Occultation Newsletter

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FROM THE PUBLISHER

This is the second issue of 1987. Some changes in IOTA/ES instructions are shown below.

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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
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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.
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or by air (AO) mail @ 1.56 1.50
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IOTA NEWS

David W. Dunham

Fourteen years have elapsed since the last good passage of the Moon across the Pleiades visible from North America. Since the passage of March 5-6 is the first favorable Pleiades occultation visible from this part of the world since *Occultation Newsletter* began publication, this issue is naturally dedicated to the famous open cluster. This issue is being distributed early enough so that most subscribers in the U.S.A. should receive it by March 5th. Most Canadians will probably receive it too late, but this passage is not very impressive there, the Moon missing all of the bright Pleiads and covering only a few 6th-magnitude stars. Mexico will get the best view of this passage, so I have sent a preprint of the Pleiades article to Guillermo Mallén. Unfortunately, there will be little or no time to process special requests for March 6th after you receive this, but many already will have been alerted either by the special P-catalog predictions distributed with U.S.N.O.'s 1987 total occultation predictions or by my articles in *Sky and Telescope*.

Unless a separate article is written, information about meetings with IOTA involvement, those held since the last issue was published and future meetings, will be included in the IOTA NEWS article. The only meeting since the last issue was the American Institute of Aeronautics and Astronautics (AIAA) convention in Reno, NV. On January 14th, Paul Maley and I were able to exchange information about, and discuss the next steps that need to be taken, to complete analyses of the 1985 May 4th lunar eclipse grazes of Alpha 2 Librae and of the 1983 May 30th occultation of 1 Vulpeculae by Pallas. It is critical that we publish the results of these observations, especially for Pallas, which has waited much too long. The astronomical community has counted on us to publish these results, and we need to do so to maintain IOTA's credibility and demonstrate that we have a purpose other than just the distribution of predictions. I hope to have papers prepared on these occultations before I become too involved with needed star catalog improvements and 1988 predictions, which I must begin earlier in the year than I did for 1987 predictions, which have been distributed either just barely in time or too late. My tight schedule, including several business trips noted below, will make it difficult to find enough time to get the job done, and any help others can provide without too much direction from me will facilitate the situation and be greatly appreciated. At least, most of the data are already in computer-readable form, so that the job should not be impossible. For Pallas, we want to document the full coverage of the event, including as many as possible of the miss observations, few of which are in the computer database, and few of which have even been reported to us. In most cases, one arc minute will be sufficiently accurate for the latitudes and longitudes of the miss observers, but local and regional coordinators should get this information before we lose contact with too many observers. This is also a concern for some of the discordant timings of the occultation by Pallas.

From March 16 to 25, I will make another trip to Japan, to coordinate my spacecraft orbital design work with Robert Farquhar, my technical supervisor at Goddard Space Flight Center who is spending three months in Japan, and with workers at the Institute of Space and Astronautical Sciences in Tokyo. I hope to attend a meeting of Japanese comet observers in Shizuoka on March 21 and 22, and meet again friends in the Lunar Occultation Observers Group and at ILOC and Tokyo Observatory.

As noted in the last issue, I will be attending a Symposium on the Diversity and Similarity of Comets at Brussels, Belgium, on April 6th to 9th. I plan to arrive in Hannover, German Federal Republic, to meet Hans-Joachim Bode on April 4th. On April 5th, we plan to have a small meeting of IOTA/ES in northern Germany, perhaps in Hamburg, close enough to Denmark that IOTA/ES members there can attend. As soon as the symposium schedule is known, I will suggest one or two evenings when I might meet with Belgian observers in Brussels, as suggested by Jean Meeus, whom I have not seen in almost twenty years. Hans Bode expects to attend an evening meeting in Brussels, which would provide a valuable opportunity for IOTA, IOTA/ES, and GEOS to coordinate their activities. On April 10th, I plan to visit the European Space Agency's ESTEC in Noordwijk, the Netherlands, and will return home the next day.

On May 18-20, I will attend an AIAA meeting on Solar System Exploration in Pasadena, CA. I will also spend the preceding weekend, and one other weekday, in southern California. During May, I also may attend the American Astronomical Society's Division on Dynamical Astronomy meeting in Cambridge, MA, on the 7th to the 9th.

As described on page 38 of the last issue, International Astronomical Union Colloquium No. 98, "The Contribution of Amateur Astronomers to Astronomy," will be held in Paris, France, from June 20 to 24. We have no new information about this meeting, but considering my many other trips mentioned above, I probably will not attend the colloquium, but will work here on necessary projects, such as the Pallas paper, instead. In any case, Paul Maley plans to represent IOTA at the colloquium, and he can present my papers if I do not go.

The Pomona, CA, superconvention mentioned last time has been named Universe '87 and will be held at Pomona College in Claremont, CA, from July 11 to 18. IOTA is one of the participating organizations, along with the Astronomocal League, the W.A.A., A.L.P.O., the A.S.P., I.A.P.P.P., and Problicom. More information is in the February issue of *the Reflector*. A meeting packet and registration form are expected to become available about April and can be obtained by sending your name and address to: Astronomical Society of the Pacific; Summer Meeting Department; 1290 24th Ave.; San Francisco, CA 94122; enclosing two first-class stamps with your letter would be appreciated.

The official annual IOTA meeting is still tentatively scheduled for October 10th in Houston, TX, although local observers warn me that the predicted profile for the Oct. 12th Beta Tauri graze in the area is quite uninteresting, promising only two events for most observers.

Walter Nissen and Bob Bolster inform me that daylight savings time begins on April 5th this year. I incorrectly showed it occurring during the last week of April in my lists of mid-Atlantic expeditions and Washington, DC, total occultations distributed in January. If you have these lists, you should add one hour to the times of events listed for April 5 to 25, to convert them from EST to EDT.

Last October, the Australian government proposed a quick closing of VNG, their short-wave time signal service. David Herald and Graham Blow encouraged many Australian and New Zealand observers to write letters protesting the action. Probably many other VNG users also complained; the proposal was dropped, with no future plans to shut down the station.

I recently received a letter from Alexander Osipov giving a brief account of recent occultation activity in the Soviet Union. During 1985, 490 lunar occultation timings were made at 17 observatories; a detailed report is expected in a couple of months. During 1986, 44 contacts were timed by expeditions for grazing occultations of 136 Tauri (Z.C. 890) and 107 B. Tauri. Astrometric updates were obtained for a number of asteroidal occultations, but for various reasons, no timings resulted from these efforts.

Unfortunately, this issue, like most of the ones before it, is being prepared under considerable time pressure, and I have not been able to write articles covering everything that I wanted to say. Most of my urgent prediction jobs have been completed. I hope to generate computer-produced finder charts (especially for faint stars and for events not in Goffin's coverage) and regional maps for distribution to coordinators outside of North America and Europe, which I have not had time to do during the past several months. Since it will be nearly four months before I need to work on the next issue, I hope to finally answer many letters that I have not had a chance to acknowledge during the past several months, and in general clean up and organize a large pile of prediction material, uncompleted observation reports, and letters that have accumulated during the past several months and years. The next issue is targeted for distribution before the convention in Pomona in July, but the publicity from *Sky and Telescope*, *the Reflector*, and other sources may render *O.N.*'s role redundant for this purpose. Certainly, the next issue will be distributed well before the September 13th Pleiades passage.

LUNAR PLEIADES PASSAGES

David W. Dunham

The current series of Pleiades passages began in the

Southern Hemisphere nearly a year ago. The first one visible under favorable conditions from the Northern Hemisphere occurs on Thursday evening, March 5-6, the first in a series that will last over four years in the Northern Hemisphere.

Value. Due to the large number of occultations that can be seen during only a few hours, and the very accurate positions and proper motions that have been determined for even very faint stars in and near the rich cluster, accurate timings of Pleiades occultations have special value for the detail they can provide for studies of the lunar profile, especially as defined by Chester B. Watts' limb correction charts in the USNO publication, "The Marginal Zone of the Moon." Since the Pleiades are relatively far from the ecliptic, the Moon's latitude libration during passages is always very different from those encountered during eclipses, so Pleiades timings are not directly useful for solar eclipse analyses undertaken for solar diameter measurement. However, the detailed information obtained from Pleiades timings is valuable for general lunar profile studies, which are not only useful for eclipse analyses, but also improve all other astrometric uses of occultations, such as determination of the zero-point of right ascension and absolute proper motions needed for determining the Oort parameters of galactic rotation.

Predictions. O.N. readers who time occultations should get detailed USNO total occultation predictions (if they have not already done so) by sending accurate geodetic coordinates and telescope information to: Mrs. Marie Lukac; Nautical Almanac Office; U. S. Naval Observatory; Washington, DC 20390. Besides the regular XZ-catalog predictions, for 1987 (and for the following years of this series) she also distributes P-catalog predictions, including Pleiades stars to 12th magnitude with chronologically ordered summaries. Mrs. Lukac and I prepared a complete cross-reference table, giving names and Flamsteed, B.D., SAO, and XZ ("USNO" or Z.C.), and Hertzsprung numbers for all P-catalog stars that are also in the XZ, and Mrs. Lukac distributes this with the predictions. If you need predictions in a hurry (such as totals for the site of a graze during the March 6th passage), I might be able to supply them if you call me at 301,585-0989.

Observing Considerations. Observing strategies for Pleiades occultations are discussed in "Passages of the Moon through the Pleiades Star Cluster," distributed with 1987 USNO total occultation predictions by Mrs. Marie Lukac. Expeditions to time bright-limb grazes of Alcyone (Eta Tauri = Z.C. 552), when the Moon is not full or highly gibbous, are most important, if the bright-limb graze path is within your traveling distance. Alcyone is usually the only Pleiad that is bright enough to make reliable timings against the bright limb, if atmospheric seeing is good and the Moon's surface brightness is not too great. If the Moon is 5% or less sunlit, bright-limb grazes of some of the fourth-magnitude Pleiads might also be observable.

Timing the largest possible number of occultations with the largest-available telescope is the next most important job, especially for experienced observers. If there are a few or several observers timing occultations in one metropolitan area, they will sample usefully different parts of the lunar profile if they are separated by 5 kilometers (3 miles) or more in a north-south direction perpendicular to local graze paths; less separation is useful for obtaining different data for nearly grazing events.

Expeditions to observe dark-limb grazes are especially useful for those with only a little occultation-timing experience, since the timing accuracy for grazes is less stringent than for totals, and dark-limb grazes of bright Pleiads are easy to observe. Grazes are also useful projects when there are many observers in a city such that their separations from each other are too small to give usefully different total-occultation results. Expedition leaders should schedule time to observe total occultations during the passage, not just the graze, especially useful for those who want to gain occultation-timing experience.

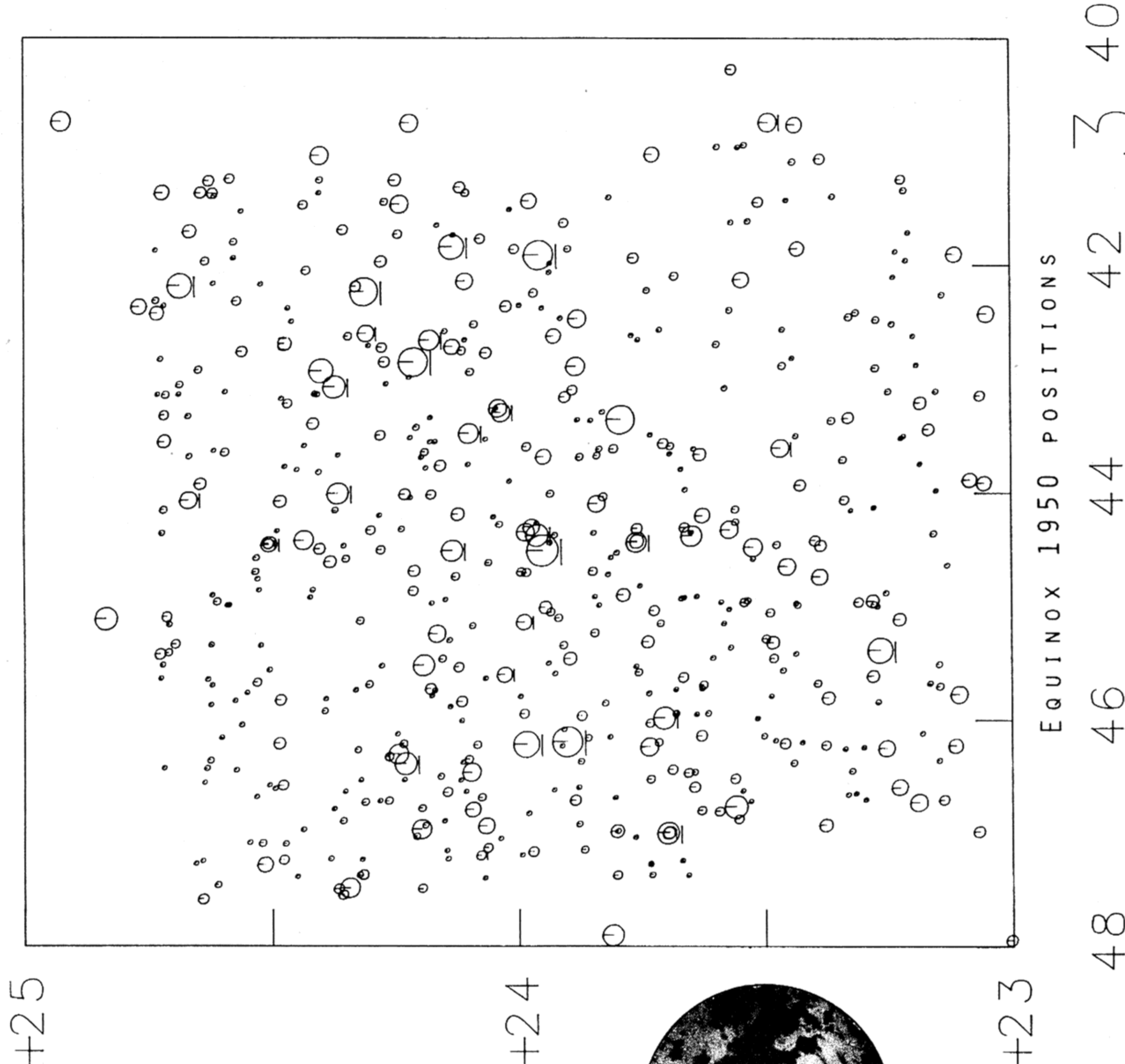
Selecting a location where two (or even three, if you're lucky) grazes can be observed during the passage is useful, since the grazes will occur at slightly different position angles; when analyzed together, the timings will define a larger section of the lunar profile than if only one graze had been observed.

