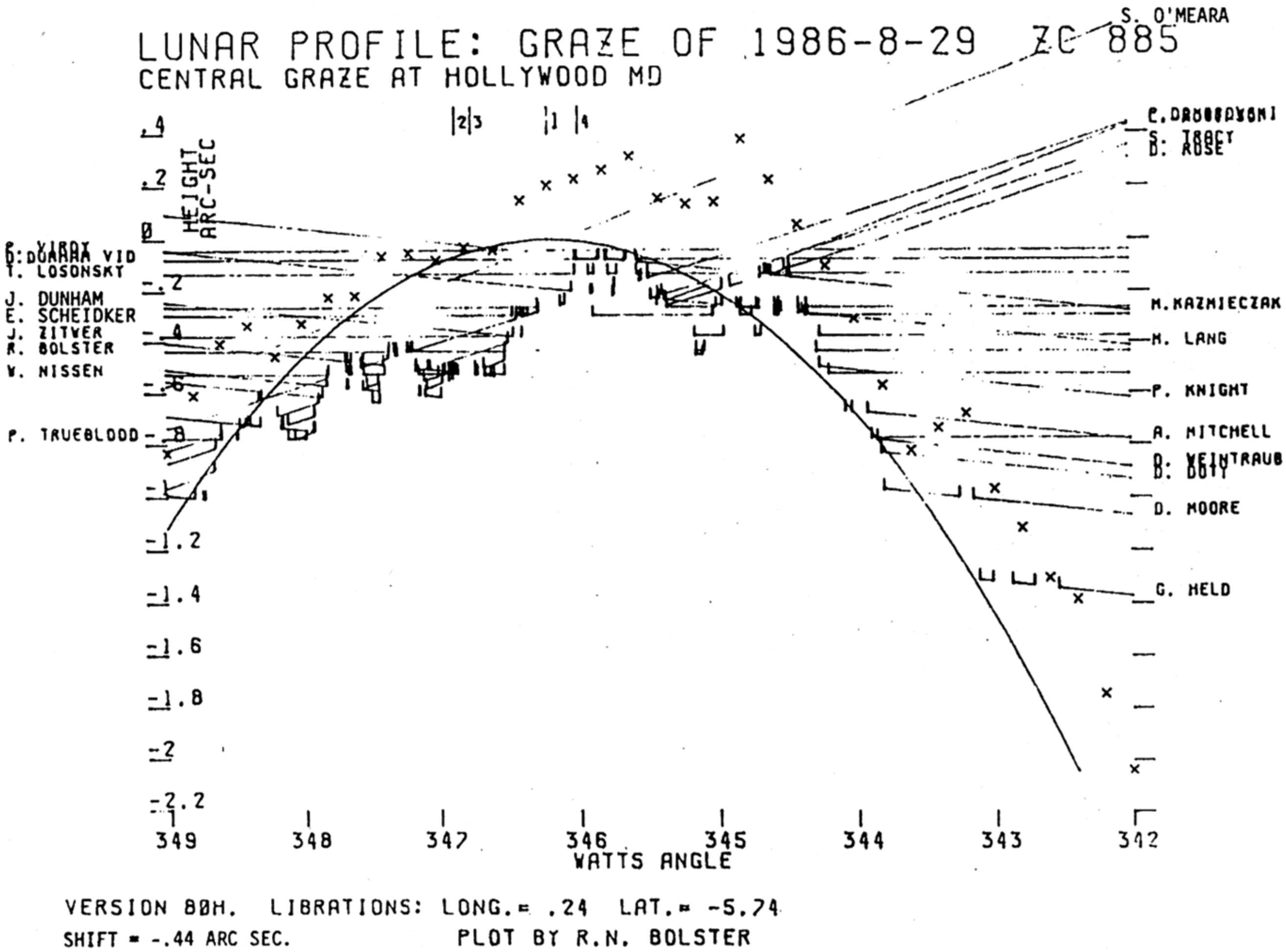
On p. 58 of the last issue, I said that a graze of 107 B. Tauri had been observed in the Soviet Union in 1986. This star is not in the Z.C. In a recent letter, Alexander Osipov said that the star was actually Z.C. 840 = 107 B. (Aurigae). Bode assigned the star to Auriga, but after the I.A.U. later specified official constellation boundaries, the star ended up in Taurus. Osipov said that 825 occultations were timed at 17 Soviet observatories in 1986.

ASTRONOMY AND PERSONAL COMPUTERS

Joan Bixby Dunham

Projects Updates: Now that we have had some experience with the PC projects, as well as comments and discussions on them at the Universe '87 meeting, we have reorganized the projects list to be more useful. Some of the projects are removed as completed, others because we do not think they are going to be very productive or useful. Let me know if you are interested in doing some of the following projects, or if you think you have done some work that applies to some of them. Also, we would like to hear about other projects that IOTA members think would be useful.

1. Write a program to use when entering, editing, or correcting occultation observations data to go to the ILOC. See David's article (p. 92) in this issue for the format. Data can be entered in the ILOC format with a simple editor, but it would be better to have software to check entries for obvious errors and to help in editing or correcting the entries. Peter Manly has written software earlier, before the format was defined, and perhaps that could be modi-



Robert Bolster prepared this reduction profile of the graze of Z.C. 885 on 1986 August 29 using his Apple II computer and observer track data computed with the OCC program at USNO. Central graze for the four expeditions are indicated with vertical lines under "HOLLYWOOD" in the heading:

No.	Place	Expedition leader(s)
1	Hollywood, MD	D. Dunham and R. Taibi
2	Plymouth, MA	J. Maltsberger
3	Narragansett, RI	P. Dombrowski
4	Reidsville, NC	M. Lang

The curve is the Moon's mean limb, and x's are points from Watts' limb correction charts. Unfortunately, Bolster's platter draws the paths too quickly, so that parts of them are invisible or very light. Paths for the Maryland observers are horizontal, with observer names on the left. Scheidker called out "R" for what was actually a flash, causing the discordant line near the center of the plot. Slanting lines show paths for other expedition observers, who are named on the right. The names for P. Dombrowski and L. Robinson are printed on top of each other. Dombrowski, whose path has the smallest slope of the two, timed 22 events. For the observers outside of Maryland, the path slopes, caused by differences in position angle of central graze, are large due to the factor of 31 exaggeration of vertical distances over horizontal distances. The shift given at the bottom does not include the empirical correction applied to northern-limit profiles by the ACLPPP prediction program. Using the current December 1986 version of ACLPPP, the effective shift was -0".19.

fied.

2. Search occultation reports for double star data, report the observations, and put the information into a machine-readable format for inclusion in the graze predictions. Don Stockbauer is defining the format.

3. Bob Bolster wrote a program for the Apple II to create reduction profiles of grazing occultations based on the observations and on the occultation prediction data available for PCs. Now what is needed are options to format the USNO OCC output for the Apple and to add the ability to retrieve data from the new format for electronic reporting of grazing occultation observations. Also, it would be nice to have this software converted to work on other computers.

4. Write software to help in planning observations, given a particular observing site's location and limitations. The software would have a "mask" it would apply to the sky that describes the viewing blockages from buildings, trees, etc. It could scan the prediction data and tell observers which events might not be possible from the observing location, and might include times of Sun and Moon rise/set, with an option to enter coordinates of any object and compute its rise/set/culmination. It could be combined with the precise predictions software described later.

5. Write a PC program to compute total occultation predictions for local regions to use the regular iterative method for determining occultation times. This could be done by converting a part of the Evans program used to compute the USNO total predictions to run on a PC. Part of the project would be to determine a means of reducing the size of the input data set needed so that the data will fit conveniently on a few floppies. There is a BASIC program to compute totals from a and b factors, similar to the FORTRAN program Walter Morgan uses to answer requests for standard coverage predictions. David Herald has written a program with the more accurate occultation computations for the Commodore C64/C128, but he needs the star catalog data on a floppy before he can use it. A commercial program, PC Almanac, also does computations of occultations this way, but also has a very limited amount (about 30 stars) of catalog data.

6. Write software to help in leading grazes. One project in particular would be to investigate the use of PC mice in measuring the coordinates of observers. Are they accurate enough? Are they practical? Graze leaders might have more ideas for software.

7. Larry Dunn has written a graze and asteroid occultation simulator for the Macintosh, which he demonstrated at Universe '87. He generates graze events next to a gibbous Moon with a random fence of obstructions, trying to generate a view similar to what is seen through a telescope. He included options to simulate atmospheric turbulence or not, and to show the obstructions or not. Larry's address is given at the end, for those Mac owners who would like a copy. (Send him a disk and an addressed and stamped mailer.)

Data reduction of the Pallas asteroid occultation seems to show that there is a difference in reaction times between asteroid and lunar occultation events. A simulator is one way to see whether there really is a difference, and what it is. A project would be to use Larry's simulator, or write one for other machines, and collect the difference in reaction times for simulated grazes, as compared to simulated asteroid occultations, from many different people. The simulators also are useful for showing inexperienced observers what to expect.

8. Convert ALPO president John Westfall's Moon plots from an Apple II+ to a PC XT. These are used by Westfall to plot daily charts of the Moon for ALPO, outlining the maria and major craters, and showing the terminator. The project is to see whether this would be useful for portraying important occultations, especially reappearances.

Project Status: The following is a summary of what was done for some of the projects we had listed in the past.

Don Oliver has converted the GRAZE, ACLPPP, and MEEUSMAP programs to PCs, and is in charge of distributing them. Several computors are now using PCs to do the graze predictions.

Bob Bolster, as mentioned earlier, has written software for an Apple II to do reduction profiles of the grazes.

Don Oliver and Pat Trueblood each worked on arranging David's graze computor papers into a graze computor manual. I am now in the process of combining what they did and updating it, and have a preliminary user's guide for the GRAZE program, but not ACLPPP or MEEUSMAP. Pat also entered David's list of local occultation observers into a PC-File+ database, to give us some practical experience in using that DBMS.

For double stars, Walter Nissen is deriving a method for determining separation, position angle, and their rates of change from speckle interferometry data on stars for which orbital elements are not known. Don Stockbauer is standardizing the formats used for storing double information and writing a program to read the data files and automatically insert the double star information into the graze input data sets.

On the project to create a data base of observatory information: Several volunteered to do data entry of the observatory information, and have ideas on how to do the data storage and retrieval. However, first we must have data on the observatories, and we do not have a good plan for getting that yet.

Software: The software available from me is listed below. For each, send the number of diskettes indicated and a self-addressed mailer with sufficient postage for the mailer and diskettes, approximately 22¢ for the mailer and 17¢ for each diskette in the U.S. These are MS-DOS 5¼ DSDD diskettes.

1. Generate total occultation predictions, written in GWBASIC (2 diskettes)

2. Computerized ILOC forms, in Microsoft Basic under CP/M, provided to us as text files on an MS-DOS diskette. (Peter Manly's software, discussed in

project #1, 1 diskette)

3. Six diskettes of public domain or shareware astronomy software.

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Larry Dunn; 34625 Seavey Loop Road; Eugene, OR 97405

Don Oliver; 13173 Clarewood; Houston, TX 77072

HUBBLE SPACE TELESCOPE AMATEUR PROPOSAL DEADLINE EXTENDED TO NEXT SHUTTLE LAUNCH

David W. Dunham

At the Universe '87 convention in California, Steven Edberg met with other members of the Amateur Astronomers Working Group (A.A.W.G.) for H.S.T. proposals. With the current launch delays, the original June 30th deadline was considered unrealistic. In order to avoid the need to change the deadline again in case of further delays, the deadline for receipt of the preliminary proposals has now been set as the date of the next American Space Shuttle launch. But as a reward to those who met the June 30th deadline, all of those proposers will be accepted for the second round of more detailed proposals. The A.A.W.G. plans to have the second-round proposal forms ready for distribution by the end of the year. Also, foreign amateurs can be co-investigators, but not principal investigators, for the H.S.T. This is partly to save costs, since the Space Telescope Science Institute will pay travel expenses for the principal investigator to be present when his or her observations are made. Another decision, which I objected to but was overridden, was the definition of professional astronomers, who are excluded from the amateur proposals, even as co-investigators. A person is considered a professional astronomer if, at the time he submits his proposal, he either earns a majority of his income from an astronomical profession, or if he has an advanced degree (either Masters or Ph.D.) in astronomy. I objected to the degree part because some advanced degree holders do not earn their incomes as astronomers, and consequently, unlike professionally employed astronomers, they usually can not use the resources of the institutions where they work to submit professional (General Observer) H.S.T. proposals. As of late July, Paul Maley informs me that IOTA has received five occultation-related proposals for H.S.T. amateur observations.

JOHANNES MICHAEL ANTONIUS POLMAN (1927-1986)

Luiz Augusto L. da Silva

On June 2, 1986, Prof. Johannes M. A. Polman, known as Jorge Polman, living at Recife, Brazil, passed away at age 59.

Polman was an IOTA member, chairman of the Asteroidal Occultations Section of the Iberian-American League for Astronomy (an intercontinental society founded in 1982), and a former coordinator of the Occultation Commission of the Brazilian Union of Astronomy, as well as an ex-president of this same society.

In 1981, he was elected the IUAA adviser for Latin America, and performed this function up to the time of his death.

Under his auspices, regional meetings were organized, and he stimulated astronomical clubs and societies. He also proposed several observational projects involving occultations visible from Brazil.

In 1972, Polman founded the "Clube Estudantil de Astronomia," at Recife, which is one of the best-equipped amateur societies in Brazil. It is still active, with introductory courses, practical work and publications.

Polman was born in Amsterdam, on January 7, 1927, and took root in Brazil during 1952. Here, he was clergyman and professor. His fascination for astronomy, particularly for observing, his talent for small inventions, and his mastery captivated everyone who knew him. He was dynamic, indefatigable, jovial, and possessed by a notable sense of good humor. At the same time, he was simple and sympathetic. His death opened an enormous void, very difficult to fill.

THE 1983 NORTH AMERICAN DATUM

David W. Dunham

Articles in several North American newspapers during the past month have told how several landmarks have "moved" 50 meters or more as the result of a new survey using modern techniques. These changes are large enough to be of interest to occultation observers. Most North American maps use the 1927 North American datum for their survey reference. The comprehensive new survey was undertaken to define the improved 1983 North American datum. Recent maps published by the U. S. Geological Survey have tickmarks in the corners showing the offsets between the two datums, and list the numerical values.

We do not yet have the corrections needed to convert 1983 North American datum coordinates to the I.A.U. ellipsoid world geodetic system used for analysis of occultation observations, but we will soon try to get this information. About ten years ago, results of preliminary work for the 1983 datum allowed new corrections to be determined for different parts of the 1927 datum to permit more accurate calculation of the I.A.U. ellipsoid coordinates from 1927 datum coordinates. These were incorporated into the OCC program geodetic database at USNO by Van Flandern. These corrections are nearly equivalent to the shift to the 1983 datum, which will give relatively small changes from them. So the lack of 1983 datum conversion factors should not be as serious a problem as the newspaper articles might imply for our work. We will try to convert everything to the 1983 datum when we get sufficient information to do so. Although unlikely, we may need some help in tracking down this information for specific areas, and will let you know if that is the case.

SOLAR ECLIPSE NEWS

David W. Dunham

1987 March 29, broken annular: This eclipse was total over parts of the Atlantic Ocean. The best land view was seen from Gabon, on the Atlantic coast of central Africa, where the eclipse was broken annular. The beads phenomena were even better than during the 1984 May 30 eclipse, since the Moon's apparent radius was about 1" larger relative to that of the Sun. Observers from the United States, France, Germany, and Japan gathered at Port Gentil to observe the eclipse from three locations in an effort coordinated by Paul Maley. Maley published an article about their efforts in the July issue of *Sky and Telescope*. Torrential rain dampened spirits the morning of the 29th, but the clouds thinned as the central eclipse approached. The thickness of the clouds changed rapidly during the central eclipse at Maley's and Hans Bode's sites, allowing video recordings of only brief glimpses of Baily's beads. IOTA/ES was given official notification of their group's status as a scientific organization about a week before the eclipse, so that the travel expenses of members from the German Federal Republic are deductible from the income that they report for tax purposes, just as is the case for the parent IOTA in the U.S.A. The Japanese team was fortunate to have the thinnest cloud cover at their site, but the battery powering their video equipment failed right at central eclipse! Fortunately, they got complete photographic records of Baily's beads, both with an 8-mm movie camera and a 35-mm camera with automatic winder taking pictures at half-second intervals. Reiko Morufushi showed me their records while I was in Tokyo on May 11th. They have just begun the analysis of their material, with help from ILOC.

Plans for expeditions to time Baily's beads near the edges of future eclipse paths are mostly preliminary and are briefly described below:

1987 September 23, annular: Paul Maley and Hanssen Tours travel agency have worked with astronomers at Purple Mountain Observatory and Beijing Observatory to set up an expedition to observe this eclipse from China. The planned tour will leave San Francisco on Sept. 18 and return on Oct. 4. Several IOTA members plan to be in the tour, including me. While in China, the tour will visit Beijing, Shanghai, Xian, and Guilin, as well as sites at both limits in two separate groups in and south of Taiyuan on eclipse day. Hans Bode has made plans to observe the eclipse from the southern limit in the south-central U.S.S.R., which is much less expensive for Europeans to travel to than China.

1988 March 18, total: The only land crossed by the edges of this path are in Sumatra, Borneo, and the southern Philippines, as shown on maps that have been published now in both *Sky and Telescope* and *Astronomy*. Maley is planning to go to the latter location, if the limit areas are reasonably safe by eclipse time. The Hanssen Tours expedition will depart Los Angeles on March 12th and return on the 25th, with cost $2680, double occupancy. Observations will be made from, and north of, General Santos on Mindanao. Those interested should contact Paul Maley; 15807 Brookvilla; Houston, TX 77059. Hans Bode is planning to observe from the east coast of Borneo, and David Herald and other Australians hope to observe from Banka Island near Sumatra. Unfortunately, Fiala's attempt, to obtain U.S. Naval support to get to the southern limit, where it crosses two rather inaccessible islands south of Mindanao, seems to have failed.

1990 July 22, total: Maley has contacted astronomers in Leningrad and in the Soviet Academy of Sciences to make preliminary arrangements to observe this eclipse from the northern U.S.S.R.

1991 July 11, total: Maley notes that the southern limit passes very close to Puerto Vallarta.

IOTA/ES NEWS

David W. Dunham

My plans to visit Europe, to attend a comet symposium in Brussels, Belgium, were briefly described on p. 58 of the last issue. After spending the first night at Hans-Joachim Bode's house in Hannover (where I gave him copies of IOTA graze and total occultation software on diskette for his IBM-compatible PC), we traveled to Kiel on April 5th, where we had a meeting of mostly German members of IOTA/ES. Kyril Fabrin and Leif Kristensen traveled from Denmark to attend the meeting. Hans gave a report of his expedition the previous week to Gabon, where he joined Paul Maley in efforts to videorecord the March 29th eclipse (see p. 111). Shortly before his trip, IOTA/ES was officially recognized by the government of the German Federal Republic as a scientific research organization. So like American members of IOTA, German members of IOTA/ES can now deduct the costs of their travels for eclipses and occultations from their income taxes. Hans also proposed an expedition to the vicinity of Alma Ata, U.S.S.R., to observe the annular eclipse of September 23rd near the southern limit, but few expressed any interest in such an effort; a total eclipse would be more popular. I discussed the status of IOTA's various projects. Fabrin discussed the arrangements for the sixth annual European Symposium on Occultation Projects (ESOP-VI), to be held in Aalborg, Denmark, at the end of August. This will probably reach readers too late to make new arrangements to attend, but anyone interested can get more information from Dr. Kyril W. Fabrin; Raadsherrevej 2, Hasseris; 9000 Aalborg, Denmark; telephone (08) 181513. I'm sure that a separate mailing about ESOP-VI was distributed to IOTA/ES members some time ago.

During one evening while I was in Belgium, a dinner/meeting was arranged at the Urania Observatory in Hove, a suburb of Antwerp. I met most of those attending the meeting for the first time, including Edwin Goffin, Roland Boninsegna, and Henk Bulder from the Netherlands. Also there were Eberhard Bredner from Germany (he met me in Brussels and drove me to the observatory) and Jean Meeus, whom I had last seen nearly 20 years ago. Goffin had just completed selection of his asteroidal occultation predictions for 1988, and was starting to print them. Jim Stamm received Goffin's package of 1988 events in May, and David Werner has already begun annotating the charts that we will publish in the North American asteroidal occultation supplement for 1988, which we probably will distribute with the next issue. I had lunch with Jean Meeus at the Brussels airport where he works, a few hours before my return flight. He demonstrated his lunar ephemeris program, which achieves an accuracy of 0".01 using a subset of Chapront's lunar theory ELP2000. From some 37,000 terms, Meeus combined several and eliminated the majority of terms with very small coefficients to produce his subset of nearly 6000 terms. He repeated his long-standing request for the XZ catalog, the updating of which I would have completed by now if I had travelled less this year!

In early June, I returned to Europe, to attend a spacecraft mission planning meeting at E.S.A.'s European Space Technology Centre (ESTEC) in Noordwijk, the Netherlands, on the 9th, and a symposium on problems in astrodynamics and celestial mechanics in Turin, Italy, the rest of the week. I first visited Hans Bode in Hannover again on the 7th. After a fine outdoor dinner, we got ready for an occultation of Spica. Hans set up his video camera on a 20-cm Schmidt-Cass. while Wolfgang Beisker attached his photoelectric photometer to a 25-cm Newtonian reflector. Hans had an 8-cm refractor, to which we were able to attach my RCA Ultricon camera. A large cloud bank in the west threatened us for two hours before the occultation, but it moved towards us only very slowly, with the wind blowing some low clouds from the south. The partly cloudy sky provided drama, but we were lucky; the Moon was in the clear when Spica disappeared, and all of our equipment worked, making it perhaps the best-recorded occultation by IOTA/ES. Unfortunately, everyone else that I met during the rest of my trip was clouded out that night.

This was the last of my six business trips during the first half of 1987. It was two weeks before the International Astronomical Union Colloquium No. 98, "The Contribution of Amateur Astronomers to Astronomy," in Paris. My frequent travelling had put me far behind with many projects, so I decided not to go to Paris for the colloquium. But I was already scheduled to give papers there. Since I knew that Hans Bode planned to be at the Paris meeting, I gave him material for my two presentations while I was in Hannover, so that he could read my papers.

On the 8th (Whit Monday), I travelled to Leiden, the Netherlands, where I was met by Henk Bulder. Before dinner at his home, he showed me his 25-cm reflector, with which he timed 268 occultations during one year, in spite of Holland's bad weather (only about 50 clear nights a year). We then went to Leiden Observatory, where we held a meeting on occultations attended by about 50 people. I showed some of my videotapes, including the Spica occultation recorded the night before. Henk discussed plans for future grazes, and described observations of two grazes on consecutive nights early in May. One was the May 8th graze of Sigma Leonis, also observed in Germany (see p. 104). But in Holland, the event occurred exactly at sunset. Even so, observers had little problem seeing the star, and one even videorecorded the graze, the first in Europe, as far as I know. But due to the bright background, contrast was poor, so the graze events are hard to see on the video.

My flight to Italy landed in Milan, where I was met by Marco Cavagna, holding a sign that read in part, "(3123) Dunham now flying-by Milan." He and a friend drove me to the train station, where we had time for a sandwich before my train left for Turin. In Turin, I met IOTA/ES member Francesco Cerchio, who was also at the celestial mechanics symposium. He is the director of the Occultation Section of the Italian Union of Amateur Astronomers. Francesco Cerchio and workers at the Turin Polytechnic Institute, which sponsored the symposium, did a great job in making my visit to Turin very enjoyable. Both Cavagna and Cerchio planned to be in Paris, where they could see my graze videotape shown by Bode.

Paul Maley and Charles Herold represented IOTA's interests at the colloquium in Paris on June 20 to 24. Paul gave a talk on videorecording eclipses, and Hans Bode discussed his trip to Gabon for the March 29th eclipse. He also gave my talk on videorecording grazes (I had given him a 7-minute tape of 4 of the best events), while Wolfgang Beisker gave my presentation about the 1983 occultation of 1 Vulpeculae by Pallas. Many occultation observers throughout western Europe, as well as Prof. Tomita from Japan, were at the colloquium, and I am sorry that I couldn't attend it myself. It provided an opportunity for members of IOTA, IOTA/ES, and GEOS to get together to discuss some mutual problems, and consider ways for increasing future coordination. The possibility of holding a future intercontinental meeting of occultation observers was discussed (see p. 92).

ASTEROIDAL, COMETARY, AND JOVIAN OCCULTATIONS DURING 1987

David W. Dunham

This is a continuation of the article started in *O.N. 4* (3), 41 and continued on p. 66 of the last issue. David Werner prepared all of the finder charts in this issue, usually annotating charts 1° and 3° on a side that I generated with a computer. I made a modified version of the A.C. 1° chart program to produce similar charts from combined catalog data. Werner and I hope to prepare all or most of the 1988 finder charts for North America early enough so that they can be distributed, along with some of Sôma's world maps, with the North American asteroidal occultation supplement (based mainly on Edwin Goffin's material) for 1988.

A list of priority asteroidal occultations, identified by Robert Millis (Lowell Obs.) and Roland Boninsegna (GEOS), was published in *O.N. 4* (3), p. 49. I propose that some other events, listed in the last issue, also deserve at least preliminary astrometry, and should be added to the priority list. These additional events are listed below:

Date	Asteroid	Star	Notes
Aug 30	247 Eukrate	SAO 213992	Dec. −31°
Nov 13	313 Chaldea	BD +4° 1281	
Nov 14	7 Iris	L 5 3047	$\Delta m = 0.3$
Nov 25	2060 Chiron	Anonymous	
Nov 27	336 Lacadiera	BD +18° 527	
Dec 11	160 Una	SAO 77137	
Dec 16	250 Bettina	SAO 61705	

Observers are encouraged to monitor all of the priority events that are observable at their locations with predicted miss distances of 3" or less, even if no astrometry is obtained to improve the predictions. This is not just to check for secondary occultations. Uncorrected predictions can have large errors, and even if you are very close to a path improved with astrometry, we might not be able to notify you in time. Usually, last-minute results are obtained less than a week in advance. The only practical way to notify a large number of observers is by mail, and those in outlying areas have a good chance of receiving the mailed notices after the event. When we get a good astrometric update for an event in the U.S.A., I try to telephone as many observers as possible, but this is time-consuming and expensive, so that often only a few regional coordinators can be contacted this way. Besides the priority events, you are also encouraged to monitor other observable appulses with predicted closest-approach distances less than 1", since there is then a reasonable chance for an occultation; those with distances less than 2" also have some chance and also should be considered.

On p. 69 of the last issue, the angular diameter of Jupter is incorrectly given as 24".53. The correct diameter is twice that value. The values for the diameter in km, and the predicted central duration on the previous page, are correct.

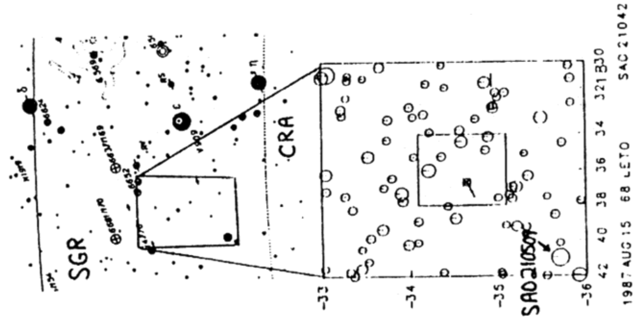
None of the occultations by Comet Wilson (1986l), listed on pages 66 and 67 of the last issue, were visible from the Earth's surface. I kept in contact with Brian Marsden and Daniel Green at the Smithsonian Astrophysical Observatory in Cambridge, MA, to keep track of the latest astrometric observations and new orbit determinations of both Comet Wilson and Comet 1987c. As of mid-April, they still had no new observations of Comet 1987c, or of Comet Wilson since its conjunction with the Sun, so I telephoned David Herald to ask for Australian help to get critically needed positions of these southern comets. By late April, observations of both comets had been reported to Cambridge by David Herald and by astrometrists in Chile, allowing Marsden to update the orbits, which I then used to compute new occultation predictions. The orbit of Comet Wilson differed by over 20" in the cross-track direction from the one that I used for the predictions in the last issue, and that for Comet 1987c changed by a large fraction of a degree from the first orbit that I had used for that comet for predictions computed in March. Around May 1st, I sent the updated predictions for urgent events to regional coordinators, most of them in the Southern Hemisphere. In early May, I was in Tokyo on business, and took the opportunity to deliver a magnetic tape with the new occultation data to Mitsuru Sôma, who generated world maps for the events. In mid-May, I sent copies of the maps and predictions for events, primarily in late May and June, to regional coordinators in the appropriate areas. Around May 20th, new orbits for both comets were issued by Marsden, and I updated the predictions again. Again, the new orbits showed that the previously distributed occultations either were not visible at all from the Earth, or took place far from the regions to which I had sent predictions. I distributed a last round of predictions for the few remaining events to regional coordinators in late May. Two of the events were potentially visible from the U.S.A. and Europe, one perhaps from Florida and one possibly from southern Europe, but the chances were not large.

This activity was partly the result of a request to Don Yeomans of the International Halley Watch for predictions of occultations and appulses by Comet Wilson to early type stars by Prof. Nye Evans at the University of Keele in England. He wanted to observe some of the better appulses with the IUE satellite, and coordinate the observations with ground-based observations of the same events. Don sent the request to Lowell Observatory, where Ted Bowell apologized that his software could not handle hyperbolic orbital elements input, and asked if I could help. I did, but since Prof. Evans was interested in appulses as well as occultations, including from a satellite which is usually several Earth radii distant, I needed to modify my occultation search program to generate a list of geocentric appulse data for all events where the minimum separation was less than two arc minutes as seen from the Earth's center.

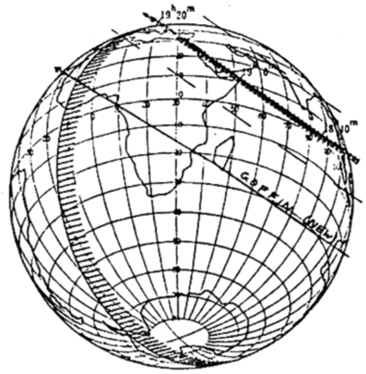
I have not heard whether any of Prof. Evans' planned IUE observations were successful, but he did write thanking me for the predictions. The changes in the computed orbits described above show the great difficulties in trying to predict occultations by new comets, especially to the accuracies needed to see dimming by dust near the nucleus.

The numerous trips that I have made this year, and other pressing obligations, delayed resumption of my work on the 1983 May 29th Pallas occultation. I began working on it again only recently, but hope to have a manuscript ready for formal publication well before the end of 1987. I also hope to complete analyses of other asteroidal occultations reported to IOTA, especially the 1983 Nemausa event, before the Asteroids II meeting that will be held in Tucson, AZ, next March.

Graham Blow sent me a copy of the 7-page Newsletter No. 3 of the Australasian Asteroidal Astrometric Group, working under the auspices of I.A.U. Commission 20's Working Group on Occultations. The newsletter, dated June 26th, "updates asteroidal event results during the first half of 1987." The newsletter documents vigorous activity by astrometrists and observers in New Zealand and Australia, discussing in detail astrometry obtained by the Black Birch, Perth, and Lowell observatories for five appulses, one (511 Davida on March 16th) that resulted in the first videorecording of an asteroidal occultation from Carter Observatory in Wellington, and another (Hermione on March 26th) that may have produced a long dimming (like the "cloud" of particles around Pallas proposed by Russian astronomers, see *O.N. 3* (8), p. 167). Coordinator Graham Blow closes with a sad note: "I think we are all aware that Perth (Observatory) is currently facing closure. Perth has been a highly active contributor to the network, and it would be a great loss if their input was removed. Carter Observatory's future is also under threat, the observatory having effectively run out of money and now being subject to a funding and organisational review." It will indeed be unfortunate if any more Southern-Hemisphere observatories engaged in astrometric observations follow the closures of the Republic and Sydney observatories. Perhaps considering this situation, and the difficulty of asteroidal occultation astrometry in general, the group should add "Research" between "Astrometric" and "Group" to provide an appropriate acronym!