The Passage of 1987 March 6. The passage of March 5-6 will be visible from most of North America, with the more southerly locations experiencing a more central passage with occultations of more of the brighter Pleiads. A map identifying all SAO stars in the cluster, and general information about total occultations during the passage, will be published in the March issue of *Sky and Telescope.* The northern limits of the occultations of Merope (23 Tauri = Z.C. 545), Alcyone, Atlas (27 Tauri = Z.C. 560), and Pleione (28 Tauri = Z.C. 561) crossing the southern U.S.A. are shown on the map on p. 68 of the January issue of *Sky and Telescope.* The first three of these paths are also in the 1987 Western Hemisphere grazing occultation supplement distributed with *O.N. 4* (2).

Pleiades Charts. The two Pleiades charts here are similar to the chart pairs that were prepared for each of the 1985 and 1986 total lunar eclipses, and distributed to Eastern Hemisphere observers early in 1985. The first chart used equinox 1950 positions to plot all stars within the 2°-on-a-side box shown. The stars were selected from my combined catalog described on pages 45-48 of the last issue, and include all of the P-catalog stars. Duplicate entries were deleted before plotting the charts. The faintest stars shown on the chart are 13th magnitude, while the brightest one, Alcyone, near the chart's center, is magnitude 3.0; the plotted diameter of the star varies linearly with the magnitude.

The second chart is similar to the first one, but includes identifying numbers just to the right of stars of mag. 11.0 and brighter, and the paths of The Moon's center for several cities. The positions are apparent positions (equinox of date) so they can be located with the apparent positions given in the USNO total occultation predictions. Consult the chart in the March issue of *Sky and Telescope* for SAO numbers. The star number key is as follows:

7 - 520: USNO P-catalog number
530 - 570: Zodiacal Catalog number
4750 - 5020: USNO XZ number, star not in P-catalog

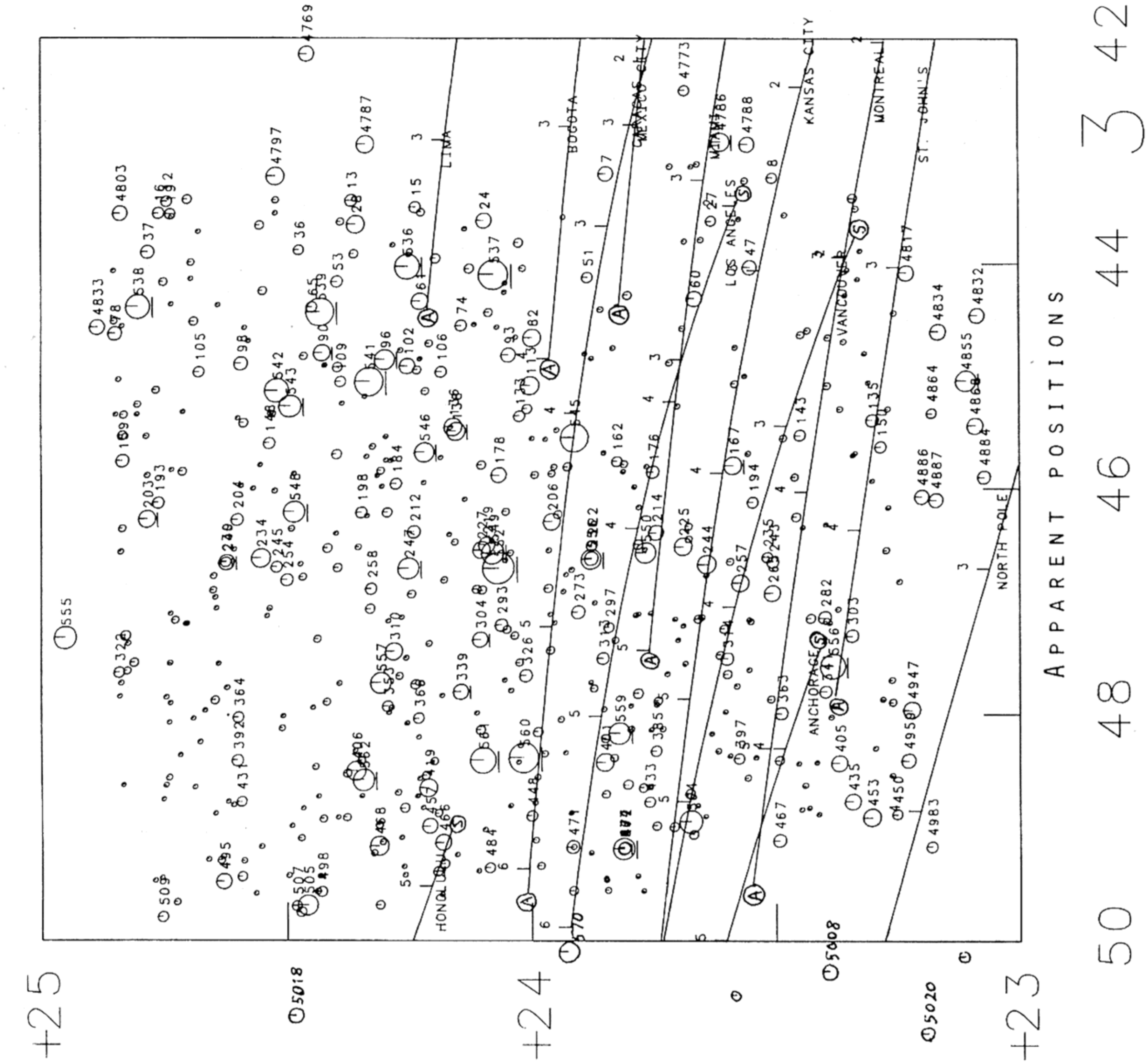


The paths of the Moon's center for several cities are shown. The city's name is plotted near the right-side (low right ascension) end of the path. The names of Caracas and Mexico City are printed on top of each other between stars 7 and 4773; the longer path is for Mexico City. The paths end with a circled A near moonset, and with a circled S near sunset. Tick marks show the Moon's position at hourly intervals, with the Universal Time hour given above the tick mark.

The Moon's disk shows its correct size for March 6. It will be 37% sunlit, with the position angle of the lunar north pole (0° Watts angle) being 348° and the position angle of the north cusp being almost the same, at 346°. Since the Moon is waxing, disappearances will occur along its advancing dark edge, with the center of the sunlit limb being in position angle 256°.

The next Pleiades chart that will be published in *O.N.* will be for the September 13th passage visible from most of North America. The chart will then be more necessary for locating reappearing stars. If I can get some help (see p.   ), charts like this one can be prepared for IOTA members, and perhaps local publications, for some passages visible outside North America.

While preparing the second chart, I found an error in the AGK3 position for B.D. +24° 552. The proper motion in declination is incorrectly given as +172".30/century. Wayne Warren consulted the SIMBAD on-line stellar database in France, where he found that the proper motion in declination is actually about -4".4/century. With this correction, the star was found to be identical with P 98, so I deleted the AGK3 data from the Pleiades-area subset used for plotting the charts. The star is not in the XZ cat-



alog, but it is number 1957 in the K-catalog with the bad AGK3 data, so ignore any predicted occultations of K01957 in your regular USNO total occultation predictions.

Grazing Occultations. Reductions of two previously observed northern-limit Pleiades grazes show that the March 6th grazes, and presumably all northern-limit Pleiades graze paths will shift south by 0".25, or 0.5 km or 0.3 mile south (measured perpendicular to the limit) on the ground, from IOTA's current 80H-based predictions. The two grazes were selected simply because they were the first ones that I could find; included were three stations during the graze of Z.C. 536 observed near Soltan, German Federal Republic, on 1972 March 19 by Hans-Joachim Bode's expedition, and four stations of Don Stockbauer's expedition for Z.C. 556 observed last September 23rd in Texas. Z.C. 556 is an outlying member of the Pleiades; both it and Z.C. 536 have accurate positions and proper motions from the P-catalog which are now used with the XZ catalog for the 80H reductions. A reduction was also attempted for another graze on 1972 March 19 observed at Leipzig, but the observer reported some difficulties in following the star and the analysis showed that he had a close miss, which was consistent with the other reductions.

Eleven graze paths of Z.C. stars brighter than mag. 7.5 during the March 5-6th passage are shown in the R.A.S.C. *Observer's Handbook* for 1987. Many North American IOTA members have predictions for these and other grazes during the passage, from their regular prediction coverage. I know of only a few planned expeditions, including ones to southern Alabama and Valdosta, GA, for the Merope graze.

Videorecordings of the Alcyone graze will be attempted during expeditions by Paul Maley near Corpus Christi, TX, and Gerald Rattley near Tucson, AZ. I hope to videorecord the grazes of Merope and Atlas from where their paths cross at Sand Dunes National Monument near Alamosa, CO. I will arrive at Denver Airport at 1:45 pm on the 5th, and drive from there to the Sand Dunes; telephone me if you might be interested in joining me for this effort. If the weather forecast for Colorado is unfavorable, I may join a southern-California expedition for Alcyone instead; I expect to be in southern California for a couple of days after the passage in any case. My wife, Joan, will be on a business trip to the San Jose, CA, area that week, and will probably try to observe the Pleione graze near Salinas, probably joining a local expedition. There will probably be an effort to observe the low-altitude graze of 6.8-mag. Z.C. 550 near Cranford, NJ. Call me at 301, 585-0989 if you want more information about these expeditions.

Double Stars. Known or suspected double stars are underlined on the charts. These are listed in the table below. The USNO double star code is given in the "D" column. Codes K, X, and Y show that the star is suspected to be a close double from previous occultation observations, but duplicity is quite uncertain, position angles often can't be specified, and magnitudes and separations are very crude at best. The position angles of pairs with separations less than 0″.3 are likely changing rather quickly. "SB" in the Note column indicates a spectroscopic binary. The third component of a triple star is given on a second line without the USNO and SAO numbers, and without Mag1 (primary mag.).