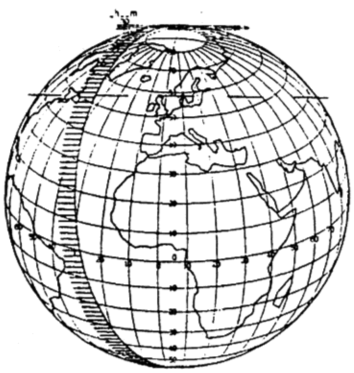


L 1 90 by Ophelia 1987 Aug 14



SAO 210421 by Leto 1987 Aug 15

SAO 78085 by Ophelia 1987 Aug 18



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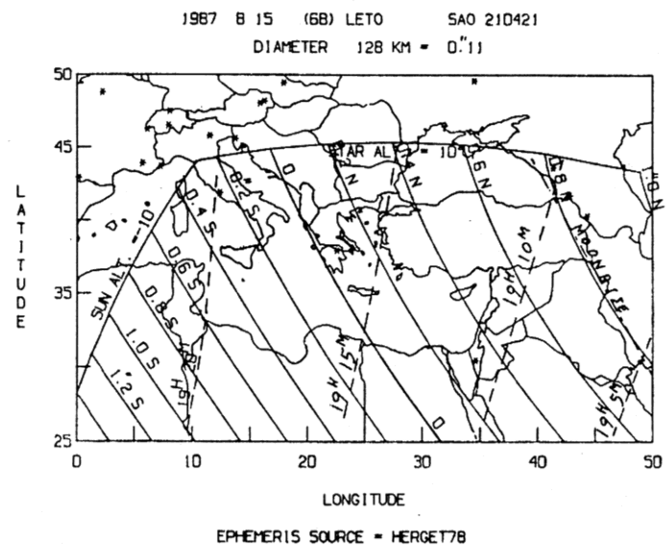
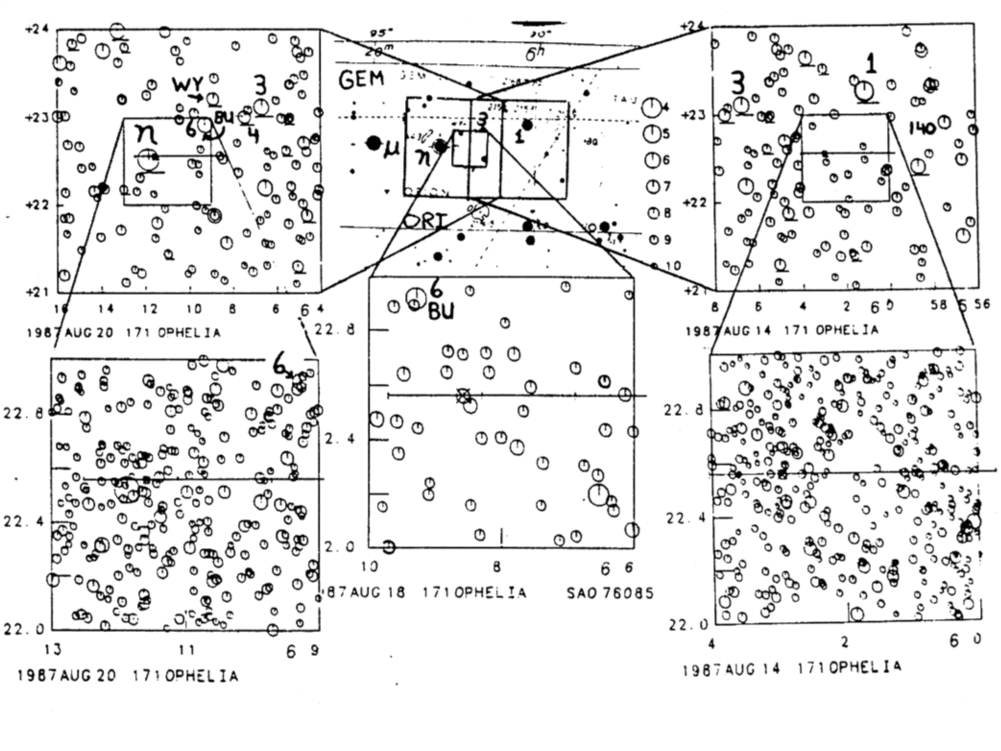
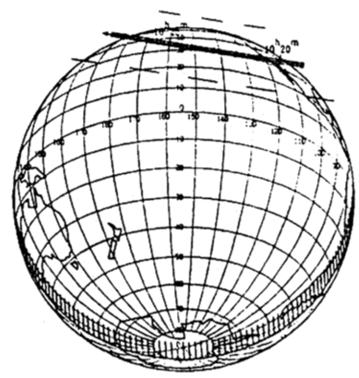




Anonymous by Egeria 1987 Aug 18

L 5 2539 by Pales 1987 Aug 18

Anonymous by Egeria 1987 Aug 19



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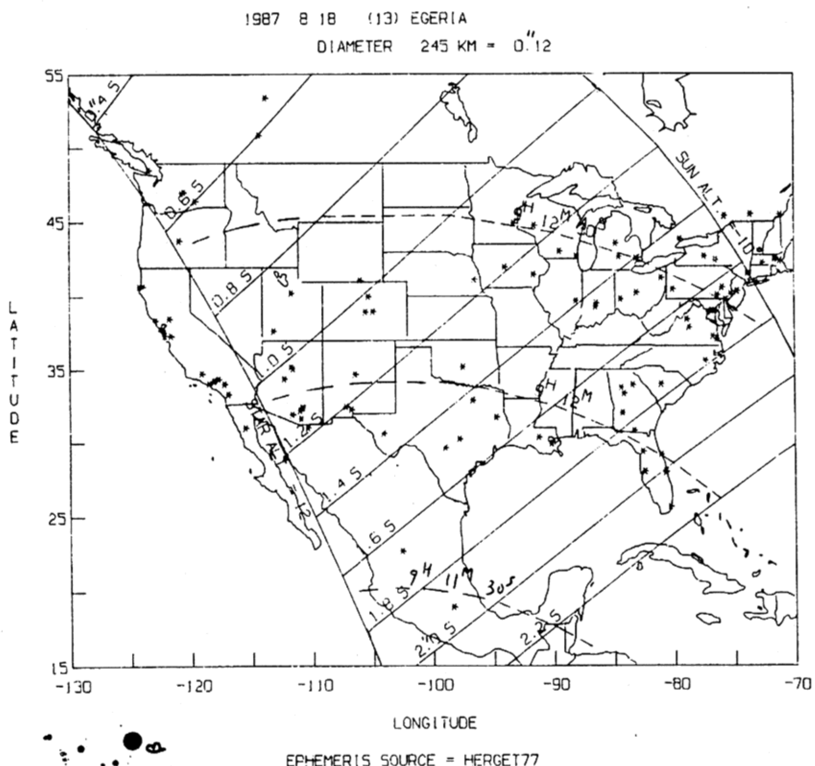
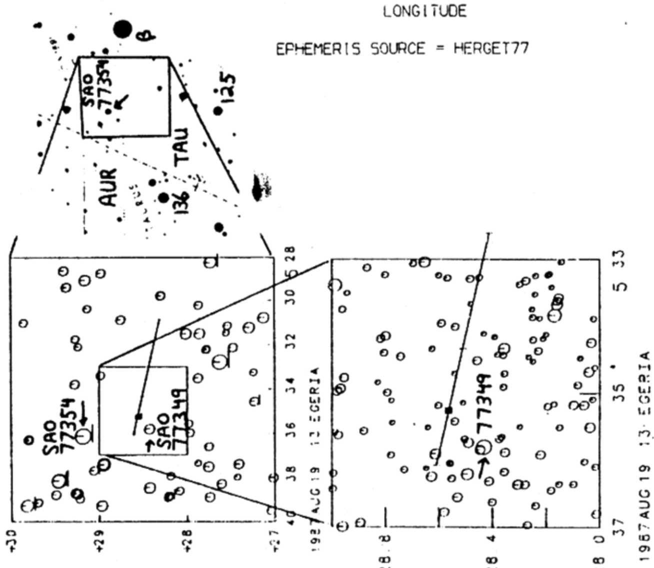
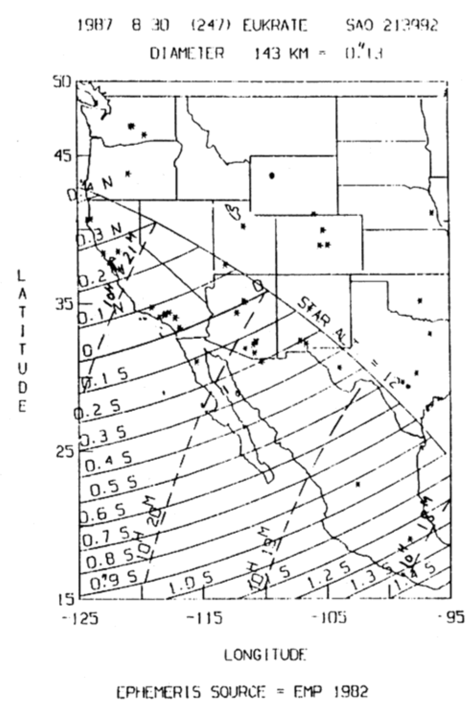




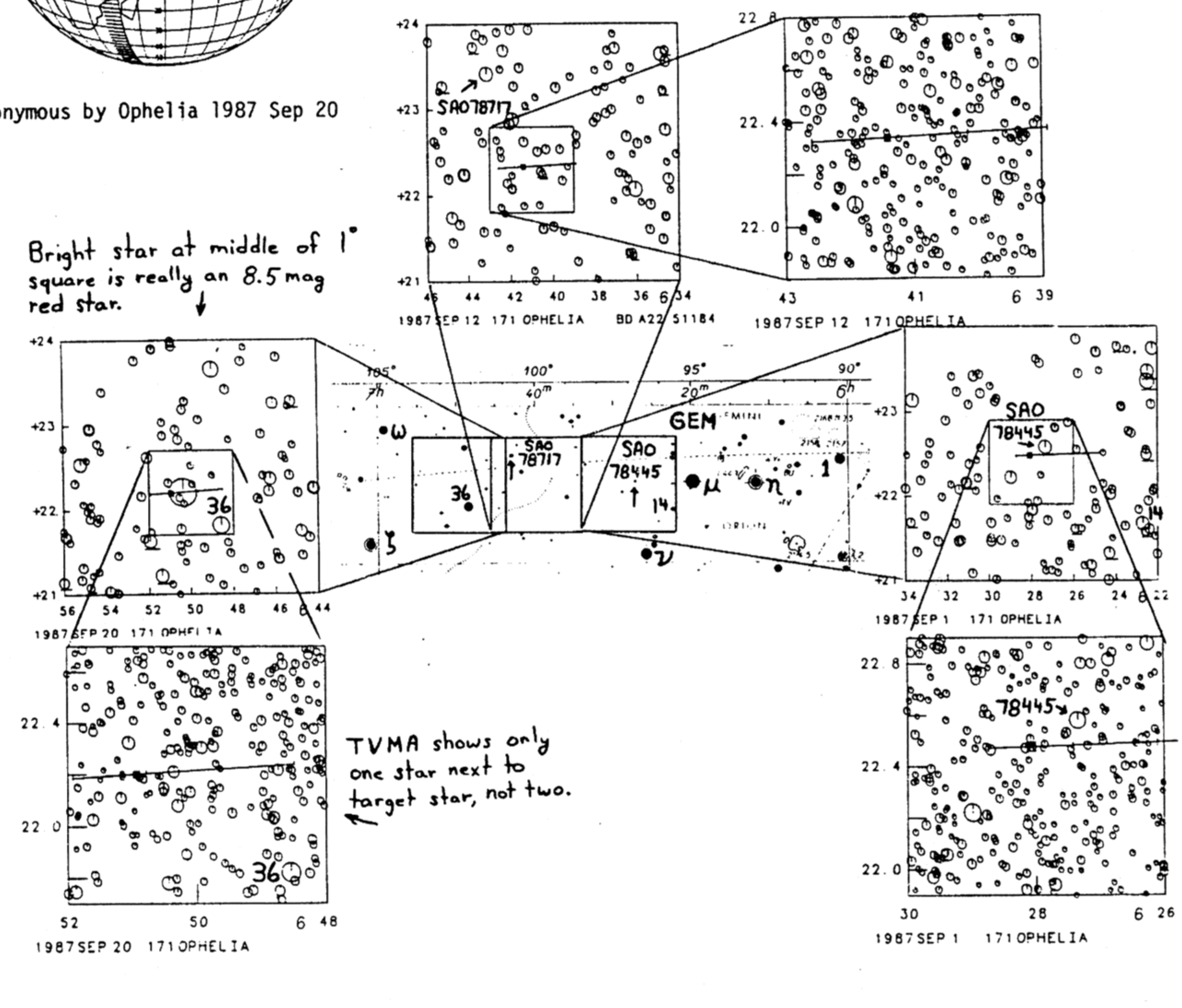


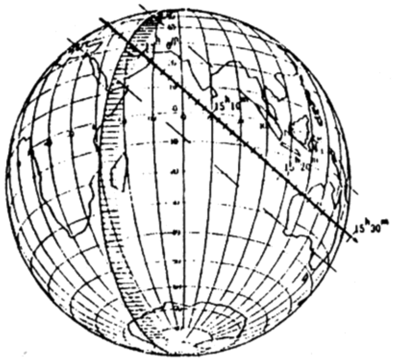
-1° 488 by Roma 1987 Aug 24

Anonymous by Ophelia 1987 Sep 1

A2251184 by Ophelia 1987 Sep 12

Anonymous by Ophelia 1987 Sep 20

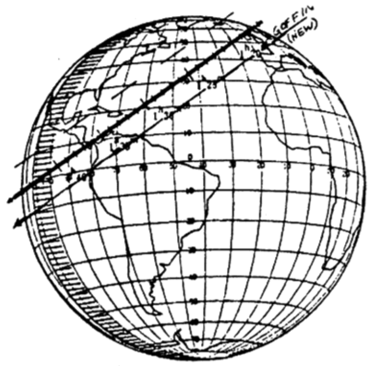




C2313912 by Christine 1987 Aug 27

SAO 190239 by Flora 1987 Aug 31

SAO 128330 by Adria 1987 Sep 1



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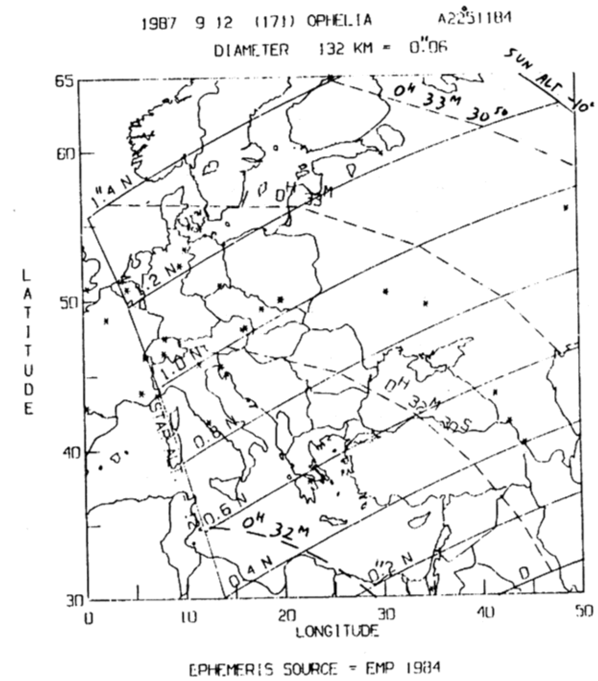

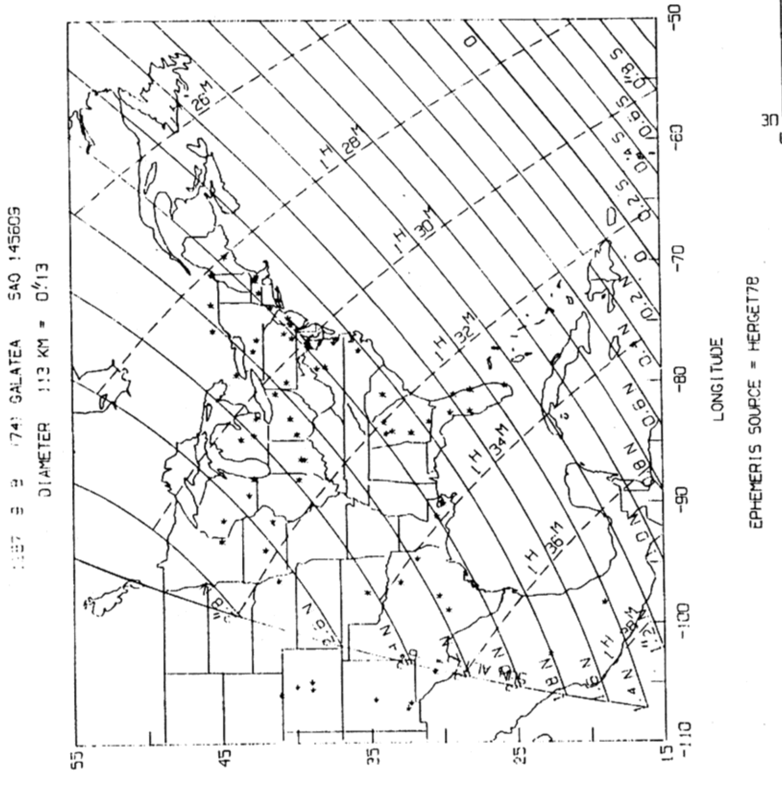

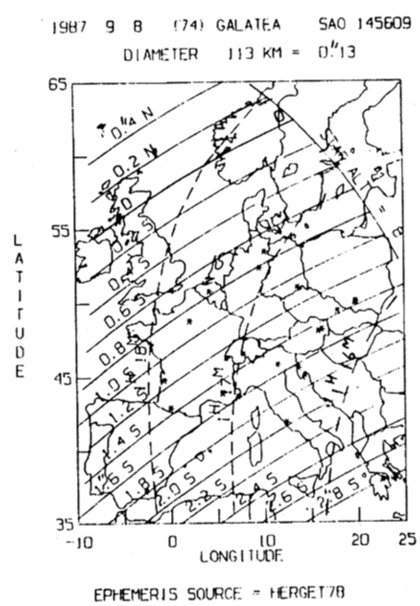

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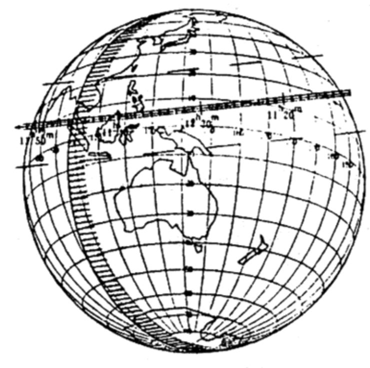
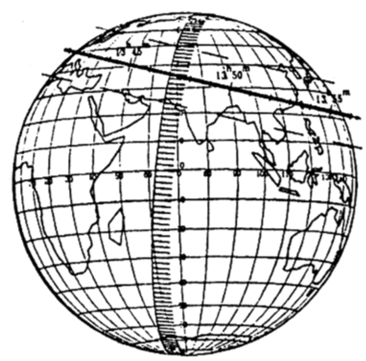
L 2 3555 by Davida 1987 Sep 3



L 5 1969 by Pales 1987 Sep 3

SAO 128306 by Adria 1987 Sep 3



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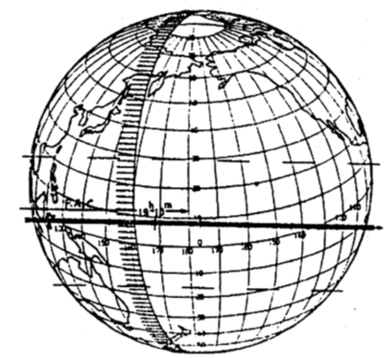

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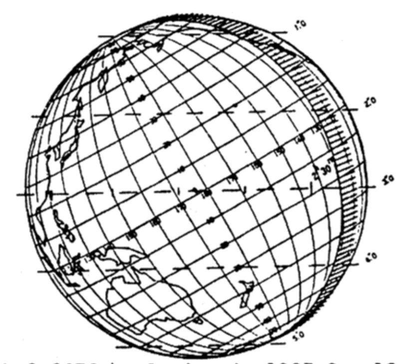

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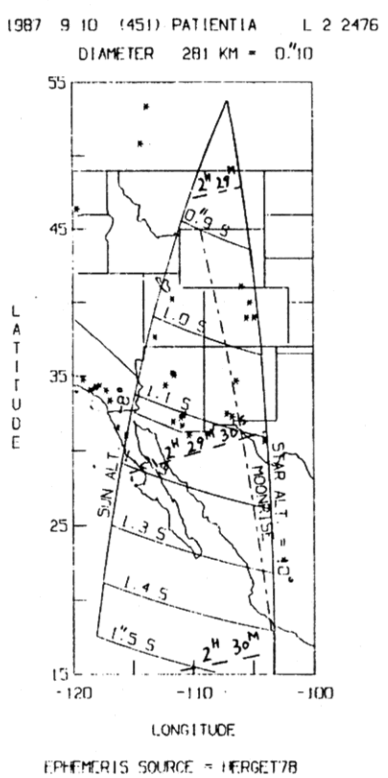
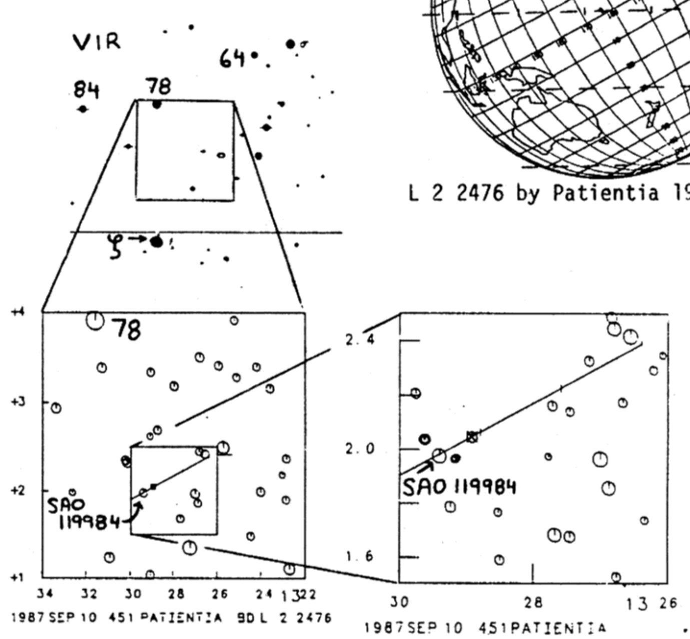
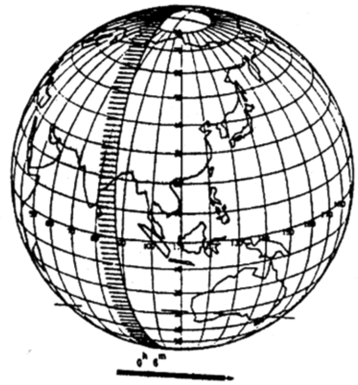
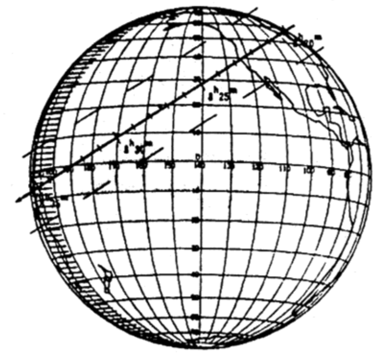