USNO#	SAO#	D	Mag1	Mag2	Sep.	P.A.	Note
X4778	76097	A	8.8	10.8	1″.8	242°	ADS 2714
X4786	76103	V	8.5	9.5	0.02	296	
ZC536	76126	X	5.7	7.7	0.1		
ZC537	76131	U	3.9	7.0	.005		
ZC538	76137	V	6.4	6.4	0.05		Electra
ZC539	76140	X	4.6	6.1	0.1		Taygeta
P 90	76149	V	9.4	9.4?			SB
P 96	76152	C	8.4	10.1	.026	4	
ZC541	76155	X	4.7	4.7	.003		Maia
X4855	76156	W	8.5	9.1	.001		SB
				11.2	3.4	337	ADS 2748
ZC543	76164	K	7.3	7.3	0.1?		22 Tauri
P 138	76169	O	8.3	9.3	.16	147	ADS 2755
ZC546	76173	K	7.8	7.8	0.1?		
P 167	76175	K	8.7	10.7	0.05?		*O.N. 1*, p. 48
ZC548	76183	K	6.8	9.8	0.3	173	*O.N. 1*, p. 36
P 203	76184	A	8.6	10.6	1.0	171	ADS 2760
ZC549	76192	U	7.1	8.2	.002	205	
ZC551	76197	W	7.4	9.4	.0001		SB
				9.1	6.1	265	ADS 2767
ZC552	76199	K	3.0	4.6	.031	207	Alcyone
P 247	76200	U	7.1	8.5	.0004		SB
P 304	76207	C	9.4	10.1	0.52	109	
X4936	76214	A	9.1	9.3	0.6	269	ADS 2776
ZC556	76215	K	5.7	7.7	0.05?		SB
P 339	76218	A	9.0	10.0	0.3	53	ADS 2782
ZC559	76225	U	6.4	9.3	.009	288	26 Tauri
ZC560	76228	U	4.1	5.6	.006		ADS 2786, Atlas
ZC561	76229	K	5.4	7.4	0.05?		SB? Pleione
ZC562	76236	X	7.4	7.4	0.1?		
ZC567	76251	W	6.9	8.9	.0004		SB
P 474				8.9	10.2	236	ADS 2795
X4989	76254	X	8.5	9.1	.051	220	*O.N. 1*, p. 5
X4993	76257	A	9.5	9.5	1.0	91	ADS 2801AB
				12.6	18.1	340	ADS 2801ABXC
X5025	76277	C	8.7	12.2	1.6	262	

More about Pleiades doubles can be found in the *O.N.* issues listed in the notes, and in two *Astronomical Journal* articles (of which I was a co-author), J. McGraw, *et al.*, "Occultations of the Pleiades: Photoelectric observations at Tonantzintla with a discussion of the duplicity of Atlas," *79* (11), 1299, and P. Bartholdi, *et al.*, "Occultations of the Pleiades: Reappearances observed photoelectrically at McDonald Observatory," *80* (6), 449.

M4, ALASKA, AND HAWAII OCCULTATIONS

David W. Dunham

The tables and text below are from the manuscript for my article "Lunar Occultation Highlights for 1987," published in *Sky and Telescope 73* (1), 68 (January, 1987). There was not enough room to include this material in *Sky and Telescope*, so it is reproduced below.

M4: This 6th-magnitude globular cluster is 14' in diameter, about half that of the Moon. It is occulted about 2 hours before Antares. The crescent-moon events listed in the table should give interesting views.

Occultations of M4

U.T. date	% sunlit	Area of visibility
Jan. 25, 12^h	23-	Central U.S.A.
Feb. 21, 19	45-	Japan
Sept. 28, 11	28+	Australia

Events for Alaska and Hawaii: At Honolulu, Hawaii, Spica will be behind the Moon for 50 minutes starting at 12^h50^m U.T. May 11th, again for 80 minutes starting at 6^h 7^m July 5th, and finally for 59 minutes beginning at 15^h10^m November 18th. At Anchorage, Alaska, there is only one 61-minute Spica occultation starting at 11^h42^m May 11th. Some other special events are included in the tables on this page. Predictions for other occultations of bright stars at Honolulu are included in the R.A.S.C. *Observer's Handbook*. More predictions based on stations at Ewa Beach, HI, and at Anchorage, AK, are available from W. V. Morgan as noted [in the "For More Information" section of the "Lunar Occultation Highlights for 1987" article]. Four dark-limb grazes cross populated parts of Alaska and Hawaii, listed in the table, where "%" is the lunar % sunlit and "L" specifies a northern or southern limit.

Grazing occultations in Alaska and Hawaii

Date	U.T.	Star	Mag.	%	L	Location
March 22	14:45	W Sgr	4.3	50-	S	Honokohau to SW. Kilauea, Hawaii
April 7	5:53	Omega Cnc	5.9	59+	N	S. Clear, AK, 60 mi. S. Fairbanks
July 20	15:20	SAO 76249	7.3	23-	N	S. Kahe Pt. to Kaaawa, Oahu
Oct. 14	15:06	Z.C. 1131	7.2	51-	S	15 mi. NE of Anchorage, Alaska

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.

ILOC collects reports of lunar total occultations; I do not need copies of them.

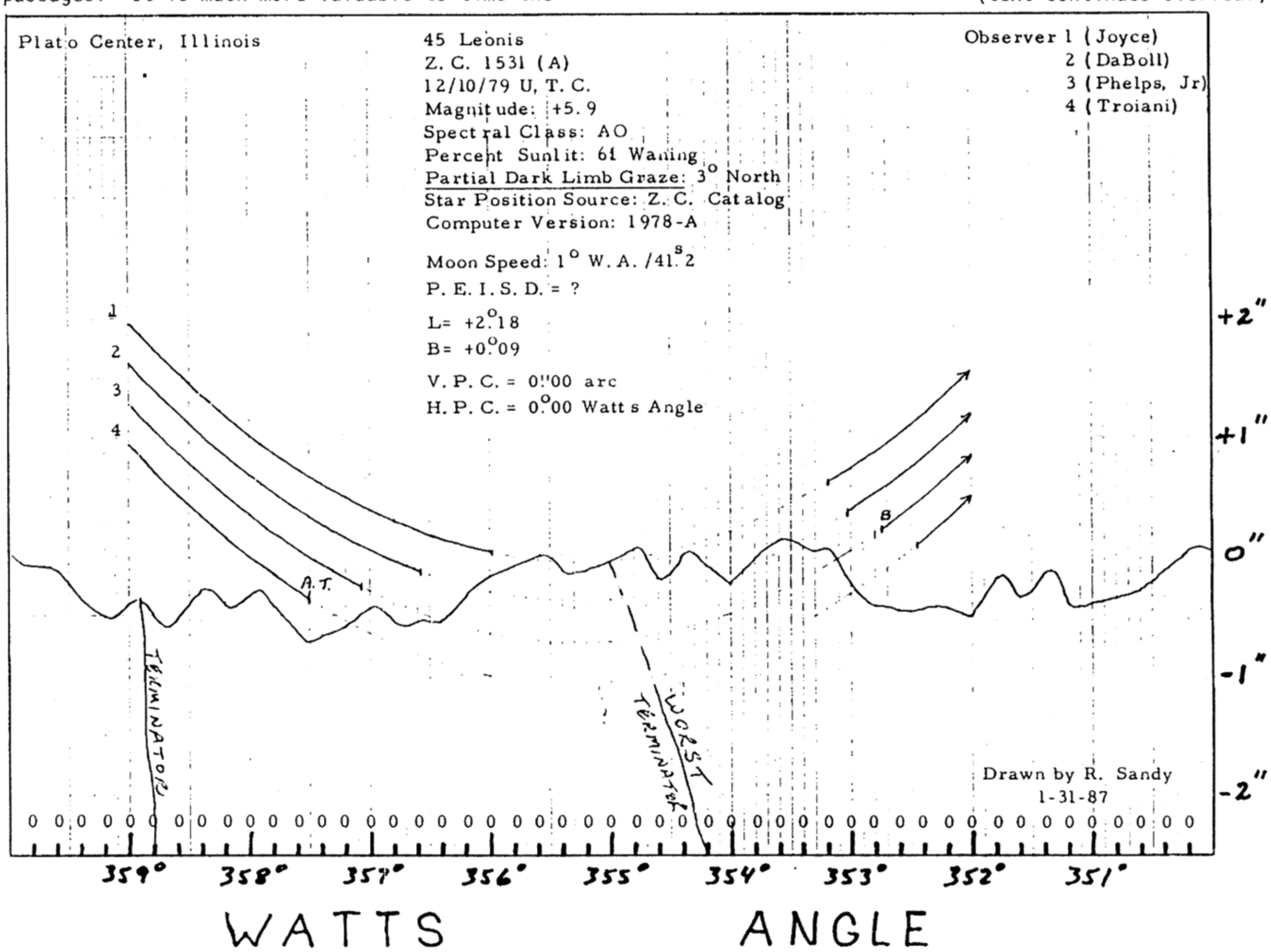
In the last issue (*O.N.* *4* (3), 40), I stated that ILOC requires data to be on its own forms. The IOTA/ILOC (main grazing) occultation report form is a standard ILOC form, so there is no problem with it. The problem arises with any format which requires transcription to ILOC's format, as this would require unnecessary work by ILOC or me.

Date	V P	Star #	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap Cm		C St WA	b
1986													
0713		1749	6.1	33+	14N	Amberley,NewZ'land	2	16		20	Brian Loader	2N 15	-3
0727		109742	8.6	63-	17N	Worth, IL	1	4	1	15	Robert H. Hays, Jr	2N342	12
0731		0611	7.0	28-		Brisighella, Italy	3	9	1	20	C. Frisoni		
0910		184191	8.4	39+	4S	Brisbane,Australia	4	17		25	Steve Hutcheon	16S178	
1011		2898	7.2	56+	7S	Pinyon Pines, CA	1	5	1	20	David Paul Werner	173	76
1108		2998	6.2	40+	16S	Georgetown, GA	1	8	1	25	Tony Murray	1S165	72
1210		0184	6.2	77+		Coventry, CT	1	1	3	11	Philip Dombrowski		
1224		138658	8.5	49-	18S	Pt. Barrow, TX	1	6	1	20	Don Stockbauer	2S199	-14
1987													
0105		146740	8.7	30+	21S	Hoskins Mound, TX	2	17	1	20	Don Stockbauer	3N160	32

Your 1987 graze predictions are being computed by a new software version (80H). A new version usually means that you will need to manually apply a new set of empirical corrections to the predictions. Please see Dunham's article "Lunar Pleiades Passages" on p. pages 58 to 62 for details, especially p. 61.

Dunham has emphasized that observers should concentrate on total occultation timings during Pleiades passages. It is much more valuable to time the largest number of totals possible than to travel to a graze path and time few to no totals. The only exception would be efforts to observe Alcyone at both limits in order to measure the lunar polar diameter. A question arises; how far must two stations timing totals separate to give non-redundant data? The contacts of the same star should not occur closer together than the smallest interval of Watts data (0.2 degree). This works out to three miles on the Earth's surface perpendicular to the bearing of graze isoskiatics during the passage. If the stations are separated a large distance downtrack, even three miles may be inadequate, since the

(text continues overleaf)



bearing will vary during the passage.

The Houston Astronomical Society can claim the distinction of observing the first graze of a Pleiad during the current series of passages. The star was Z.C. 556 on 1986 September 23 at Katy, Texas. However, none of us realized that the star is a Pleiad until after the fact. Z.C. 556 is an outlying member, and the Moon was fairly bright. These data helped David Dunham to derive an empirical correction specifically for grazes of Pleiades members (see "Lunar Pleiades Passages").

I still have copies of a paper detailing how to calculate a graze shadow shift available on request.

Thanks for the reports sent in.

CORRECTION

David Dunham points out that in the grazing occultation supplement for 1987, an incorrect designation was shown for one of the regions listed on page 87GOS-3. It should be "X1," not "XI."

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. So far, we have received 400 '1986' reports on 119 events. Only 5 reports indicated positive events. Furthermore, if we eliminate the handful of events that were well observed, we find an average of about 2 observers per event. One additional report can go a long way in determining a shift, or giving us other essential data.

The summary for the last half of 1986 is ready for the next issue – minus a few late reports. Since the addenda are time-and-space consuming, and it is desirable to have all of the data in one place, I would appreciate it if you would send me all of your 1986 reports immediately.

Additions: Table 1. Addendum to Table 1 of *O.N. 4* (2), 26 – Additional appulses observed from January through June 1986.

Asteroid	Star	Date	Observers
(1456) Saldanha	AGK3 +06 1234	Jan 12	MpMy
(1021) Flammario	AGK3 +13 1334	Mar 22	MpMy
(195) Eurykleia	AGK3 +13 1042	Apr 10	Sm
(633) Zelima	SAO 142361	Jun 11	Cp

Table 2. Addendum to Table 2 of *O.N. 4* (2), 27 – Observers and locations of events recorded from January through June 1986.

Observer	ID	Location	No.
Tim Cooper	Cp	Sasalburg, South Africa	1
Patrick Manly	My	Tempe, AZ	2
Peter Manly	Mp	Tempe, AZ	2
J. Smit	Sm	Pretoria, South Africa	1

Correction: O.N. 4 (2), 26. The Feb 18 event should list Mc as the observer, not Me.

There are several predictions by Goffin that are visible from North America, but have paths more than 2 arc seconds away. Consequently, they are not included in the North American supplement. I will send these to anyone who sends me a self-addressed envelope (if U.S.A., please add 39¢ stamp).

In answer to several questions regarding accuracy in reporting observing coordinates: The report form (I will include some ARP forms with the above mailing) asks for longitude, latitude, and elevation. For negative observations, a place name, and rough estimates of the coordinates are usually sufficient. However, if you observe an occultation, then we need geodetic coordinates accurate to within 1.0 second (0.0003 degree), or about 100 feet on the ground. Your best determination of elevation from a topographic map will be well within that accuracy (50 ft..). If we need your report for analysis of an event, then we may need the full accuracy. If it is not included, then I will call or write to you for it. Therefore, when you make an observation, you should be able to obtain the coordinates at a later date, if the need arises. Of course if you use a regular observing site, then those coordinates would be the same ones that you sent to IOTA, and should be included in your occultation/appulse reports.