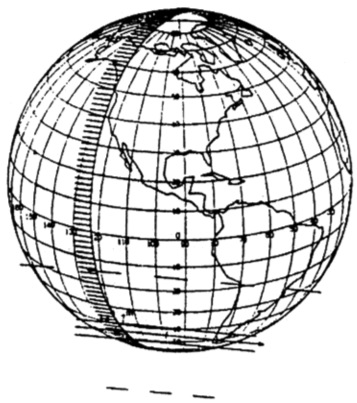


A2250234 by Ophelia 1987 Sep 10

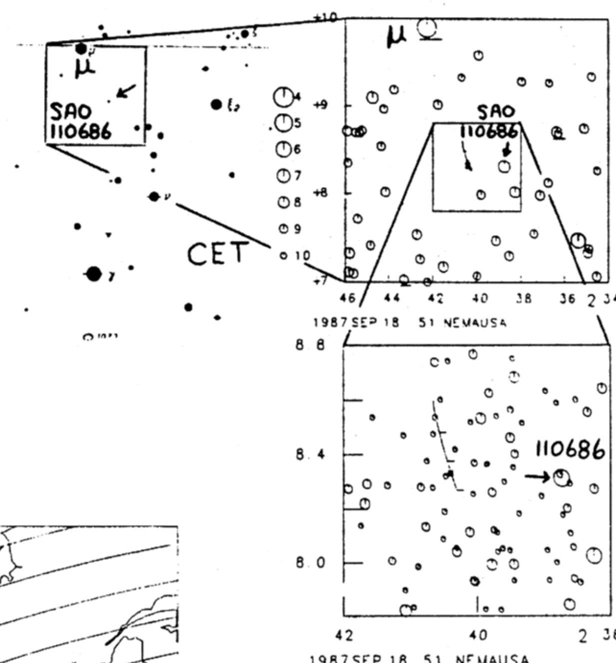
SAO 129951 by Antigone 1987 Sep 11

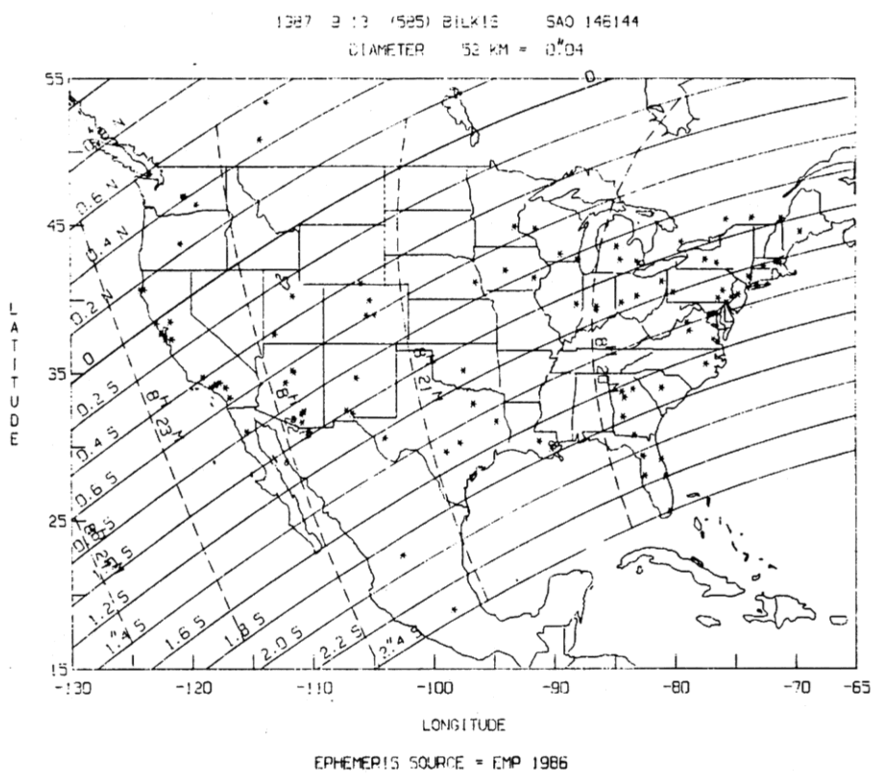


SAO 146144 by Bilkis 1987 Sep 13



A2156386 by Vesta 1987 Sep 13

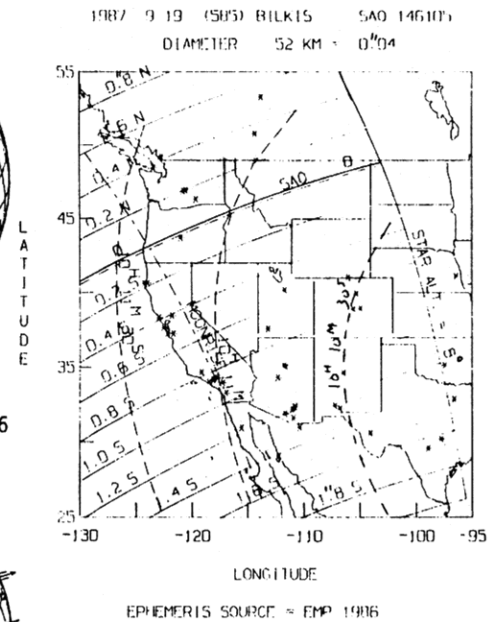




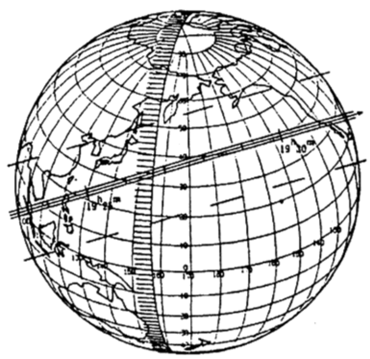
Anonymous by Nemausa 1987 Sep 18

SAO 128919 by Athor 1987 Sep 14

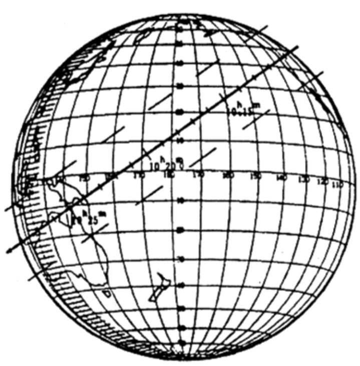
Anonymous by Egeria 1987 Sep 16



SAO 159661 by Eugenia 1987 Sep 16



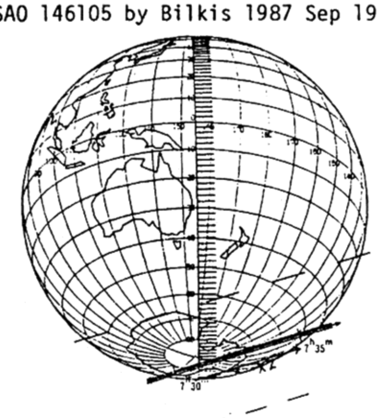
Anonymous by Egeria 1987 Sep 16



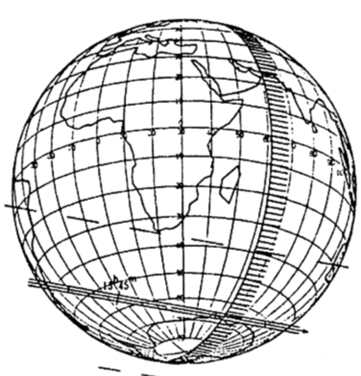
SAO 146105 by Bilkis 1987 Sep 19

SAO 94325 by Turandot 1987 Sep 19

Anonymous by Egeria 1987 Sep 20

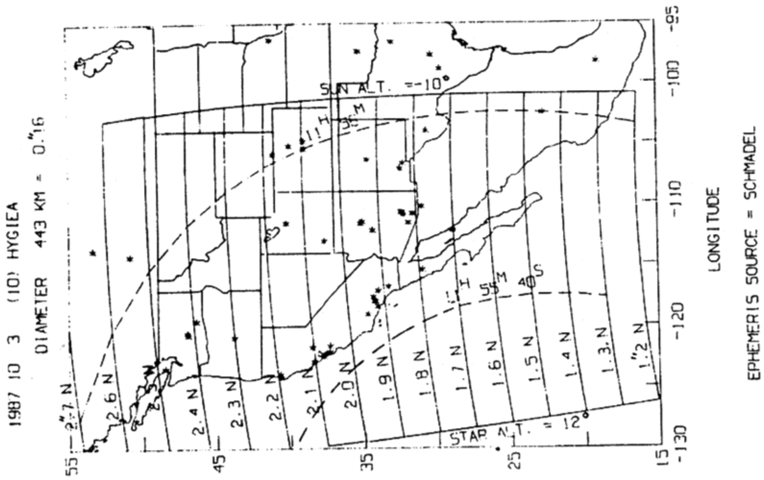


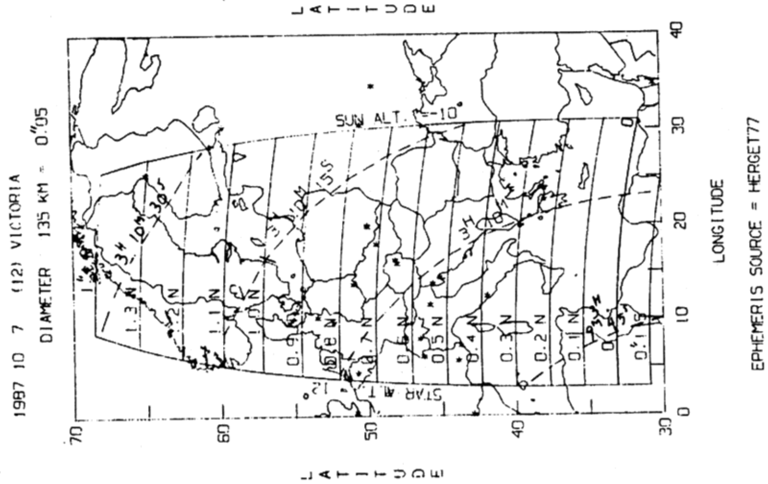
C2914681 by Diana 1987 Sep 27

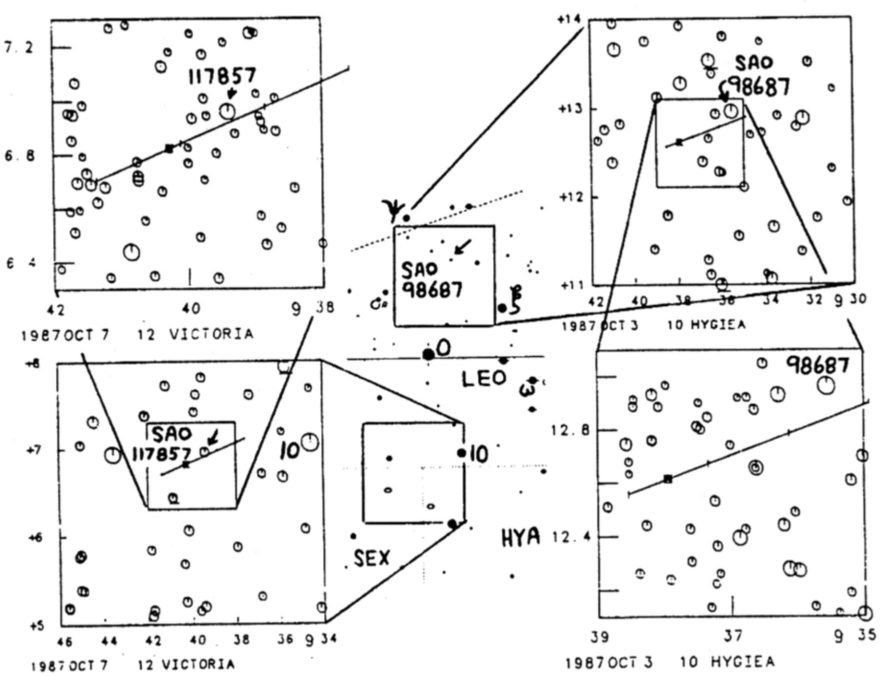


SAO 184207 by Themis 1987 Sep 27

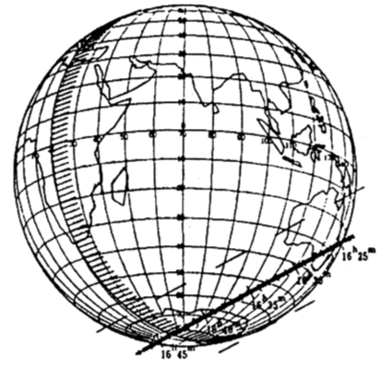
Anonymous by Vesta 1987 Sep 27







Photographic star atlas
Shows two stars at target
star location



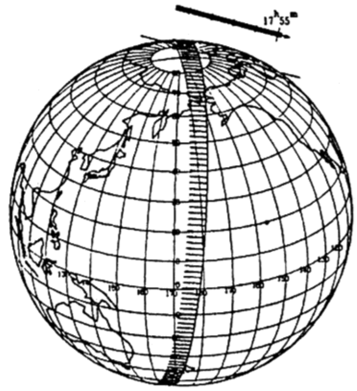
SAO 164633 by Kalypso 1987 Sep 28

SAO 140372 by Asporina 1987 Oct 2

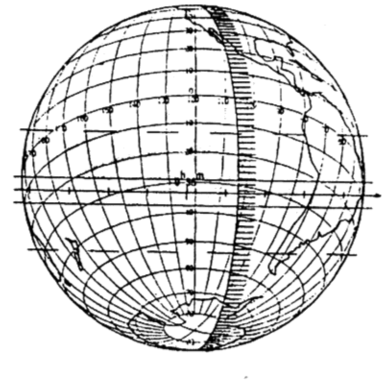
Anonymous by Hygiea 1987 Oct 3

Anonymous by Victoria 1987 Oct 7

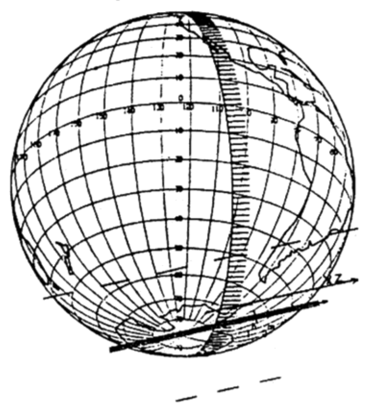
SAO 76842 by Massalia 1987 Oct 8



SAO 78477 by Ludmilla 1987 Oct 9



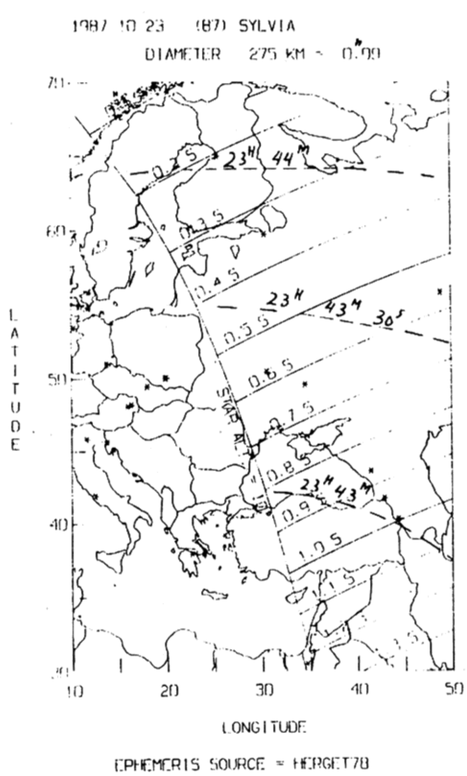
C2814103 by Ceres 1987 Oct 10

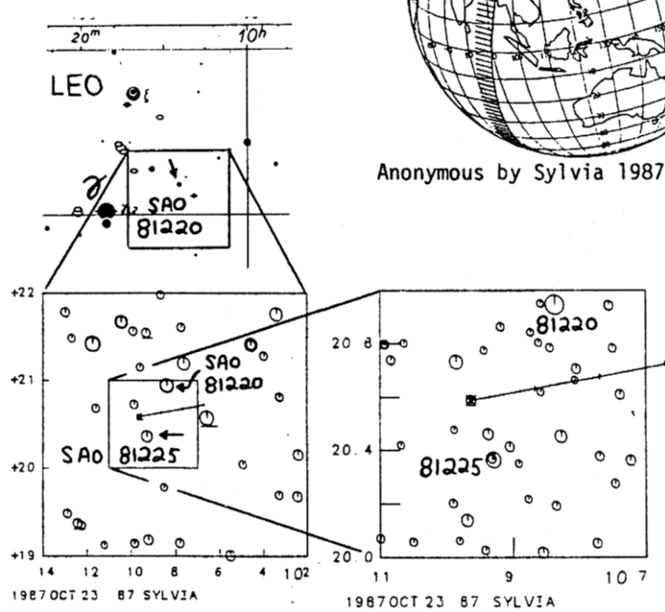


SAO 186957 by Diana 1987 Oct 18

SAO 130628 by Roma 1987 Oct 19

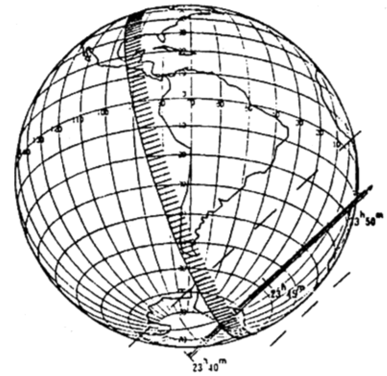
SAO 109969 by Jupiter 1987 Oct 20



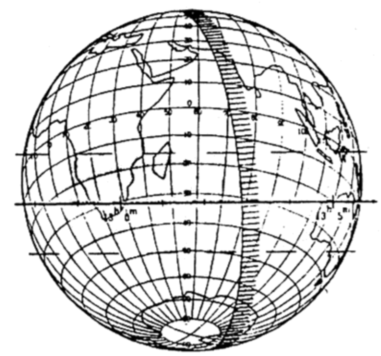


Anonymous by Sylvia 1987 Oct 23

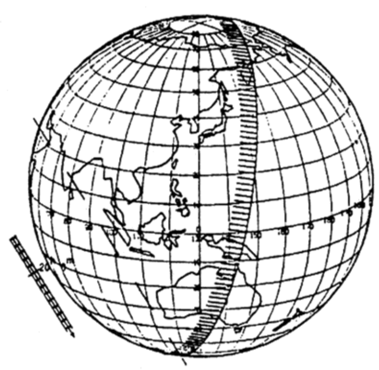
Anonymous by Victoria 1987 Oct 21



SAO 189898 by Lamberta 1987 Oct 21

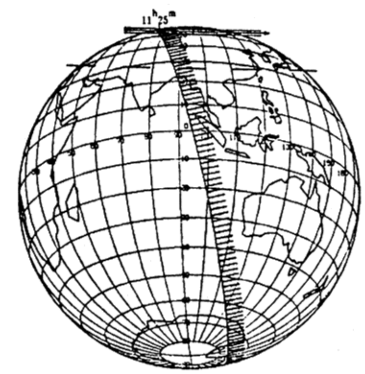


B2565374 by Christine 1987 Oct 25

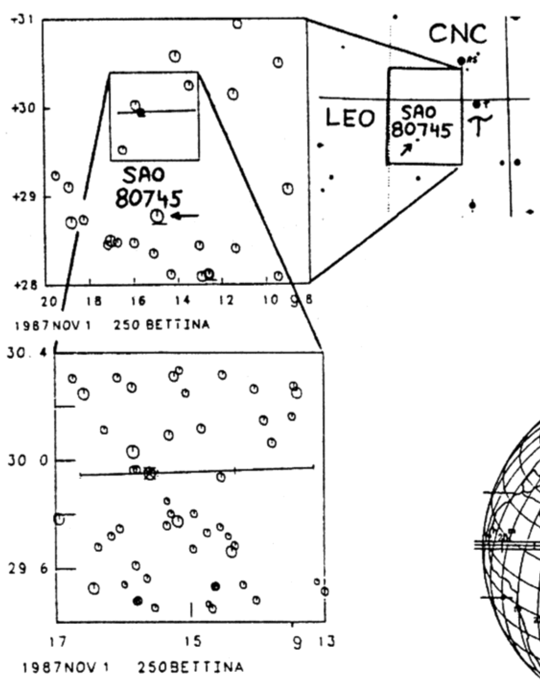


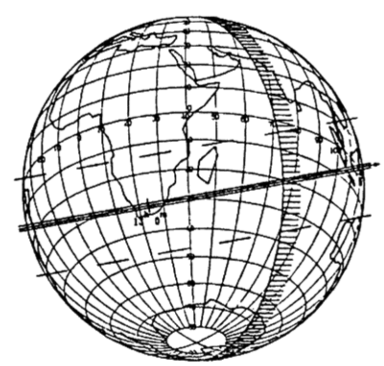
L 1 2134 by Hilda 1987 Oct 25

SAO 190319 by Flora 1987 Oct 25

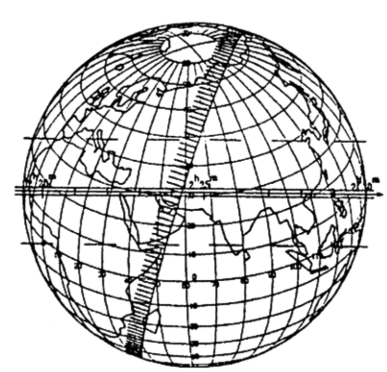


SAO 188815 by Hebe 1987 Oct 27



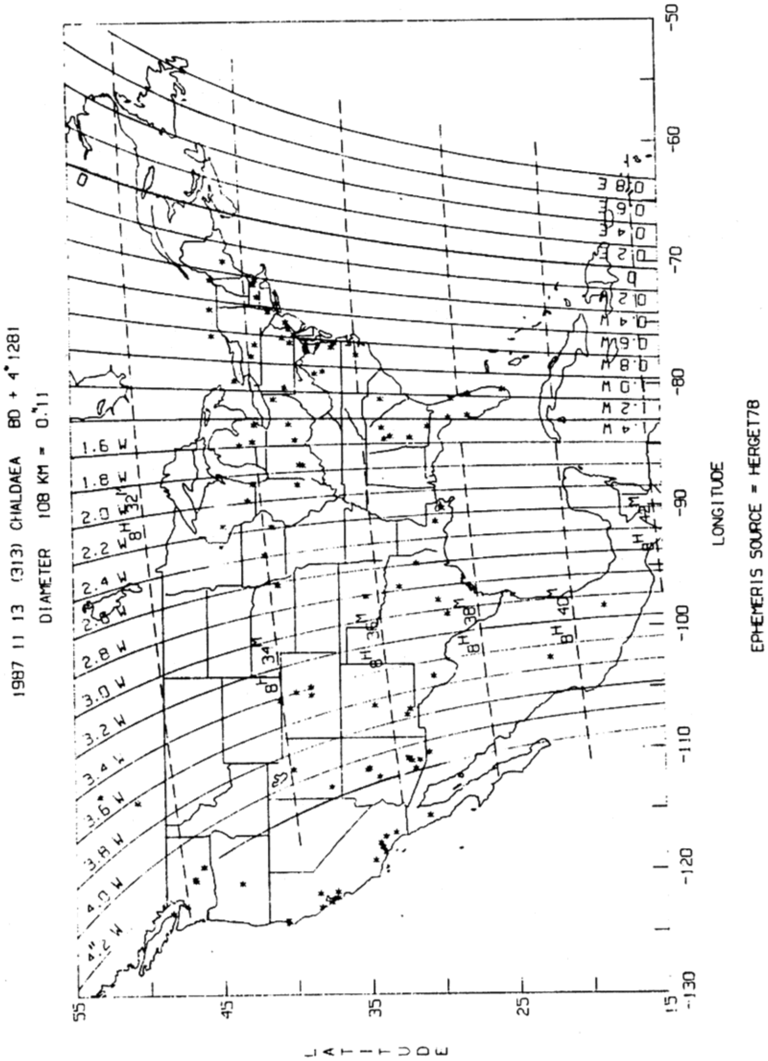


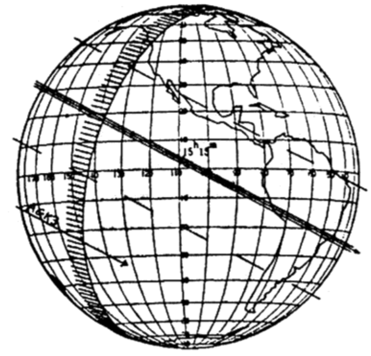
C2612888 by Alexandra 1987 Oct 27



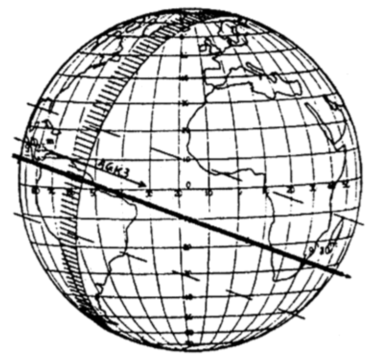
Anonymous by Bettina 1987 Nov 1

SAO 163450 by Pales 1987 Nov 1



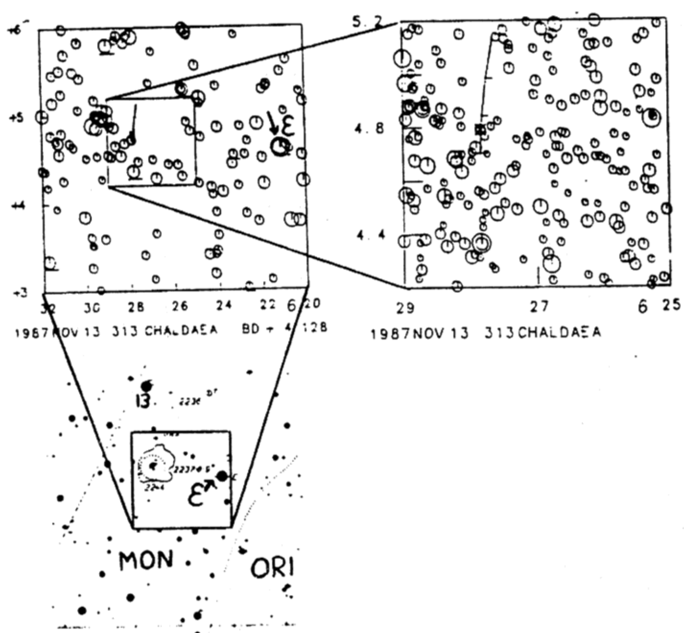


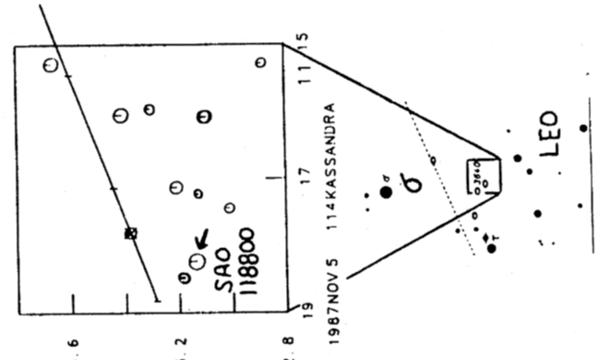
SAO 137809 by Aspasia 1987 Nov 1

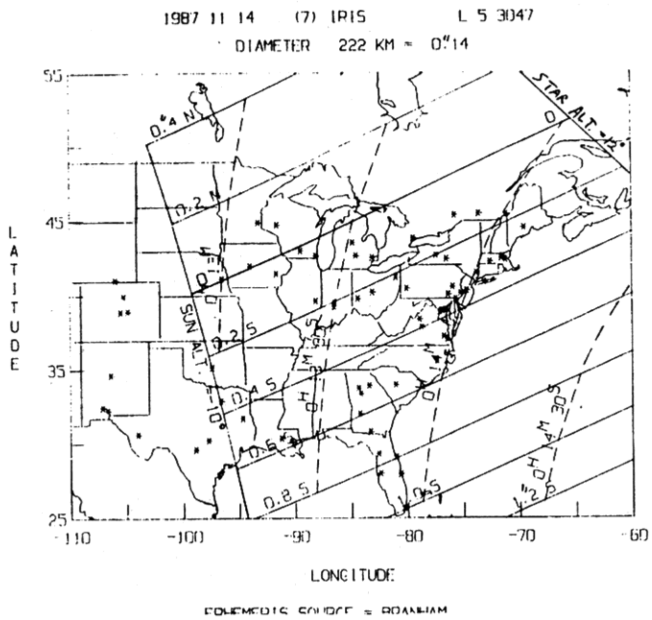


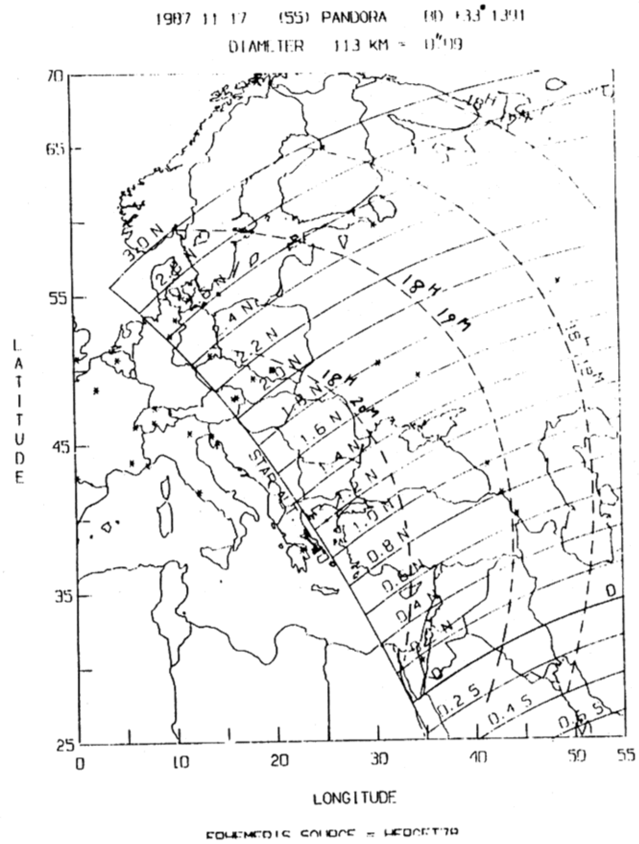
+3°2487 by Kassandra 1987 Nov 5

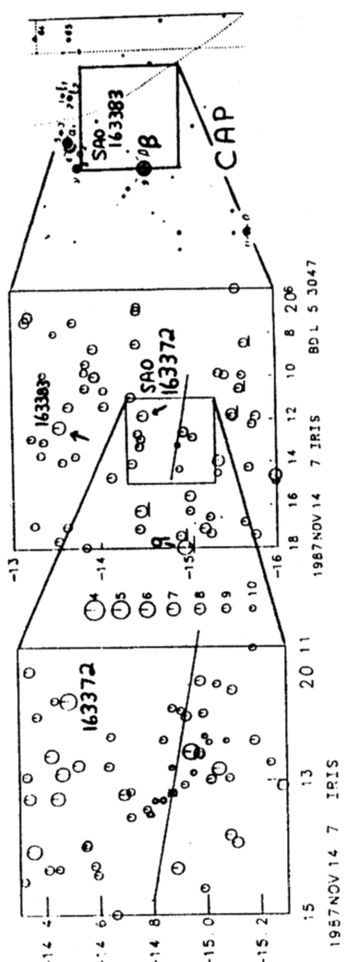
+4°1281 by Chaldea 1987 Nov 13

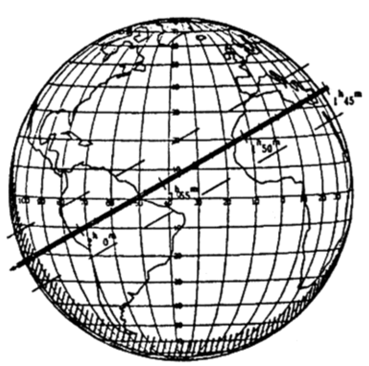




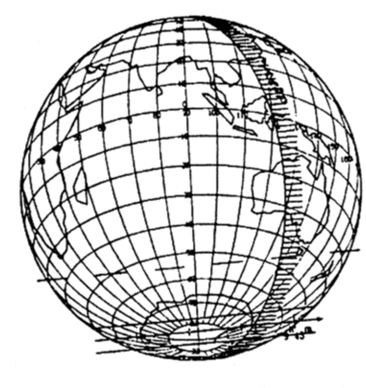






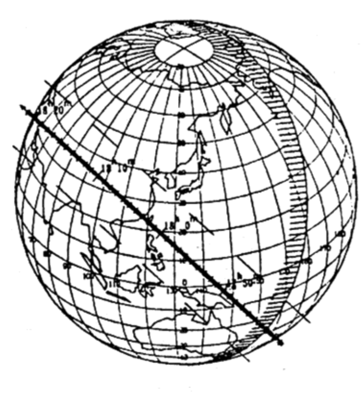


SAO 110418 by Nemausa 1987 Nov 2



C2814856 by Ceres 1987 Nov 5

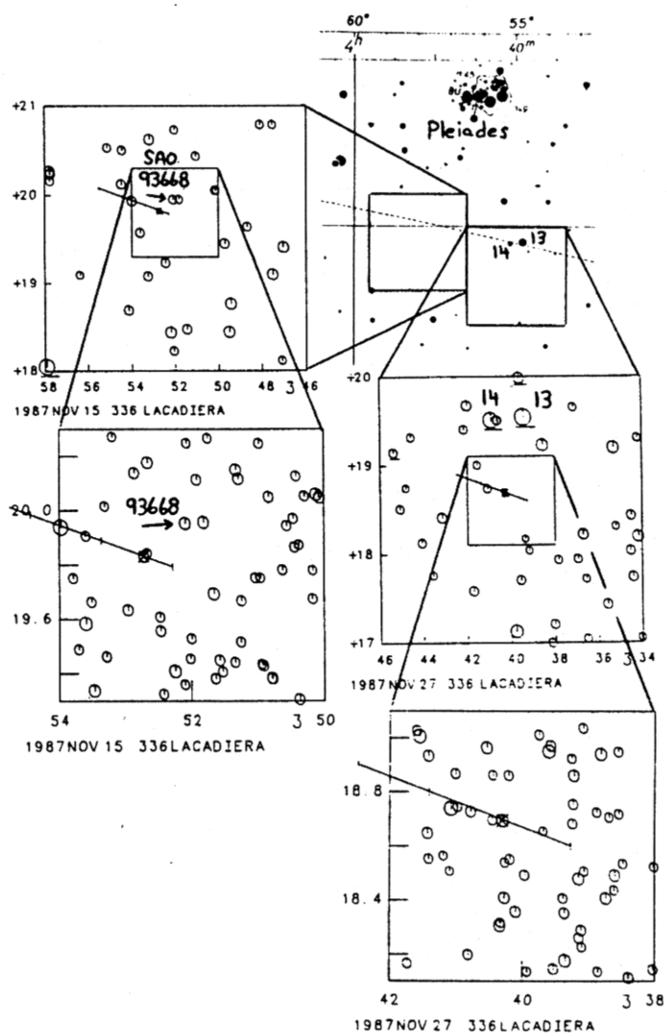
L 5 3047 by Iris 1987 Nov 14

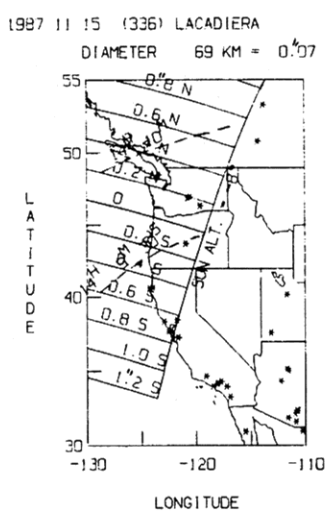


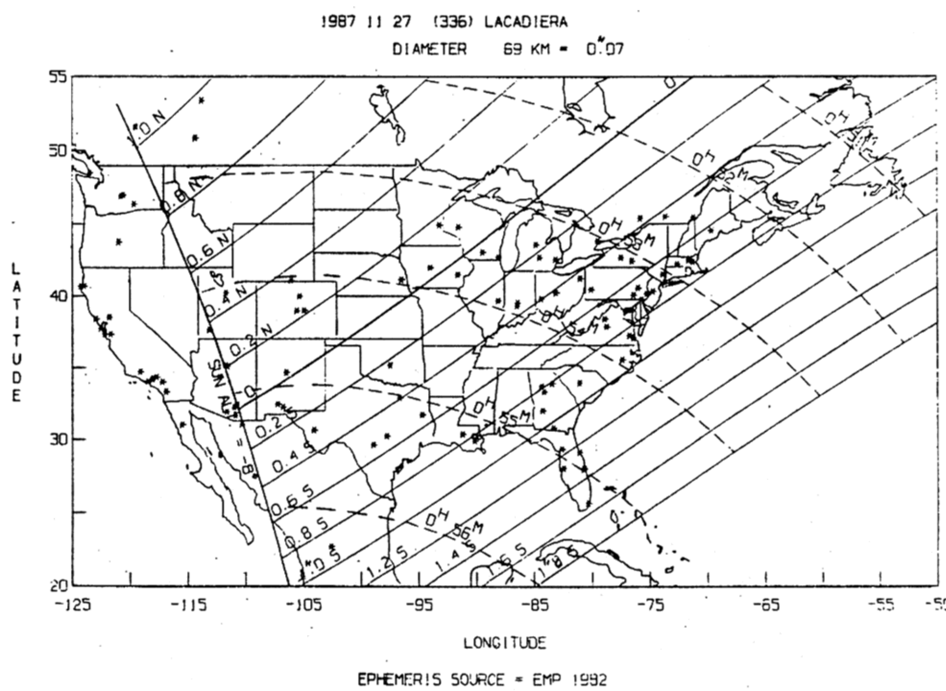
+33°1391 by Pandora 1987 Nov 17

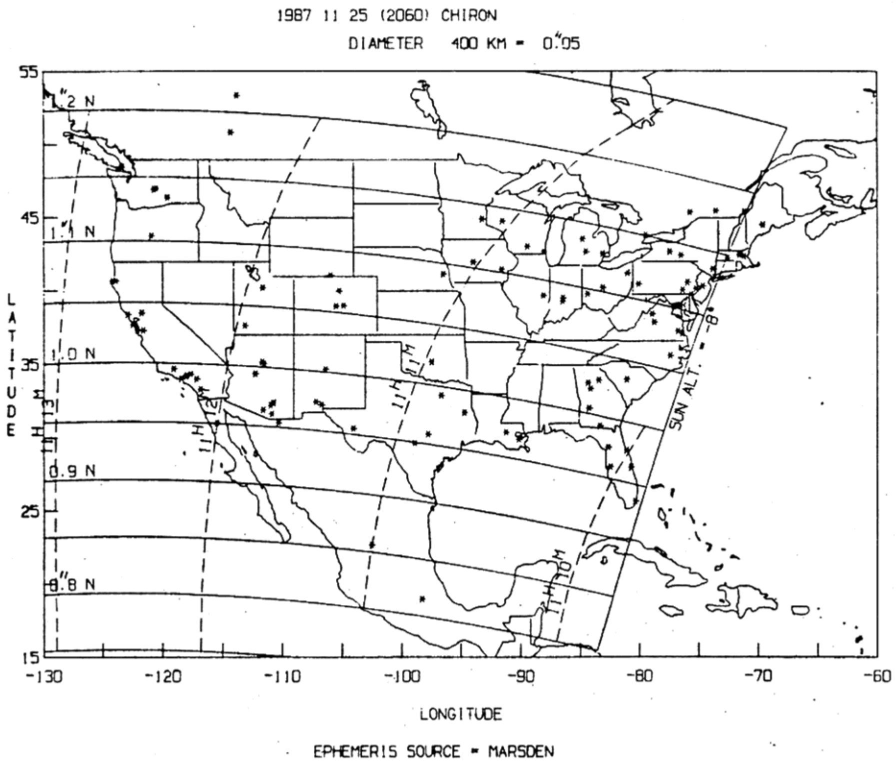
Anonymous by Lacadiera 1987 Nov 15

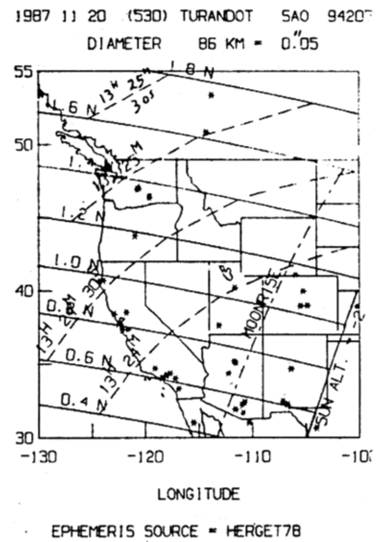
+18°527 by Lacadiera 1987 Nov 27

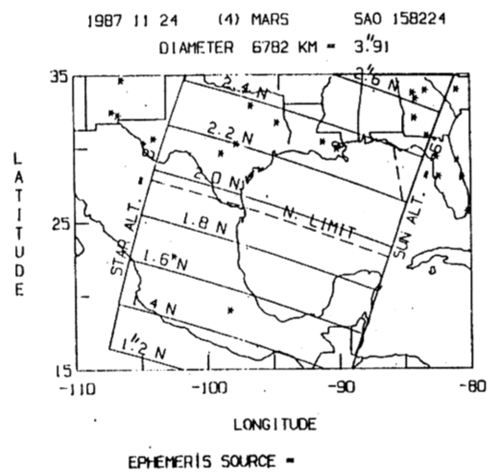