ASTRONOMY AND PERSONAL COMPUTERS

Joan Bixby Dunham

Projects personal computers can be used in a number of ways to assist in occultation observing. It is not necessary to write programs; many quite useful projects can be done with nothing more than a word processor. David and I, along with others, have tried to define projects that would be interesting to do as well as helpful to observers. We developed a list of projects at a meeting in mid-January, and we have added several to the list since then. The following is a short summary of the projects:

1. Observatory project: It would be nice to be able to query a data base of observatories whenever there is a change in a predicted path for an asteroid occultation to see what observatories will be in the new predicted path. This project has several facets: 1) Collect information on local observatories, especially privately owned permanently mounted telescopes. This includes the observatory coordinates, telescope(s) size and type, the address and phone number(s) of the owners and/or observers who use them, equipment available for observing occultations, etc. An example of the type of information is that given in the Vercoutter *Directory of European Observatories*... 2) Design the data base that will hold this information. This means to define the fields used to store the information in the data base records, their contents, the order in which they appear, and their size. 3) Design an efficient algorithm to select observatories that are within the predicted asteroid occultation path.

Deciding which data base software is the best to use for these occultation projects is also a project. I have started investigating data base management systems (DBMSs), and found that good ones allow "importing" files into their data bases. We can use any computer that can communicate to the external world to prepare the data base contents, so that people can work on these projects without needing to own a specific type of computer or a specific DBMS.

2. Abstracts database: Read recent journals and astronomy-oriented publications to find papers on occultations. Write an abstract of what the paper says, and provide that, along with the name of the paper's author(s), the name of the journal and the volume, issue, pages, and date. It may or may not be desirable to provide this information in a data base. The purpose is to provide, through the *Occultation Newsletter*, a summary listing of papers on occultations, similar to those David provided in *Vol. 1* of *O.N.*

3. Update double star information in the star catalogs data used in occultation predictions. There are several sets of data collected from observers' reports of doubles detected during occultations, as well as those detected by other means. In addition, there are many known doubles with more recent data than that in the star catalogs. There is, for instance, a growing number of stars for which there are orbital elements.

4. Prepare a program to create reduction profiles of grazing occultations based on the observations and on the occultation prediction data available for PCs. Bob Bolster is attempting this on an Apple II.

5. Organize and revise the instructional papers for IOTA grazing occultation computors. This is purely a writing and editing project. Pat Trueblood has volunteered to retype these papers into machine-readable form (no small task). As she types, she will delete out-of-date information, and make changes to improve them. We need additional editorial and writing assistance from one or more people who have been computors to make this package more useful.

6. Prepare plots of tracks of the Moon's center across the Pleiades, or prepare input for David's mainframe program that currently does this job. The input for the mainframe program might be simplified by generating the lunar and solar coordinates with David's simplified LUNA and SOL subroutines.

7. Compute total occultation predictions for your region using a and b factors for standard station data, like that now used by Walter Morgan and Hans Bode. I have written a program in BASIC for an MS-DOS computer to do this.

8. Write a program that will read the standard station data mentioned above for several stations and produce a table of the brighter stars in the same format as that published in David's "Lunar Occultation Highlights" articles in the January issues of *Sky and Telescope*. This could also be used for producing similar tables for Pleiades passages that *Sky and Telescope* plans to publish in future issues for the better North American passages (starting with the one this March).

9. Help with analysis and quality assurance of observations of the well-observed 1983 occultations by Pallas and Nemausa. Similar work may be needed for comprehensive analysis of many of the video records of the 1984 May broken-annular eclipse. Part of this is to locate the observers and prepare a data base of their current addresses.

10. Computerize reporting occultations to the ILOC. Peter Manly has sent us his software that computerizes the occultation report form by collecting the data the observer enters, storing the data, and, on command, printing the observation reports. Now we need the next step: defining a format and media for sending these data to the ILOC. This will include reaching an agreement with the ILOC on what they can use. Peter Manly's software probably will not run on their computers, but this may only require that it be converted to machines they can use, and that it have an additional output in the format they use when they key in the observations.

11. Prepare a version of the USNO XZ catalog for PCs. We have several requests for this.

I will maintain a more detailed list of these projects, their status, and who is working on them, which I will provide to anyone who sends me a SASE.

Data and Program Exchange. Exchanging data and programs is a continuing problem. We are able to read disks for MS-DOS and Apple II+ (DOS and ProDOS only) machines. Also, we have modems and communications software and can upload and download software and data. We have a membership on Source (ID BBB326) and can retrieve from that, as well. We are fully aware that Apple IIs and IBM PCs are not the only personal computers available, and each programming project has a corollary – someone to convert the programs to other computers.

The following programs are available to anyone (with MS-DOS capability) who sends a diskette and a self-addressed stamped floppy mailer to me at P.O. Box 7488, Silver Spring, MD 20907:

1. Generate total occultation predictions, written in GWBASIC for MOS-DOS machines (see project #7).

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 #10).

3. Graze programs, executable load modules, and examples (5 diskettes).

David Herald has a series of programs that run on the C-64 and the C-128. In particular, he has programs for occultation predictions and reductions that would be nice to have on other formats as well as the Commodore. How much trouble that would be is unclear; if he wrote his programs in machine code rather than Basic, it might be easier to start over. He does have the ability to write and read MS-DOS diskettes, so he can probably provide the software in text files. He will provide his software for the C-64 and C-128 for the cost of the diskettes plus shipping. You can write to him about these programs at P.O. Box 254; Woden, A.C.T. 2606; Australia.

Computer Astronomy Network is "a newsletter for the computer astronomer." At 50¢ per issue, $3.00/6 issues, it is obtained by sending a check to the editor, Barry Malpas, at 20 Helen St., Warren, NJ 07060. Ask for the November-December '86 issue, which has an index to 280 articles on computer astronomy appearing in 62 magazines and journals in 1986.

SOLAR SYSTEM OCCULTATIONS DURING 1987

David W. Dunham

This is a continuation of the article started on p. 41 of the last issue. The tables of asteroidal and planetary occultations contain data for most of the second half of the year, starting (on July 18th) where the tables in the last issue ended, and going to the end of the year.

Some new events are included at the beginning of the table involving possible occultations by Comet Wilson. There is not enough time to get world maps for these events produced by Mitsuru Sôma and included in this issue. New orbital elements for the comet were used to generate a new ephemeris whose path differed from the one used for the predictions in

Table 1, Part D

1987 DATE	Universal Time	PLANET Name	m_v	Δ,AU	STAR SAO No	m_v	Sp	R.A. (1950)	Dec.	Occultation Δm	Dur	df	P	Possible Area	El Sun	MOON El	%Snl	N Up
Apr 17	12h01m	Com.Wilson	7.2	0.82	247214	8.5	K2	21h49m.4	-56° 52'	0.3	2	4	24	Indian Ocean	82°	62°	86-	none
May 6	3 42	Com.Wilson	6.8	0.65	249738	8.8	F5	7 6.0	-61 23	0.2	2	2	19	Brazil	93	86	50+	w 60° W
May 7	9 11	Com.Wilson	6.8	0.66	235120	10.2	A2	7 19.6	-57 47	0.05	2	3	19	Patagonia,Austral.,PNG	92	81	62+	w150 E
May 12	12 37	Com.Wilson	7.1	0.75	219137	7.8	B9	7 53.2	-44 15	0.5	2	3	22	Antarctica; India	89	83	99+	all
May 22	22 24	Com.Wilson	7.8	1.02	175746	8.9	K2	8 21.8	-26 2	0.3	2	5	30	South Atlantic?n	80	118	22-	none
May 25	11 23	Com Wilson	7.9	1.09	175893	9.7	A5	8 26.0	-23 3	0.2	3	5	32	South Atlantic?s	77	98	5-	all
Jul 18	2 23-35	1975QD	16.4	3.83	189192	7.6	K0	20 18.5	-23 38	8.8	5	24	70	n.Africa,Brazil,n.Chile	172	86	47-	e 35 W
Jul 20	23 52-71	Christine	12.6	1.53	186544A	6.0	B1	18 12.2	-20 24	6.6	6	27	41	n.Africa,Patagonia	155	150	20-	e 30 E
Jul 21	0 03-21	Christine	12.6	1.53	186544B	13.0		18 12.2	-20 24	0.6	6	27	41	nw Africa,Brazil,Peru	155	150	20-	e 15 E
Jul 21	19 28	Europa	12.0	3.35		11.7		3 59.7	13 57	0.9	9	11	17	China, Korea	57	17	14-	all
Jul 22	2 58	Bamberga	11.2	2.10		10.4		3 44.5	28 31	1.2	7	8	12	central Africa	58	17	12-	all
Jul 22	23 33	Bamberga	11.2	2.10		12.8		3 46.7	28 41	0.23	7	8	12	Seychelles?s; India	59	27	8-	e 60 E
Jul 23	4 45-58	Mandeville	13.2	2.13	165095A	9.3	G5	22 24.9	-13 19	3.9	10	24	27	nw Africa,se S.America	146	117	6-	e 15 W
Jul 23	4 47-56	Mandeville	13.2	2.13	165095B	11.1		22 24.9	-13 19	2.2	10	24	27	Azores?s; nw S.America	146	117	6-	e 40 W
Jul 24	1 50-60	Christine	12.6	1.54		9.6	M3	18 10.1	-20 42	3.1	6	29	41	e. North America?s	152	169	3-	none
Jul 26	7 24-34	Pales	11.8	1.94		9.2	F8	20 22.8	-17 54	2.7	14	23	16	Patagonia?n;Antarctica	178	173	0+	none
Jul 26	10 10-56	Galatea	11.7	1.35	145932	9.2	K0	22 9.3	-5 10	2.6	27	55	17	Ecuador,Tahiti,Brisbane	149	154	0+	none
Jul 28	4 50	Princetonia	14.0	3.41	119510	8.1	F5	12 36.0	0 30	5.8	5	12	36	Tahiti?s;(CA,Mexico)?n	64	38	5+	w135 W
Jul 28	12 47	Chaldaea	13.6	2.63	93872	5.6	F0	4 17.1	13 55	8.0	3	9	35	Hawaii?s; s.California	60	89	6+	none
Jul 29	9 55	Roma	13.4	2.24	110838	7.0	K0	2 52.7	0 14	6.4	2	13	68	Peru	85	123	11+	none
Aug 5	2 28	Hilda	14.8	5.26		10.1		6 7.9	19 28	4.7	6	13	34	central Africa	40	157	74+	none
Aug 5	9 33-51	Pompeja	12.7	1.79	188689	8.2	K2	19 51.2	-24 38	4.5	10	25	24	Peru, NZ, se Australia	163	40	77+	w105 W
Aug 5	13 29-47	Beatrix	11.8	1.50	188987	9.2	A	20 7.6	-28 38	2.7	12	25	18	HI?s; se Asia,e. India	164	40	79+	w180
Aug 8	18 52-70	Melete	11.9	1.62	92414	8.7	G5	1 21.2	11 42	3.3	23	40	17	n.India, China, Kyushu	112	77	99+	all
Aug 10	5 56-79	Sophrosyne	13.3	2.21	208088	8.1	G5	16 47.6	-36 40	5.1	17	47	30	(N.Z.,HI)?w; Calif.?e	118	73	99-	all
Aug 10	20 23	Ophelia	14.6	3.64		13.1		5 58.1	22 33	1.8	4	10	40	Manchuria	48	112	97-	all
Aug 11	22 15	Melpomene	11.5	2.87		10.8		13 55.1	-1 52	1.2	6	13	28	Canary Is.; nw Africa	70	144	91-	e 25 W
Aug 12	22 41	Ophelia	14.6	3.61		11.7		6 1.1	22 33	3.0	4	10	40	nw U.S.S.R.?s	49	83	83-	all
Aug 14	5 25	Ophelia	14.6	3.60		11.2		6 2.9	22 34	3.5	4	10	40	(Newfndland,Portugal)?s	50	66	71-	all
Aug 15	18 30-83	Leto	10.5	1.60	210421	9.4	A5	18 36.7	-34 39	1.4	42	82	18	Sumatra,Red Sea,Balkans	135	128	55-	e 65 E
Aug 18	4 50	Ophelia	14.6	3.55	78085	9.1	A0	6 8.6	22 34	5.5	4	11	39	northwestern Africa	52	18	32-	all
Aug 18	9 43	Egeria	11.9	2.79		12.4		5 33.3	28 27	0.5	7	10	16	Alaska?s	60	7	30-	all
Aug 18	13 51-63	Pales	11.9	1.95		10.9		20 3.8	-18 35	1.4	18	28	16	P.I.,Malaysia, s.India	155	140	29-	none
Aug 19	12 35	Egeria	11.9	2.77		12.4		5 35.3	28 34	0.5	7	10	16	HI?n; Baja Calif. Sur	61	7	21-	all
Aug 20	7 54	Ophelia	14.6	3.52		12.3		6 11.6	22 34	2.4	4	11	39	eastern Canada?s	54	10	15-	all
Aug 24	18 07-15	Roma	13.0	1.93		10.3	F8	3 23.0	-0 54	2.8	3	19	58	Malaysia, P.N.G., Fiji	102	105	0+	none
Aug 27	15 00-30	Christine	13.2	1.85		11.2	G1	18 3.7	-23 32	2.2	10	47	50	Oman;India?n;n.Australia	118	82	9+	w 75 E
Aug 30	10 22	Eukrate	11.5	1.55	213992	9.0	G0	22 37.1	-30 43	2.6	10	18	16	sw U.S.A.; Hawaii?s	159	102	32+	none
Aug 31	1 21-45	Flora	8.7	1.07	190239	9.1	G5	21 17.0	-22 34	0.6	23	30	10	nwAfrica,sBrazil,c.Chile	157	81	38+	w 35 W
Sep 1	11 42	Ophelia	14.5	3.37		11.0		6 28.1	22 29	3.6	4	12	37	se Alaska, n.Brit.Col.	62	155	54+	none
Sep 1	18 22-36	Adria	13.2	1.90	128330	9.5	F0	23 38.8	3 21	3.8	7	22	31	PI,Malaysia,S.Lanka,Kenya	161	101	57+	w85 E
Sep 2	13 02	Alexandra	11.7	1.96	184395	9.2	G0	16 24.2	-29 42	2.6	9	14	16	S.Lanka,Indochina,seChina	90	18	65+	all
Sep 3	11 24	Davida	12.5	4.10		10.5		13 48.8	2 25	2.2	9	11	18	Vietnam, s.Philippines	46	78	75+	all
Sep 3	11 14-45	Pales	12.1	2.04		10.7		19 55.3	-18 51	1.7	34	54	17	Oahu,Micronesia,Malaysia	137	18	75+	all
Sep 3	17 39-49	Adria	13.2	1.89	128306	9.2	K0	23 37.1	3 19	4.0	7	22	31	U. S. S. R.	163	72	78+	w 80 E
Sep 7	13 48-54	Ekard	12.3	1.49	141816	9.2	K0	17 39.5	-4 15	3.2	8	19	22	Tibet,se China, Taiwan	100	78	100+	all
Sep 8	1 18-38	Galatea	11.3	1.23	145609	9.1	G5	21 40.2	-8 38	2.3	17	33	16	Norway, UK, PR, Panama	159	25	100-	all
Sep 9	19 08	Ophelia	14.5	3.26		11.7		6 38.7	22 22	2.9	5	13	36	Indonesia, Micronesia	67	86	94-	all
Sep 10	0 04	Ophelia	14.5	3.25		11.6		6 38.9	22 22	2.9	5	13	36	Mauritius?n	67	83	93-	all
Sep 10	2 29	Patientia	12.8	3.99		10.6		13 28.9	2 3	2.3	7	10	21	Rocky Mountains?s	35	168	93-	e105 W
Sep 11	7 33-46	Antigone	12.3	2.50	129951	9.2	G	2 28.4	-0 36	3.1	13	37	32	se S.America?n;Antarctic	131	17	84-	s 70 S

the last issue by several arc minutes. Consequently, none of the events listed in the last issue will occur. There is also considerable doubt about the new events, since the comet has been too close to the Sun to observe during the last three months. A significant change could occur during March, when the comet again becomes far enough from the Sun to photograph. A new orbit using these new observations is likely to be different from the orbit used here. If new events are found as a result, I will try to inform regional coordinators.

Table 2, Part D

1987 DATE	No.	MINOR PLANET Name	km	diam."	RSOI	Type	MOTION °/Day	PA	STAR SAO No	DM/ID No	D	Ephem. Source	S	COMPARISON DATA AGK3 No	Shift	Time	APPARENT R.A.	Dec.
Apr 17		Com.Wilson	100	0.17	155		2.045	156°	247211	P56 9759		MPC11429	S				21h51m.2	-56°28'
Apr 17		Com.Wilson	100	0.17	155		2.061	156	247214	P57 9977		MPC11429	PG		-0.41	0.1	21 52.0	-56 42
May 6		Com.Wilson	100	0.21	158		3.310	27	249738	P61 773		MPC11429	S				7 6.4	-61 27
May 7		Com.Wilson	100	0.21	158		3.169	24	235120	P57 1197		MPC11429	S				7 20.2	-57 52
May 12		Com.Wilson	100	0.18	161		2.462	19	219137	C44 3848		MPC11429	G				7 54.4	-44 21
May 22		Com.Wilson	100	0.14	167		1.326	18	175746	C25 6015		MPC11429	S				8 23.4	-26 9
May 25		Com.Wilson	100	0.13	170		1.147	18	175893	C22 6196		MPC11429	S				8 27.7	-23 10
Jul 18	2893	1975QD	80	0.03	446		0.138	244	189192	C2316172		EMP 1986	7P		-0.48	-0.2	20 20.8	-23 31
Jul 21	628	Christine	54	0.05	127	U	0.199	241	186544	-20 5055	T	EMP 1986	ZY		-0.35	-0.3	18 14.5	-20 24
Jul 21	628	Christine	54	0.05	127	U	0.199	241	186544	-20 5055	B	EMP 1986	Z				18 14.5	-20 24
Jul 21	52	Europa	291	0.12	1874	C	0.329	82				EMP 1982	C				4 1.8	14 3
Jul 22	324	Bamberga	256	0.17	946	C	0.582	71				EMP 1981	C				3 46.8	28 38
Jul 22	324	Bamberga	256	0.17	947	C	0.580	71				EMP 1981	C				3 49.0	28 47
Jul 23	739	Mandeville	114	0.07	474	EMP	0.183	216	165095	-13 6194	A	EMP 1986	XS				22 26.9	-13 7
Jul 23	739	Mandeville	114	0.07	474	EMP	0.183	216	165095	-13 6194	B	EMP 1986	X				22 26.9	-13 7
Jul 24	628	Christine	54	0.05	127	U	0.184	239		L 3 4161		EMP 1986	H				18 12.3	-20 41
Jul 26	49	Pales	175	0.12	882	C	0.207	261		-18 5677		Herget77	HY		-2.46	-4.7	20 24.9	-17 46
Jul 26	74	Galatea	113	0.12	353	C	0.102	254	145932	- 5 5727		Herget78	XS				22 11.3	-4 59
Jul 28	508	Princetonia	139	0.06	654	C	0.286	123	119510	+ 1 2728		Landgraf	RX	N 0 1592	-0.10	0.3	12 37.9	0 17
Jul 28	313	Chaldaea	108	0.06	331	C	0.436	88	93872	+13 663		Herget78	PA	N13 342	-0.02	0.0	4 19.2	14 0
Jul 29	472	Roma	48	0.03	102	S	0.333	92	110838	- 0 451		EMP 1986	AS	N 0 244	0.60	0.2	2 54.6	0 23
Aug 5	153	Hilda	224	0.06	1957	P	0.222	95		L 1 230		EMP 1986	H				6 10.1	19 28
Aug 5	203	Pompeja	106	0.08	390	C	0.196	265	188689	C2415666		EMP 1981	XS				19 53.5	-24 33
Aug 5	83	Beatrix	118	0.11	411	C	0.216	264	188987	C2816464		Herget78	S				20 9.9	-28 32
Aug 8	56	Melete	142	0.12	483	C	0.128	86	92414	+11 175		EMP 1980	XA	N11 139	0.00	-0.8	1 23.2	11 53
Aug 10	134	Sophrosyne	107	0.07	403	C	0.094	24	208088	C3611009		EMP 1984	S				16 50.1	-36 44
Aug 10	171	Ophelia	132	0.05	595	U	0.334	89				EMP 1984	C				6 0.3	22 33
Aug 11	18	Melpomene	148	0.07	624	S	0.292	117		L 2 3896		EMP 1980	H				13 57.0	-2 3
Aug 12	171	Ophelia	132	0.05	594	U	0.332	89				EMP 1984	C				6 3.4	22 33
Aug 14	171	Ophelia	132	0.05	594	U	0.331	90				EMP 1984	C				6 5.2	22 34
Aug 15	68	Leto	128	0.11	451	C	0.063	304	210421	C3413010		Herget78	S				18 39.2	-34 37
Aug 18	171	Ophelia	132	0.05	593	U	0.326	90	78085	+22 1215		EMP 1984	XA	N22 657	0.11	-0.1	6 10.8	22 33
Aug 18	13	Egeria	245	0.12	1210	C	0.394	75				Herget77	C				5 35.6	28 28
Aug 18	49	Pales	175	0.12	865	C	0.166	262		L 5 2539		Herget77	H				20 6.0	-18 29
Aug 19	13	Egeria	245	0.12	1210	C	0.392	75				Herget77	C				5 37.6	28 35
Aug 20	171	Ophelia	132	0.05	593	U	0.323	90				EMP 1984	C				6 13.8	22 33
Aug 24	472	Roma	48	0.03	101	S	0.246	108		- 1 488		EMP 1986	A	S 0 360			3 24.9	-0 46
Aug 27	628	Christine	54	0.04	127	U	0.102	132		C2313912		EMP 1986	H				18 6.0	-23 32
Aug 30	247	Eukrate	143	0.13	555	C	0.298	279	213992	C3118912		EMP 1982	S				22 39.2	-30 31
Aug 31	8	Flora	160	0.21	531	S	0.214	243	190239	C2215327		Branham	XS				21 19.2	-22 25
Sep 1	171	Ophelia	132	0.05	590	U	0.303	92				EMP 1984	C				6 30.3	22 27
Sep 1	143	Adria	90	0.07	316	C	0.211	265	128330	+ 2 4702		EMP 1986	XA	N 3 3036	-0.12	2.9	23 40.7	3 34
Sep 2	54	Alexandra	177	0.12	669	C	0.339	81	184395	C2912547		Herget78	S				16 26.5	-29 47
Sep 3	511	Davida	335	0.11	2740	C	0.298	119		L 2 3555		EMP 1982	H				13 50.7	2 14
Sep 3	49	Pales	175	0.12	854	C	0.084	263		L 5 1969		Herget77	H				19 57.5	-18 45
Sep 3	143	Adria	90	0.07	316	C	0.217	264	128306	+ 2 4696		EMP 1986	XA	N 3 3031	-0.10	1.6	23 39.0	3 31
Sep 7	694	Ekard	100	0.09	250	C	0.283	105	141816	- 4 4330		EMP 1986	S				17 41.5	-4 17
Sep 8	74	Galatea	113	0.13	341	C	0.179	237	145609	- 9 5819		Herget78	XS				21 42.2	-8 28
Sep 9	171	Ophelia	132	0.06	588	U	0.287	93		A2250227		EMP 1984	CC		0.19	-0.7	6 40.9	22 20
Sep 10	171	Ophelia	132	0.06	588	U	0.286	93				EMP 1984	C				6 41.2	22 20
Sep 10	451	Patientia	281	0.10	1951	C	0.341	118		L 2 2476		Herget78	H				13 30.8	1 51

The osculating orbital elements for Comet Wilson published in M.P.C. 11429 (1986 December) and used here are hyperbolic. My computer programs, designed for asteroids and planets, could only handle elliptical orbital elements. It took me nearly a week to change the program to use hyperbolic orbital elements, and verify the resulting ephemeris, which delayed production of this newsletter. As mentioned last time, the magnitudes are very rough estimates for the near-nucleus region.

Notes about individual events. The first several notes below refer to events listed in the last issue. Wayne Warren supplied some important information, especially for double stars.

Feb. 16, (19) Fortuna and B.D. +18° 565: The star is ADS 2891, with 10.8 and 11.3-mag. components separated by 2".4 in p.a. 191°. A double star code of "M" should have been printed under the "D" column. The star's duplicity was noticed by A. Klemola when he measured a plate taken to improve the prediction for this event. The star was not flagged as double in the AGK3, my only source for it in the combined catalog. It is surprising that the star is in the AGK3, since close double stars, whose images are difficult to measure accurately on a photographic plate, are usually not included in the AGK3.