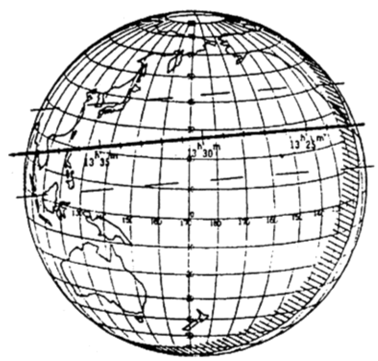




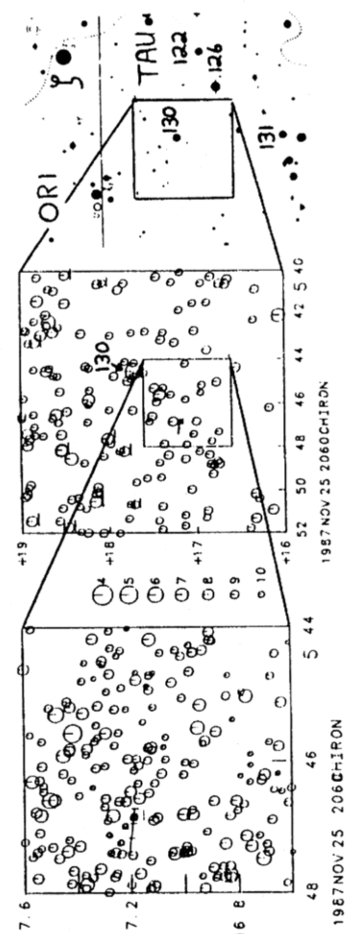


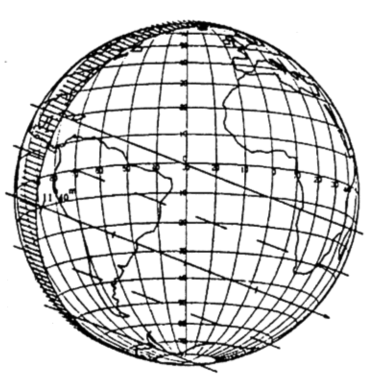




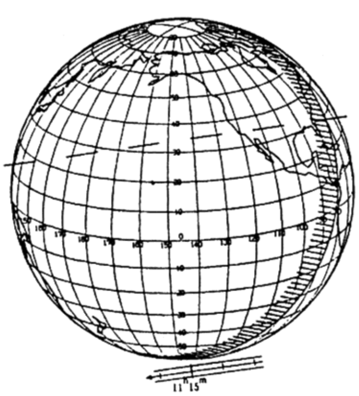


SAO 94207 by Turandot 1987 Nov 20



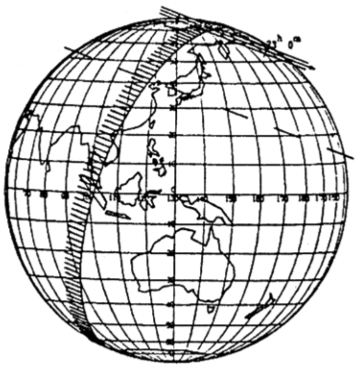


SAO 158224 by Mars 1987 Nov 24

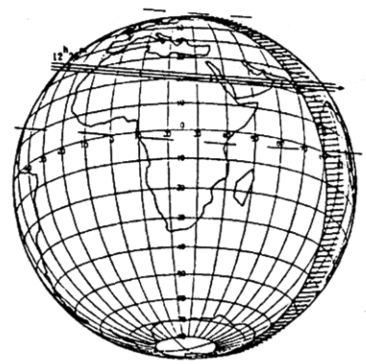


Anonymous by Chiron 1987 Nov 25

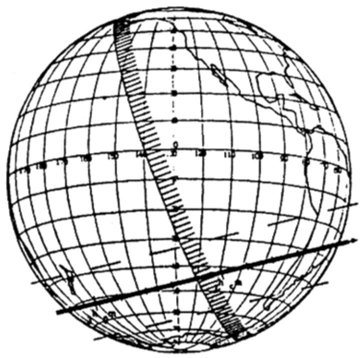
SAO 166333 by Freda 1987 Nov 9



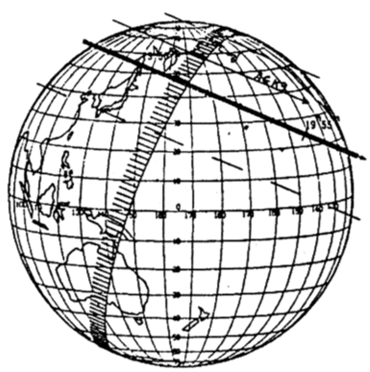
Anonymous by Camilla 1987 Nov 13



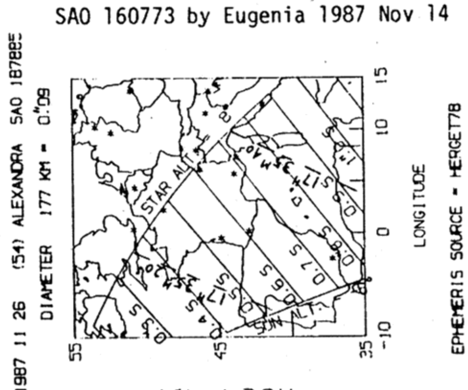
SAO 160773 by Eugenia 1987 Nov 14

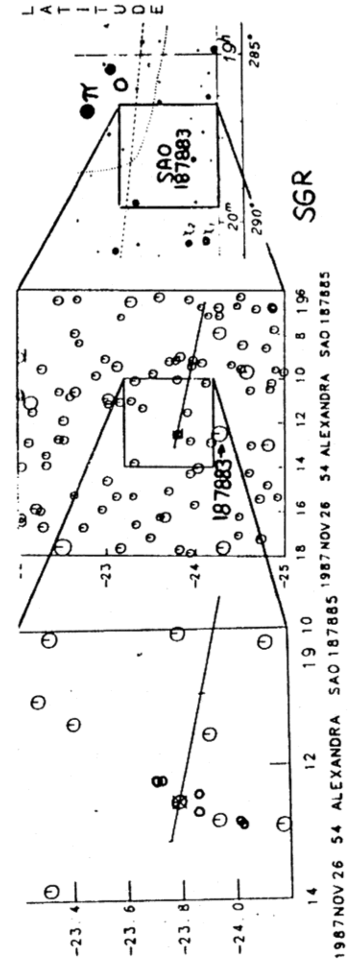


SAO 164852 by Galatea 1987 Nov 15

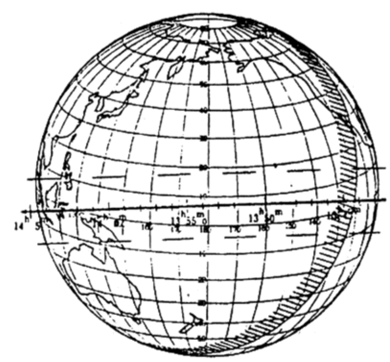


SAO 118516 by Hestia 1987 Nov 19

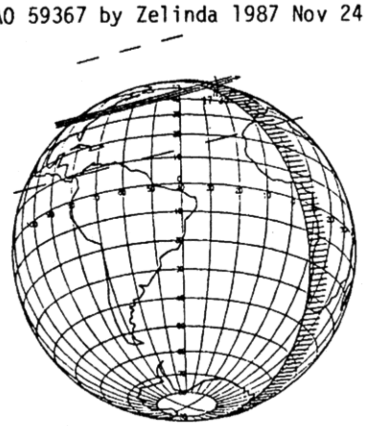




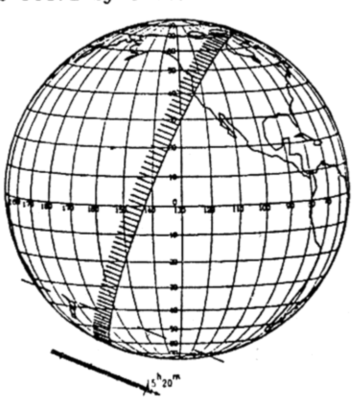
SAO 59367 by Zelinda 1987 Nov 24



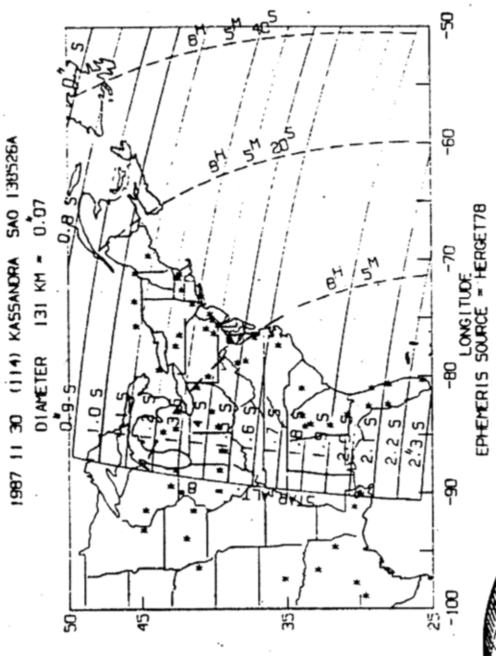
SAO 95372 by Unitas 1987 Nov 26

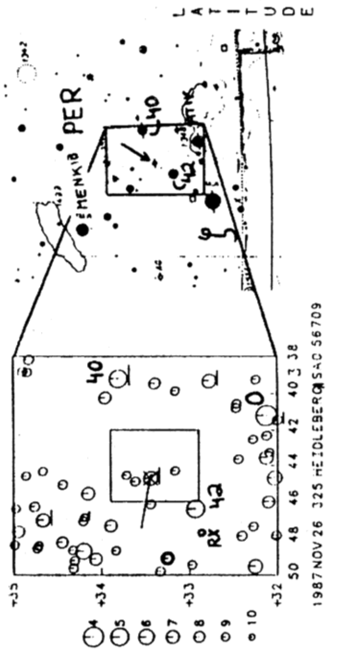


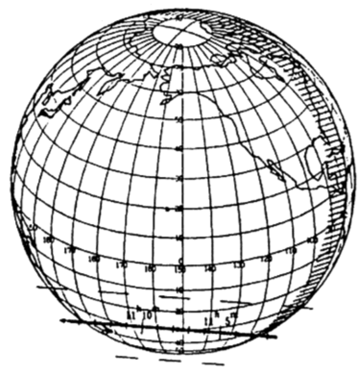
SAO 187885 by Alexandra '87 Nov 26



Anonymous by Hestia 1987 Nov 27

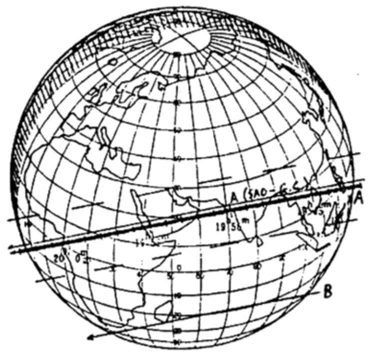




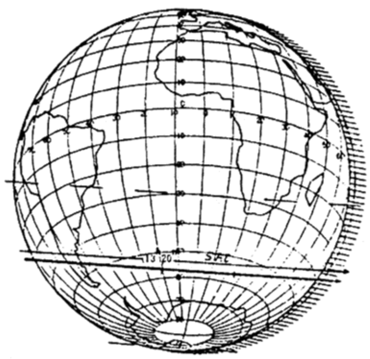


SAO 77309 by Una 1987 Nov 28

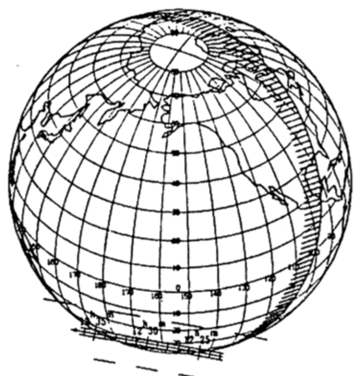
SAO 146088 by Galatea 1987 Dec 1



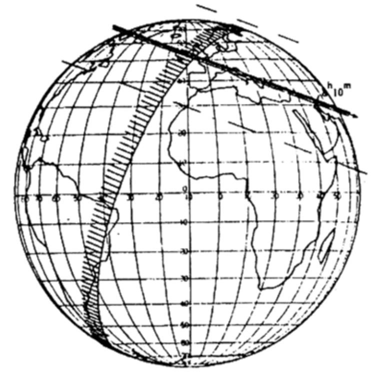
SAO 56709 by Heidelberga '87 Nov 26



SAO 185320 by Frigga 1987 Nov 28

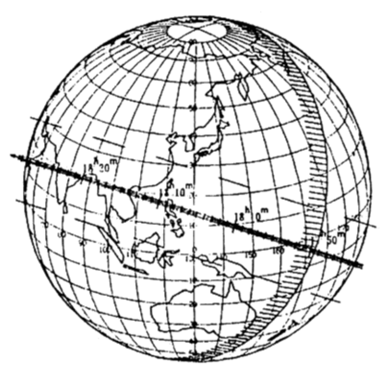


SAO 41376 by Bamberga 1987 Nov 29

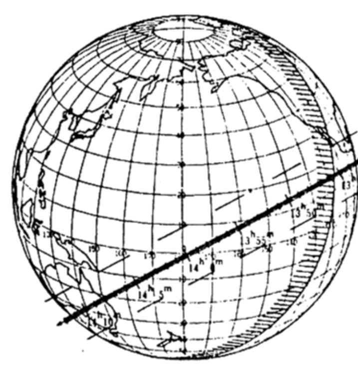


SAO 138526 by Kassandra '87 Nov 30

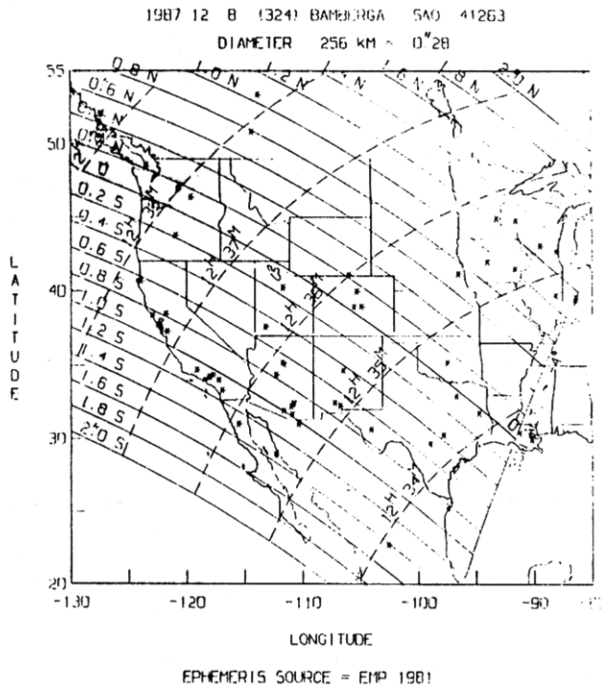
A2257333 by Ophelia 1987 Dec 1

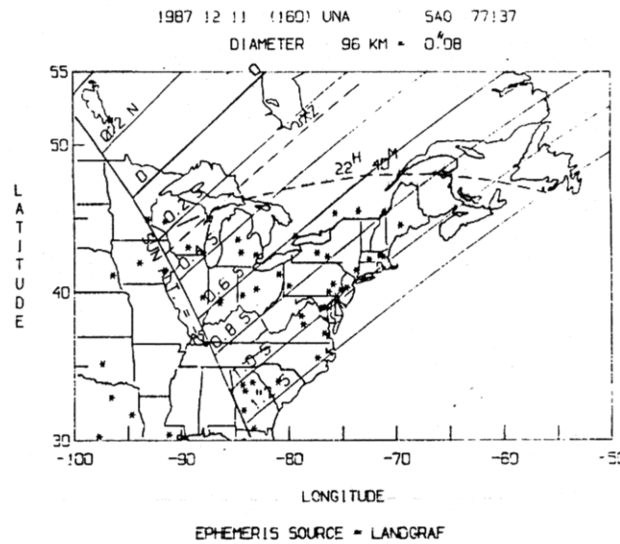


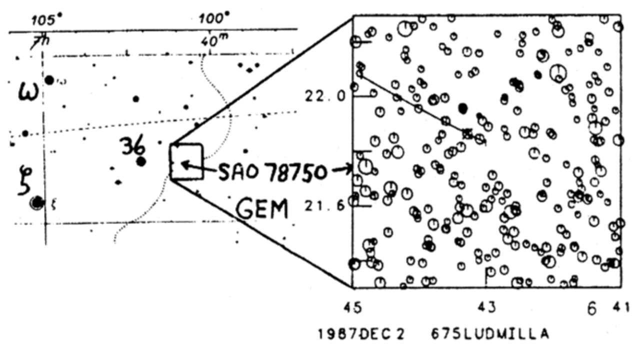
Anonymous by Ophelia 1987 Dec 1

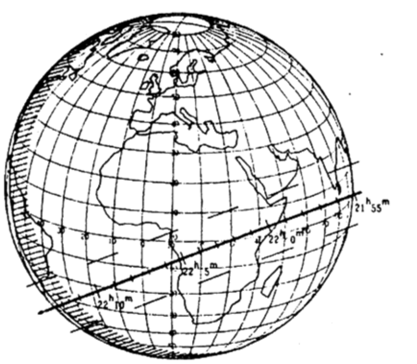


+21°1371 by Ludmilla 1987 Dec 2

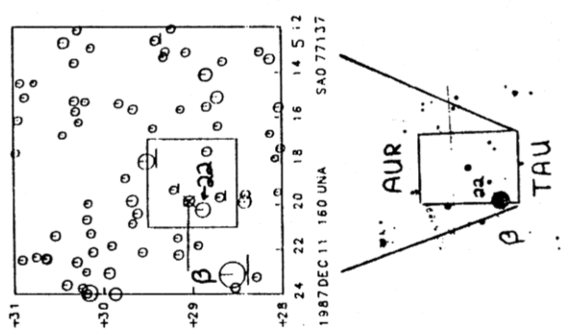


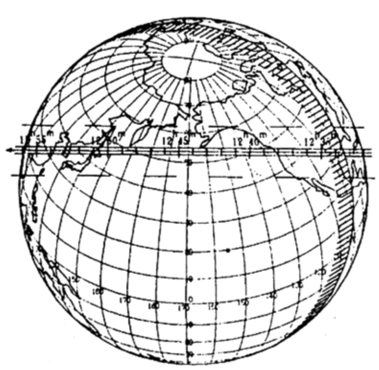




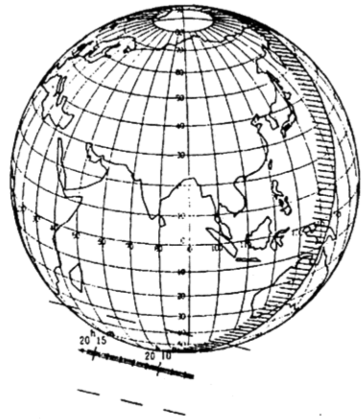


Anonymous by Lacadiera 1987 Dec 2

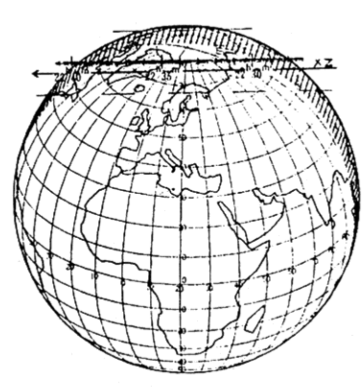




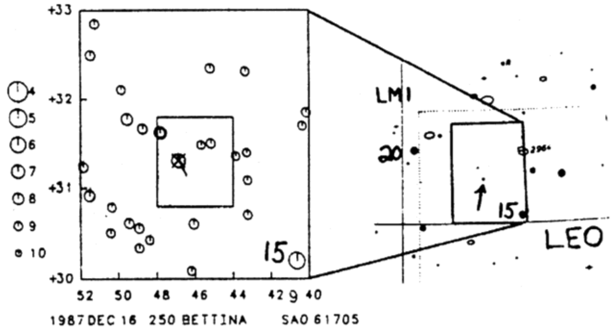
SAO 41263 by Bamberga 1987 Dec 8

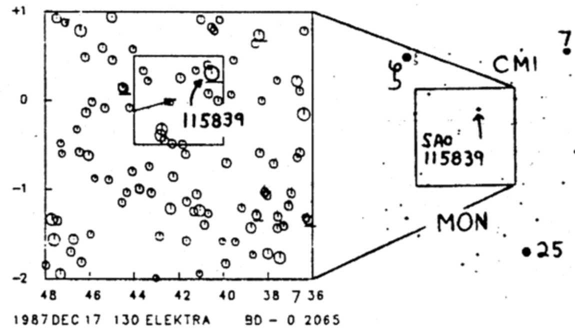


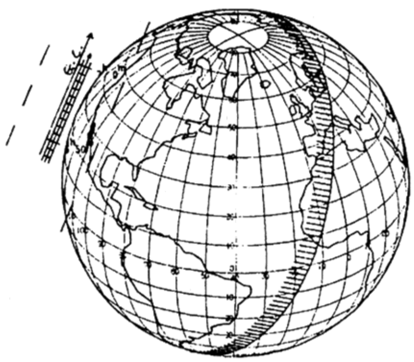
A2256168 by Ophelia 1987 Dec 11

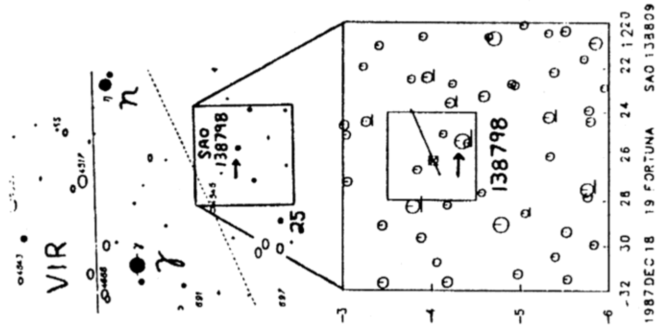


SAO 77137 by Una 1987 Dec 11



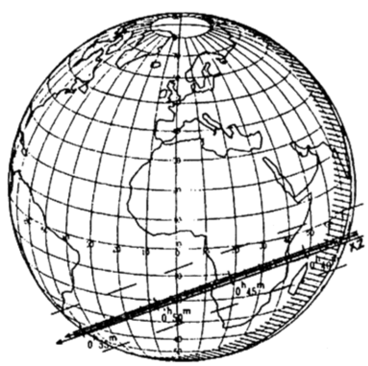






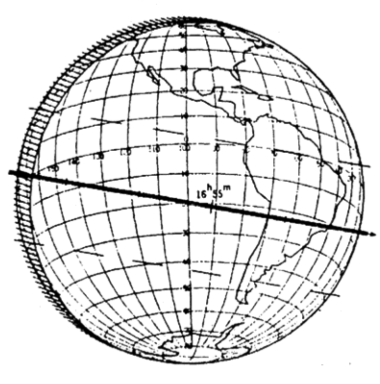
SAO 61705 by Bettina 1987 Dec 16

Anonymous by Bettina 1987 Dec 16

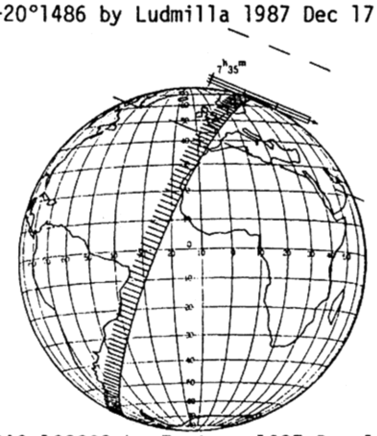


+20°1486 by Ludmilla 1987 Dec 17

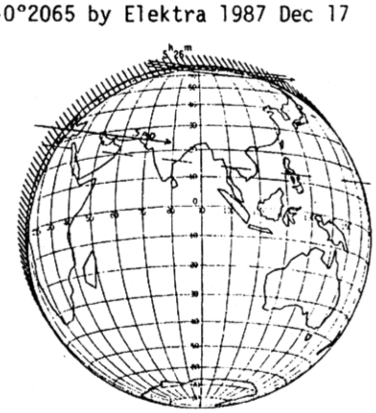
-0°2065 by Elektra 1987 Dec 17



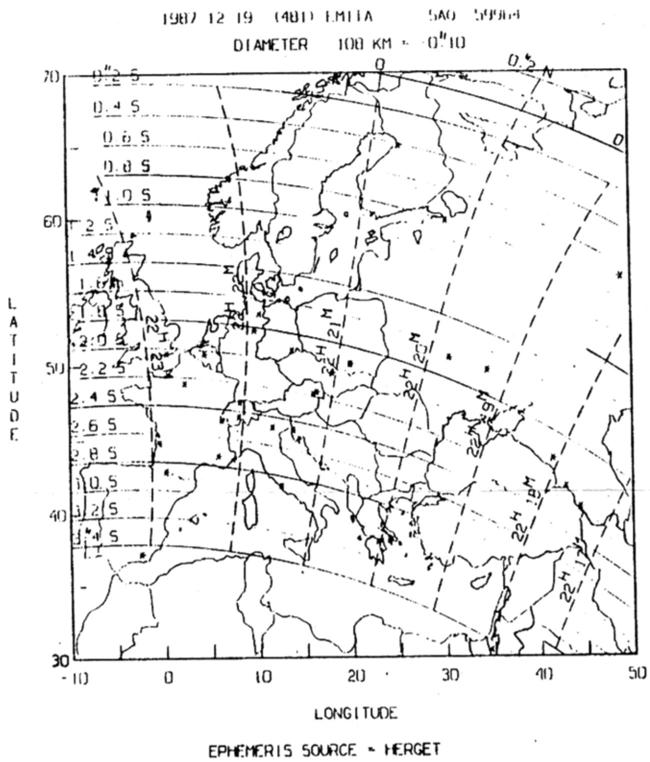
SAO 159625 by Astraea 1987 Dec 17

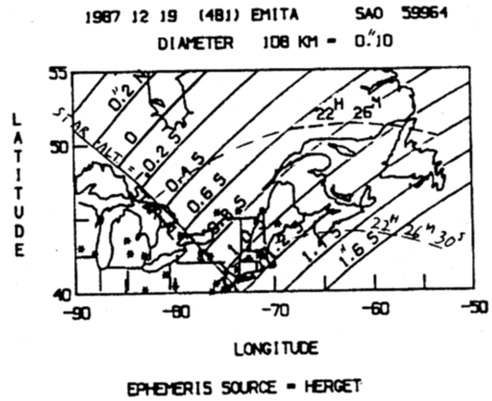


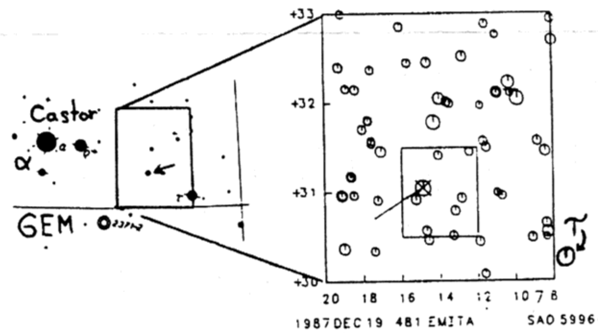
SAO 138809 by Fortuna 1987 Dec 18



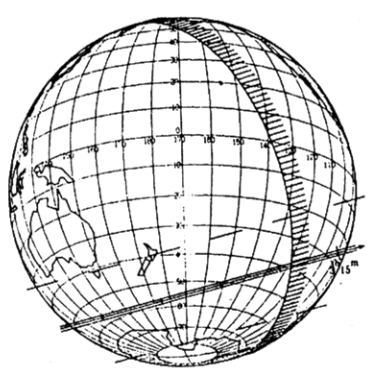
SAO 160335 by Winchester '87 Dec 19







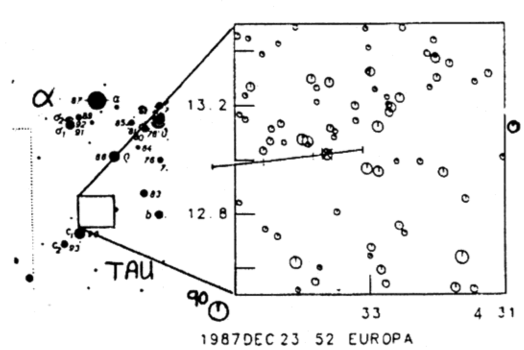
SAO 59964 by Emita 1987 Dec 19



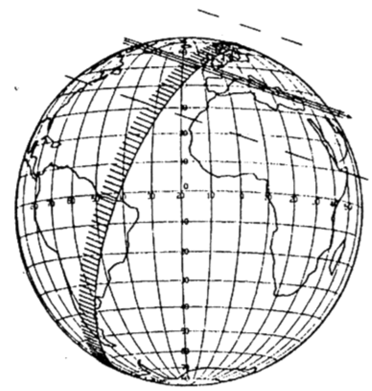
SAO 164610 by Hebe 1987 Dec 20

+12°613 by Europa 1987 Dec 23

Anonymous by Europa 1987 Dec 23



SAO 109103 by Athor 1987 Dec 20



L 2 3421 by Metis 1987 Dec 25

SAO 189335 by Venus 1987 Dec 25

SAO 58010 by Pulcova 1987 Dec 27

+10°4990 by Ursula 1987 Dec 27

L 2 3662 by Metis 1987 Dec 28