April 4: Venus will be 79% sunlit with PACBL 67°. See Sôma's world map for the location of the center-

Table 1, Part E

1987 DATE	Universal Time	PLANET Name	PLANET m_v	PLANET Δ,AU	STAR SAO No.	STAR m_v	STAR Sp	STAR R.A. (1950)	STAR Dec.	Occultation Δm	Occultation Dur	Occultation df	Occultation P	Possible Area	El Sun	MOON El	MOON %Snl	MOON Up
Sep 12	0h36m	Ophelia	14.5	3.23		12.0		6h41m.4	22°20'	2.6	5	13	35	Egypt, Middle East	69°	56°	78-	all
Sep 13	8 19-35	Bilkis	14.1	1.75	146144	8.3	K2	22 30.0	-5 26	5.9	4	21	49	Manitoba,w.USA, HI, PNG	167	83	66-	e158 W
Sep 13	14 07	Vesta	8.3	2.92		11.5		7 26.5	20 32	0.06	18	11	8	far south Pacific Ocean	60	47	64-	all
Sep 14	18 28-48	Athor	11.3	1.16	128919	9.2	G5	0 40.9	-1 10	2.3	12	26	17	P.I.,s.Asia,Yemen,Sudan	161	70	52-	e 65 E
Sep 16	13 28	Egeria	11.7	2.43		10.6		6 21.4	31 13	1.5	10	12	14	Hawaii?s; sw Alaska	78	6	35-	all
Sep 16	18 02	Eugenia	12.3	2.71	159661	9.0	G5	16 1.0	-14 59	3.4	8	11	16	South Africa	69	138	33-	none
Sep 16	19 25	Egeria	11.7	2.42		12.0		6 21.8	31 15	0.6	10	12	14	Singapore,Luzon;Japan?n	78	9	33-	all
Sep 18	10 00-11	Nemausa	11.5	1.70		13.1		2 40.4	8 20	0.2	24	44	18	Shemya; Hawaii?e	134	82	20-	none
Sep 19	10 10-28	Bilkis	14.2	1.77	146105	8.8	G5	22 25.4	-6 12	5.4	4	23	49	nw USA;HI?s;n Australia	160	157	13-	e120 W
Sep 19	21 27-39	Turandot	14.4	2.64	94325	8.1	K0	5 4.0	13 35	6.4	9	32	45	Mideast,India,se China	100	65	10-	e 85 E
Sep 20	3 01	Ophelia	14.4	3.11		12.1		6 50.9	22 12	2.4	5	14	34	Mediterranean Sea area	74	41	8-	e 0
Sep 20	21 11	Egeria	11.7	2.37		12.0		6 28.0	31 38	0.6	10	13	14	India, w & ne China	81	56	5-	e100 E
Sep 27	7 33	Diana	14.0	2.99	186496	9.3	K2	18 10.7	-29 33	4.7	9	21	30	w Antarctica; N.Z.?n	89	39	18+	all
Sep 27	13 49	Themis	13.3	3.62	184207	9.3	G0	16 8.5	-21 28	4.1	7	12	23	eAntarctica;wAustralia?n	61	8	20+	all
Sep 27	22 59	Vesta	8.3	2.75		12.1		7 47.3	20 1	0.03	21	12	7	Seychelles; India?n	69	127	24+	none
Sep 28	16 24-43	Kalypso	13.4	1.95	164633	9.2	K5	21 43.4	-15 29	4.2	17	43	26	e Australia,e Antarctica	138	71	31+	w120 E
Oct 2	15 36	Asporina	13.6	3.10	140372	8.5	A0	15 9.1	-5 18	5.1	2	8	64	Madagascar?n	39	83	74+	all
Oct 3	11 56	Hygiea	11.4	3.83		11.8		9 37.9	12 37	0.6	12	11	13	se Pacific; Mexico?n	47	174	83+	none
Oct 7	3 10	Victoria	12.9	3.41		12.0		9 40.3	6 49	1.3	4	10	37	n. Africa, Israel	48	133	100+	all
Oct 8	17 14-40	Massalia	11.0	1.48	76842	9.2	A2	4 52.7	22 7	2.0	28	48	15	Kashmir,nChina,Sakhalin	120	40	97-	all
Oct 9	17 50	Ludmilla	12.1	1.84	78477	8.0	K2	6 29.8	25 53	4.1	10	19	20	northern U.S.S.R.?s	99	49	92-	all
Oct 10	0 38	Ceres	9.1	3.02		10.7		18 1.6	-28 34	0.22	39	14	5	nChile, Bolivia, Brazil	75	142	90-	e 60 W
Oct 18	1 00	Diana	14.2	3.29	186957	9.5	F8	18 30.1	-28 30	4.7	6	15	33	Wendell Sea;Argentina?n	73	127	21-	none
Oct 19	2 15-37	Roma	12.1	1.44	130628	5.8	G5	3 36.0	-7 33	6.3	6	29	43	Kenya,Angola;T.d.Fuego?n	145	111	13-	e 15 E
Oct 20	6 08-20	Jupiter	-2.9	3.96	109969	9.2	F5	1 30.9	7 48		4353	24	2	Western Hemisphere	178	152	6-	e 30 W
Oct 21	7 00	Victoria	12.8	3.25		10.6		9 57.3	4 53	2.4	4	11	35	Bermuda, Canary Is.	57	40	2-	e 30 W
Oct 21	23 43-51	Lamberta	13.1	2.46	189898	8.9	F5	20 56.0	-27 27	4.2	11	23	25	e.Antarctica; Angola	101	110	1-	none
Oct 23	23 44	Sylvia	13.4	4.07		10.7		10 9.6	20 35	2.8	10	14	21	Svalbard; n.U.S.S.R.?s	63	79	2+	none
Oct 25	13 05	Christine	14.0	2.57		11.1		19 3.3	-25 37	3.0	2	12	69	northern Australia	73	38	9+	w115 E
Oct 25	19 50-70	Hilda	14.4	4.13		10.7		6 55.8	16 51	3.7	46	82	27	(India,w.Australia)?n	108	146	12+	none
Oct 25	23 54-61	Flora	9.8	1.45	190319	9.3	G5	21 22.5	-22 15	1.1	14	21	13	Wendell Sea, S. Africa	105	63	13+	w 15 W
Oct 27	11 27	Hebe	9.8	1.92	188815	7.9	K0	19 57.8	-22 47	2.1	9	13	15	southern Siberia	84	24	26+	w105 E
Oct 27	13 03	Alexandra	12.2	2.52		10.8	K0	18 7.6	-26 42	1.6	5	9	21	Krakatoa, Borneo	59	3	26+	all
Nov 1	2 22	Bettina	12.4	2.67		10.0		9 15.6	29 57	2.5	13	16	14	nw Africa, Israel, Iraq	86	151	76+	w 5 W
Nov 1	9 40	Pales	12.7	2.63	163450	8.0	K0	20 16.9	-17 39	4.8	9	17	22	Shanghai, Japan	85	41	79+	all
Nov 1	15 13	Aspasia	12.6	3.01	137809	8.0	K0	10 46.8	-2 31	4.6	5	10	22	Hawaii?s	55	169	81+	none
Nov 2	1 45-61	Nemausa	10.8	1.51	110418	9.3	K0	2 11.5	2 14	1.7	12	21	16	Syria,nwAfrica,Amazon,Peru	167	40	85+	w 10 E
Nov 5	9 25	Kassandra	13.1	2.76		10.3	F5	11 17.8	3 23	2.9	3	9	31	Panama, nw S. America	53	131	100+	all
Nov 5	9 45	Ceres	9.2	3.36		10.6	G0	18 37.5	-28 29	0.3	29	11	5	New Zealand?n	57	120	100+	all
Nov 9	13 02-15	Freda	13.0	1.91	166333	9.3	F8	0 29.2	-22 57	3.7	8	20	26	wAustral.,se&cen. Asia	127	96	85-	none
Nov 13	8 28-59	Chaldaea	11.8	1.31		11.0	K8	6 27.8	4 48	1.2	19	41	18	eCanada,Dom.Rep.,wS.Amer.	130	45	52-	all
Nov 13	22 57	Camilla	12.9	3.58		12.5		11 7.9	1 53	1.0	9	13	21	northern Siberia?s	63	24	47-	all
Nov 14	0 13	Iris	10.2	2.23		11.5		20 13.2	-14 52	0.3	8	11	15	Midwest, se Canada	72	156	46-	none
Nov 14	12 29	Eugenia	12.5	3.30	160773	9.0	A0	17 40.2	-19 29	3.6	6	8	19	northern India, Tibet	34	114	41-	none
Nov 15	3 08	Galatea	12.4	1.76	164852	9.2	G5	22 2.9	-10 8	3.3	7	16	23	central Chile, s.Brazil	98	170	36-	none
Nov 15	14 09-25	Lacadiera	12.8	1.45		10.6		3 52.7	19 50	2.3	6	20	31	nwUSA,Japan,China,sIndia	172	104	32-	e165 E
Nov 17	17 44-80	Pandora	11.5	1.78		10.5	F8	6 40.5	33 8	1.4	21	50	23	PNG?s,Taiwan,China,Mideast	135	92	14-	e135 E
Nov 19	19 49	Hestia	14.0	2.93	118516	8.8	G0	10 46.7	6 12	5.2	6	15	32	s. Siberia, Sakhalin I.	76	57	3-	none
Nov 20	13 23-38	Turandot	13.8	2.16	94207	8.5	K2	4 52.5	11 41	5.3	7	23	36	BajaCA,HI?s,PI?s,Indochina	161	151	1-	none
Nov 24	11 39	Mars	1.7	2.39	158224	9.3	K5	13 51.6	-10 39		144	6	1	Mexico	31	74	13+	none
Nov 24	20 16-29	Zelinda	10.7	1.03	59367	8.3	F5	6 38.3	33 54	2.5	22	39	13	sPI,Borneo,Java,wAustrl.?s	142	167	17+	none

line and of the northern and southern limits.

May 16: For the B-component in Table 1, Part C on p. 46 of the last issue, the SAO number is wrong; it should be 94171, the same as the A-component. The star is ADS 3483, a member of the Hyades, with separation 0".37 in p.a. 141°, according to Scardia's 1976 orbit. SAO 94171A is a spectroscopic binary of unknown period. Since the separation is so small, the apparent Δm will be much smaller than given in the table, since one component will remain visible while the other one is occulted. For A, the Δm will be 1.9, while for B, it will be only 0.3, too small for reliable visual observation.

May 21: The star is Z.C. 3469.

June 29: The star is Z.C. 1763.

July 18: The star is Z.C. 2970.

July 21, (628) Christine and SAO 186544: The star is 16 Sagittarii = Z.C. 2639 = ADS 11191. The components are separated by 6".0 in p.a. 216°. The A-

Table 2, Part E

1987	MINOR	PLANET					MOTION		STAR			Ephem.		COMPARISON DATA				APPARENT	
DATE	No.	Name	km-diam.	-"	RSOI	Type	°/Day	PA	SAO No	DM/ID No	D	Source	S	AGK3	No	Shift	Time	R.A.	Dec.
Sep 11	129	Antigone	113	0.06	503	U	0.112	209	129951	- 1° 347		EMP 1980	AS	S 0	268	0.16	0.7	2h30m.4	-0°27'
Sep 12	171	Ophelia	132	0.06	588	U	0.282	93		A2251184		EMP 1984	CC			-0.10	-0.0	6 43.7	22 18
Sep 13	585	Bilkis	52	0.04	132	C	0.236	237	146144	- 5 5810		EMP 1986	XS					22 32.0	-5 14
Sep 13	4	Vesta	555	0.26	4318	U	0.356	95		A2156386		APAENAXX	C					7 28.7	20 27
Sep 14	161	Athor	100	0.12	275	CMEU	0.235	266	128919	- 1 88	A	MPC11041	AG	S 1	57	0.11	-0.3	0 42.8	-0 58
Sep 16	13	Egeria	245	0.14	1199	C	0.342	74				Herget77	C					6 23.9	31 12
Sep 16	45	Eugenia	250	0.13	1283	U	0.364	107	159661	-14 4339		Herget77	XS					16 3.1	-15 5
Sep 16	13	Egeria	245	0.14	1199	C	0.341	74				Herget77	C					6 24.2	31 14
Sep 18	51	Nemausa	141	0.11	540	CU	0.113	198				Krstnn77	C					2 42.4	8 30
Sep 19	585	Bilkis	52	0.04	132	C	0.217	236	146105	- 6 5997		EMP 1986	XS					22 27.4	-6 0
Sep 19	530	Turandot	86	0.04	306	CMEU	0.126	101	94325	+13 804		Herget78	AS	N13	417	-0.18	-0.1	5 6.1	13 38
Sep 20	171	Ophelia	132	0.06	586	U	0.263	94				EMP 1984	C					6 53.2	22 9
Sep 20	13	Egeria	245	0.14	1198	C	0.332	73				Herget77	C					6 30.4	31 36
Sep 27	78	Diana	144	0.07	698	C	0.177	73	186496	C2914681		Herget77	HX			-0.22	-0.1	18 13.2	-29 33
Sep 27	24	Themis	228	0.09	1440	C	0.284	101	184207	-21 4294		Herget78	XS					16 10.7	-21 33
Sep 27	4	Vesta	555	0.28	4311	U	0.326	97				APAENAXX	C					7 49.5	19 55
Sep 28	53	Kalypso	110	0.08	413	C	0.108	241	164633	-15 6060		Herget79	XS					21 45.5	-15 18
Oct 2	246	Asporina	70	0.03	182	UX	0.460	108	140372	- 4 3828		EMP 1986	YG			-0.10	0.5	15 11.1	-5 26
Oct 3	10	Hygiea	443	0.16	3870	C	0.314	111				Schmadel	C					9 40.0	12 27
Oct 7	12	Victoria	135	0.05	574	S	0.339	114				Herget77	C					9 42.3	6 39
Oct 8	20	Massalia	140	0.13	461	S	0.111	88	76842	+21 727		EMP 1983	RX	N22	483			4 54.9	22 10
Oct 9	675	Ludmilla	137	0.10	459		0.252	104	78477	+25 1314		EMP 1983	X					6 32.1	25 52
Oct 10	1	Ceres	946	0.43	10939	C	0.267	91		C2814103		APAENAXX	H					18 4.0	-28 34
Oct 18	78	Diana	144	0.06	700	C	0.241	78	186957	C2814698		Herget77	HX			0.24	-0.7	18 32.5	-28 28
Oct 19	472	Roma	48	0.05	100	S	0.185	228	130628	- 7 647		EMP 1986	PY			-1.11	-3.3	3 37.9	-7 26
Oct 20		Jupiter	140904	24.53			0.135	249	109969	+ 7 230			XA	N 7	172	0.09	0.1	1 32.9	8 0
Oct 21	12	Victoria	135	0.06	573	S	0.317	116				Herget77	C					9 59.2	4 42
Oct 21	187	Lamberta	143	0.08	623	C	0.179	47	189898	C2715164		Herget	S					20 58.3	-27 18
Oct 23	87	Sylvia	275	0.09	2186	P	0.229	101				Herget78	C					10 11.7	20 24
Oct 25	628	Christine	54	0.03	126	U	0.343	89		B2565374		EMP 1986	C					19 5.6	-25 33
Oct 25	153	Hilda	224	0.07	1959	P	0.039	149		L 1 2134		EMP 1986	H					6 58.0	16 48
Oct 25	8	Flora	160	0.15	508	S	0.254	68	190319	C2215376		Branham	XS					21 24.7	-22 5
Oct 27	6	Hebe	186	0.13	674	S	0.368	92	188815	C2214412		Branham	G					20 0.1	-22 40
Oct 27	54	Alexandra	177	0.10	661	C	0.477	81		C2612888		Herget78	H					18 9.9	-26 41
Nov 1	250	Bettina	270	0.14	1588	EMP	0.249	92				Herget81	C					9 17.9	29 48
Nov 1	49	Pales	175	0.09	813	C	0.242	77	163450	-17 5936		Herget77	H7			0.18	1.0	20 19.0	-17 32
Nov 1	409	Aspasia	194	0.09	893	C	0.390	118	137809	- 2 3227	F	Herget78	XA	S 2	619	-2.02	-2.0	10 48.7	-2 43
Nov 2	51	Nemausa	141	0.13	536	CU	0.257	241	110418	+ 1 392		Krstnn77	AS	N 2	221	-0.08	-0.9	2 13.5	2 25
Nov 5	114	Kassandra	131	0.07	445	C	0.449	111		+ 3 2487		Herget78	XA	N 3	1483	0.30	-0.7	11 19.7	3 11
Nov 5	1	Ceres	946	0.39	10991	C	0.326	87		C2814856		APAENAXX	H					18 39.9	-28 27
Nov 9	1093	Freda	105	0.08	364	C	0.236	334	166333	C23 188		EMP 1986	S					0 31.2	-22 44
Nov 13	313	Chaldaea	108	0.11	301	C	0.141	176		+ 4 1281		Herget78	A	N 4	777			6 29.9	4 46
Nov 13	107	Camilla	252	0.10	1677	C	0.269	110				EMP 1986	C					11 9.8	1 41
Nov 14	7	Iris	222	0.14	912	S	0.395	79		L 5 3047		Branham	H					20 15.3	-14 45
Nov 14	45	Eugenia	250	0.10	1298	U	0.442	95	160773	-19 4693		Herget77	XS					17 42.4	-19 30
Nov 15	74	Galatea	113	0.09	329	C	0.304	77	164852	-10 5830		Herget78	XS					22 4.9	-9 57
Nov 15	336	Lacadiera	69	0.07	180	C	0.271	249				EMP 1982	C					3 54.9	19 57
Nov 17	55	Pandora	113	0.09	398	CMEU	0.099	313		+33 1391		Herget78	A	N33	689			6 43.0	33 5
Nov 19	46	Hestia	133	0.06	563	F	0.247	112	118516	+ 6 2355		Yeomans	XA	N 6	1360	0.53	-1.2	10 48.7	6 0
Nov 20	530	Turandot	86	0.05	319	CMEU	0.197	264	94207	+11 677		Herget78	AS	N11	462	0.06	-0.7	4 54.6	11 44
Nov 24		Mars	6782	3.91			0.653	111	158224	-10 3779			XS					13 53.6	-10 50

component may be a spectroscopic binary.

July 23: The star is the double star RST 4104, separation 2″4 in position angle 132°. If the seeing is not good, so that the components can not be resolved, the effective Δm will be 2.0 if the primary is occulted, but only 0.2 if only the secondary is occulted.

July 28, (313) Chaldea and SAO 93872: The star is 57 Tauri = Z.C. 637.

Sept. 14: The star is ADS 608. The 9.9-mag. companion is 41″2 away in p.a. 1°, too far away to be occulted.

Oct. 20: Jupiter's disk will be fully sunlit. The occultation occurs near Jupiter's South Pole, with a length shorter than the central duration listed.

Table 1, Part F

1987 DATE	Universal Time	PLANET Name	PLANET m_v	PLANET Δ,AU	STAR SAO No.	STAR m_v	STAR Sp	STAR R.A. (1950)	STAR Dec.	Occultation Δm	Occultation Dur	Occultation df	Occultation P	Possible Area	El Sun	MOON El	MOON %Snl	MOON Up
Nov 25	11h10m19	Chiron	16.1	11.87		12.2		5h46m.8	17°12'	4.0	20	35	43	(N.Amer..HI.NZ.eAustrl)?n	155°	147°	22+	w150° E
Nov 26	13 45-64	Unitas	12.4	1.67	95372	7.8	B9	6 9.4	13 42	4.6	5	26	46	HI?n, PNG?s, Indonesia	149	136	34+	w130 E
Nov 26	17 35	Alexandra	12.3	2.79	187885	9.3	G5	19 12.5	-23 47	3.1	4	8	23	(Ireland,Iberia,France)?s	43	30	35+	all
Nov 26	19 43-61	Heidelberga	12.4	1.66	56709	6.9	B3	3 44.7	33 27	5.5	10	25	23	sPI,s.Asia,cen.Africa	167	104	36+	w 40 E
Nov 26	19 42-56	Heidelberga	12.4	1.66	56709	9.4		3 44.7	33 27	3.1	10	25	23	(nwAustral.,S.Africa)?n	167	104	36+	w 55 E
Nov 27	0 44-55	Lacadiera	12.8	1.46		9.3		3 40.3	18 42	3.5	6	20	31	Svalbard,seCanada,cenUSA	173	96	39+	w 60 W
Nov 27	15 16	Hestia	14.0	2.83		11.6		10 53.5	5 30	2.5	7	18	31	(e.Australia,N.Z.)?n	82	166	46+	none
Nov 28	11 14	Una	12.5	1.61	77309	9.1	F5	5 33.4	28 59	3.5	10	26	24	North Is.;e.Austral.?n	160	103	55+	w160 W
Nov 28	13 20	Frigga	14.3	3.92	185320	3.3	B3	17 18.9	-24 57	11.0	1.5	9	86	Patagonia; S.Africa?n	16	81	56+	w 25 W
Nov 29	12 25-40	Bamberga	10.0	1.28	41376	8.5	G0	6 46.7	40 1	1.7	39	34	7	Tahiti?n,NorthI.,Qld.?n	143	103	66+	w170 W
Nov 30	8 06	Kassandra	12.9	2.49	138526A	8.8	G5	11 57.8	-0 23	4.1	4	10	28	BaffinI.,Greenld.,Ireld.	67	173	75+	none
Nov 30	8 09	Kassandra	12.9	2.49	138526B	11.8		11 57.8	-0 23	1.5	4	10	28	(Svalbard,Lapland)?1″4s	67	173	75+	none
Dec 1	0 02	Galatea	12.6	1.93	146088	8.0	A2	22 24.2	-8 46	4.7	5	13	25	(nArgentina,sBrazil)?n	87	41	81+	all
Dec 1	17 56-86	Ophelia	13.3	2.11		12.5		7 27.9	21 44	1.3	27	59	23	Guam,Luzon,s.Asia,Yemen	138	85	87+	w125 E
Dec 2	13 45-71	Ludmilla	11.2	1.37		11.0	K0	6 43.3	21 52	0.8	19	32	14	(Baja,HI)?n;Australia	149	64	92+	w155 W
Dec 2	21 55-72	Lacadiera	12.9	1.48		9.0		3 34.2	18 7	3.9	6	21	31	India?n,cenAfr.,Braz.?n	166	15	94+	w 90 E
Dec 8	12 34-56	Bamberga	9.8	1.26	41263	8.6	G0	6 37.3	40 9	1.5	29	26	7	wUSA,Hokkaido,se China	152	19	90-	e105 E
Dec 11	20 04-20	Ophelia	13.2	2.02		12.5		7 23.5	22 1	1.1	16	34	22	(wAustrlia,S.Africa)?n	149	42	65-	e 50 E
Dec 11	22 28-40	Una	12.4	1.58	77137	8.0	K0	5 19.8	29 3	4.4	9	22	24	Siberia,Svalbard,eCanada	174	71	65-	e 45 W
Dec 16	6 44-65	Bettina	11.8	2.14	61705	6.9	A5	9 46.8	31 19	5.0	54	58	11	w. North America?e	123	69	23-	none
Dec 17	0 38-55	Ludmilla	10.9	1.32		11.2	K7	6 31.2	20 41	0.6	14	23	14	Tanzania,Angola;Brazil?n	166	117	17-	e 25 E
Dec 17	10 04-22	Elektra	11.5	2.06		10.0	F8	7 42.5	0 0	1.7	24	29	13	Peru?n;central Pacific	141	101	14-	e115 W
Dec 17	16 52	Astraea	12.2	3.38	159625	5.5	F8	15 57.5	-16 24	6.7	3	8	40	Jarvis Is.; Hawaii?n	24	18	12-	all
Dec 18	7 34	Fortuna	12.2	2.70	138809	8.6	F0	12 26.2	-4 1	3.7	10	15	17	(BaffinI,Iceld.,Lapland)?s	78	45	8-	e 25 W
Dec 19	5 26	Winchester	14.3	4.74	160335	8.8	F5	17 7.8	-10 49	5.5	5	10	33	nwUSSR? low,bright dawn	15	20	3-	all
Dec 19	22 08-26	Emita	11.9	1.46	59964	6.2	B9	7 14.9	31 3	5.7	11	24	20	China, USSR, e.Canada	159	149	1-	none
Dec 20	3 15	Hebe	10.1	2.39	164610	8.1	K0	21 41.2	-19 44	2.2	5	8	19	Easter Is.?n; Chile?s	54	62	1-	none
Dec 20	13 10-16	Athor	13.0	1.92	109103	9.3	K0	0 14.2	4 0	3.7	6	18	28	Indonesia, Micronesia	97	101	0-	none
Dec 23	7 01-12	Europa	10.4	1.89		10.7	F2	4 33.6	13 1	0.6	28	26	9	Canada,Alaska,eSiberia	157	122	9+	w145 E
Dec 25	8 43	Metis	11.5	2.70		10.6		13 46.5	-6 8	1.3	7	11	21	BaffinI;(Iceld.,Lapld.)?n	66	129	27+	none
Dec 25	17 40	Venus	-4.0	1.37	189335	6.8	A0	20 26.1	-21 4		240	5	1	Iberia, most of Africa	31	37	31+	all
Dec 27	0 47-59	Pulcova	12.6	1.98	58010	8.4	Bp	5 22.4	35 36	4.2	10	22	22	cen.Africa; seBrazil?n	163	83	46+	w 20 W
Dec 27	23 06-11	Ursula	12.7	2.84		10.6	K0	23 44.9	11 10	2.3	11	17	19	Fla.Keys,Morocco,Algeria	86	15	56+	all

Nov. 24, Mars and SAO 158224: Mars will be 97% sunlit with PACBL 112°, but the defect of illumination will be a negligible 0″1.

Nov. 26, (325) Heidelberga and SAO 56709: The star is ADS 2772, with separation 3″4 in p.a. 18°.

Nov. 28, (77) Frigga and SAO 185320: The star is theta Ophiuchi = Z.C. 2500, the brightest star to be occulted by an asteroid this year. The separation of the components of this 1-line spectroscopic binary is probably less than 0″0002.

Nov. 30: The star is ADS 8383, with separation 4″6 in p.a. 151°.

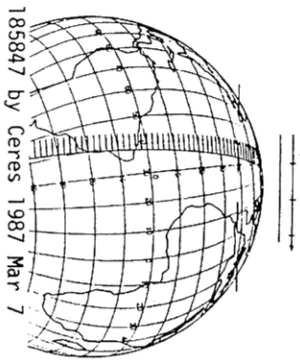
Dec. 1, (74) Galatea and SAO 146088: A gradual disappearance was seen during a lunar occultation by a visual observer, indicating the star may be a close binary.

Dec. 17, (5) Astraea and SAO 159625: The star is 49 Librae = Z.C. 2291, and is a spectroscopic binary.

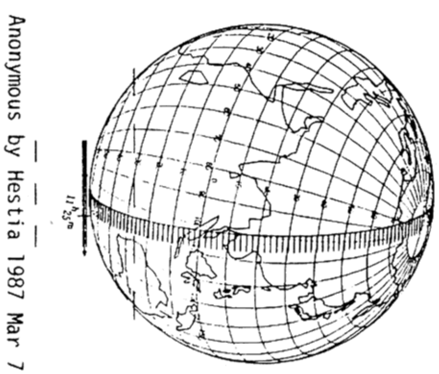
Dec. 20, (161) Athor and SAO 109103: The star has the double designation HDO 9. The secondary is 32" away in p.a. 45°. The double star catalogs give no indication about the magnitude of the secondary, but it is not obvious on the appropriate true value magnitude atlas plate, which has a limiting magnitude of about 12. In any case, no occultation of the companion will be visible from the Earth's surface.

Dec. 25, Venus and SAO 189335: The star, Z.C. 2988, will disappear on the dark edge of Venus' sunlit disk, with PACBL 259°.

[Ed: Apologies for a discrepancy in the tables. In Table 2, Part D, the entry for SAO 247211 by Comet Wilson should be deleted. Unfortunately, the superfluous listing destroys the exact correspondence between listings on facing pages, and time constraints make it impractical to do a complete revision.]



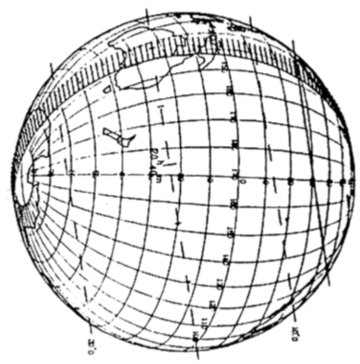
SAO 185847 by Ceres 1987 Mar 7



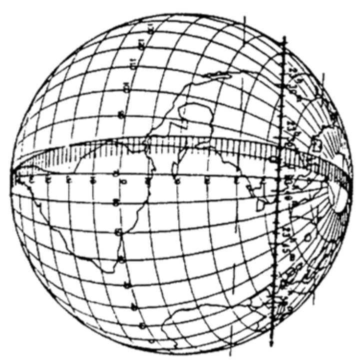
Anonymous by Hestia 1987 Mar 7

Table 2, Part F

1987 DATE	No.	MINOR PLANET Name	km-diam.	-"	RSOI	Type	MOTION °/Day	PA	STAR SAO No	DM/ID No	D	Ephem. Source	S	COMPARISON DATA AGK3	No	Shift	Time	APPARENT R.A.	Dec.
Nov 24	654	Zelinda	112	0.15	291	U	0.166	214°	59367	+33° 1384		EMP 1983	A	N33	687			6h40m.8	33°52'
Nov 25	2060	Chiron	400	0.051	3163	U	0.055	263				Marsden	C					5 49.1	17 12
Nov 26	306	Unitas	53	0.04	128	S	0.193	267	95372	+13 1158		EMP 1985	AS	N13	552	-0.25	-0.1	6 11.6	13 42
Nov 26	54	Alexandra	177	0.09	662	C	0.512	77	187885	C2315208		Herget78	XS					19 14.8	-23 44
Nov 26	325	Heidelberga	106	0.09	370	MEU	0.204	259	56709	+33 717	A	EMP 1986	AG	N33	355	0.16	0.4	3 47.1	33 34
Nov 26	325	Heidelberga	106	0.09	370	MEU	0.204	259	56709	+33 717	B	EMP 1986	A	N33	355			3 47.1	33 34
Nov 27	336	Lacadiera	69	0.07	180	C	0.270	248		+18 527		EMP 1982	C					3 42.5	18 49
Nov 27	46	Hestia	133	0.06	565	F	0.219	113				Yeomans	C					10 55.5	5 18
Nov 28	160	Una	96	0.08	310	C	0.200	274	77309	+28 829		Landgraf	XA	N28	530	0.09	0.1	5 35.8	29 1
Nov 28	77	Frigga	66	0.02	206	M	0.381	94	185320	C2413292	J	EMP 1986	FS			0.12	-0.0	17 21.2	-24 59
Nov 29	324	Bamberga	256	0.28	1136	C	0.171	280	41376	+40 1729		EMP 1981	A	N40	808			6 49.4	39 58
Nov 30	114	Kassandra	131	0.07	445	C	0.405	110	138526	+ 0 2875	A	Herget78	XA	S 0	1679	0.21	-0.2	11 59.8	-0 37
Nov 30	114	Kassandra	131	0.07	445	C	0.405	110	138526	+ 0 2875	B	Herget78	X	S 0	1679			11 59.8	-0 37
Dec 1	74	Galatea	113	0.08	328	C	0.375	74	146088	- 9 5978	X	Herget78	7P			0.36	-0.3	22 26.1	-8 34
Dec 1	171	Ophelia	132	0.09	571	U	0.077	287		A2257333		EMP 1984	C					7 30.2	21 39
Dec 2	675	Ludmilla	137	0.14	469		0.172	242		+21 1371		EMP 1983	HX	N21	722	0.00	0.4	6 45.6	21 50
Dec 2	336	Lacadiera	69	0.06	180	C	0.252	248				EMP 1982	C					3 36.4	18 15
Dec 8	324	Bamberga	256	0.28	1153	C	0.227	270	41263	+40 1678		EMP 1981	A	N40	783			6 40.0	40 7
Dec 11	171	Ophelia	132	0.09	569	U	0.134	284		A2256168		EMP 1984	C					7 25.8	21 56
Dec 11	160	Una	96	0.08	310	C	0.232	268	77137	+28 785		Landgraf	RX	N29	563	-0.27	0.2	5 22.3	29 5
Dec 16	250	Bettina	270	0.17	1600	EMP	0.077	22	61705	+31 2053		Herget81	AG	N31	966	0.19	1.1	9 49.1	31 8
Dec 17	675	Ludmilla	137	0.14	473		0.242	250		+20 1486		EMP 1983	HX	N20	702	-0.16	0.7	6 33.5	20 40
Dec 17	130	Elektra	235	0.16	1345	C	0.158	286		- 0 2065		EMP 1983	A	S 0	1079			7 44.5	-0 6
Dec 17	5	Astraea	122	0.05	436	S	0.445	101	159625	-16 4196	V	EMP 1983	F			-0.01	0.0	15 59.6	-16 30
Dec 18	19	Fortuna	226	0.12	1170	C	0.264	114	138809	- 3 3302		EMP 1981	R7					12 28.1	-4 13
Dec 19	747	Winchester	208	0.06	1469	C	0.297	97	160335	-10 4447		Landgraf	PS			-0.81	-0.7	17 9.9	-10 52
Dec 19	481	Emita	108	0.10	348	C	0.223	301	59964	+31 1529		Herget	AG	N31	753	0.48	4.0	7 17.3	30 59
Dec 20	6	Hebe	186	0.11	648	S	0.518	76	164610	-20 6277		Branham	XS					21 43.3	-19 34
Dec 20	161	Athor	100	0.07	292	CMEU	0.266	58	109103	+ 3 28	C	MPC11041	XA	N 4	30	-0.13	0.3	0 16.1	4 13
Dec 23	52	Europa	291	0.21	1805	C	0.180	277		+12 613		EMP 1982	A	N13	364			4 35.8	13 6
Dec 25	9	Metis	190	0.10	831	S	0.354	109		L 2 3421		Branham	H					13 48.5	-6 20
Dec 25		Venus	12220	12.33			1.235	77	189335	-21 5729			HZ			-0.79	-0.1	20 28.3	-20 57
Dec 27	762	Pulcova	132	0.09	574	C	0.212	247	58010	+35 1095		EMP 1986	A	N35	531			5 25.0	35 38
Dec 27	375	Ursula	214	0.10	1184	C	0.222	70		+10 4990		EMP 1981	A	N11	2968			23 46.8	11 23



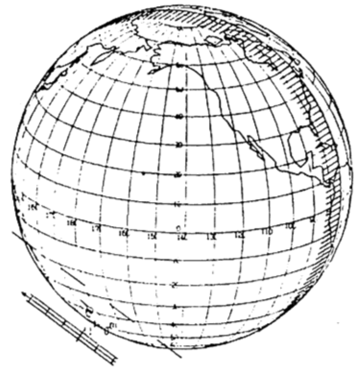
SAO 163559 by Venus 1987 Mar 6



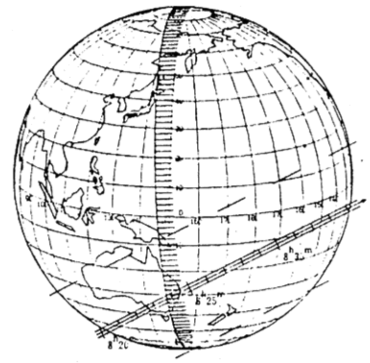
SAO 78208 by Ariadne '87 Mar 8

Anonymous by Psyche '87 Mar 14

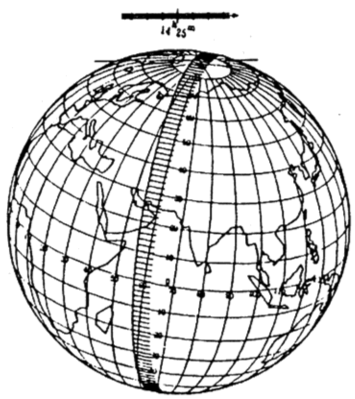
Anonymous by Patientia 1987 Mar 9



Anonymous by Patientia 1987 Mar 10

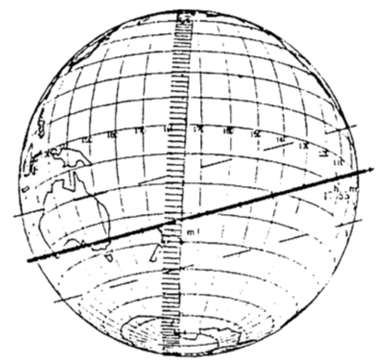


Anonymous by Camilla 1987 Mar 11



A2247308 by Parthenope 1987 Mar 11

SAO100323 by Desiderata '87 Mar 12

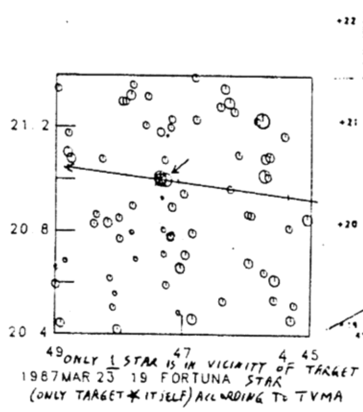


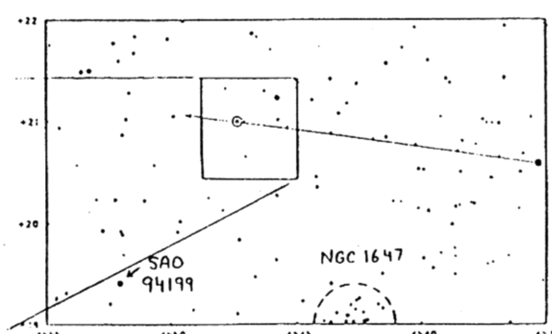
B2166509 by Ekard 1987 Mar 13

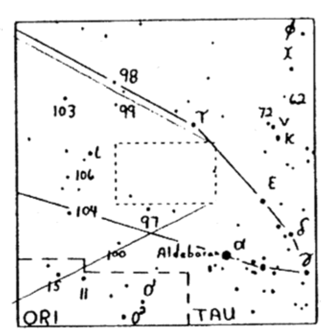
SAO 82806 by Herculina 1987 Mar 16

SAO 100625 by Davida 1987 Mar 16

+20° 830 by Fortuna 1987 Mar 23





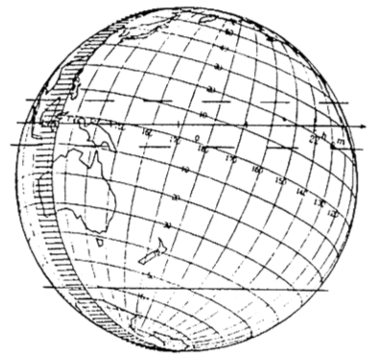


Anonymous by Hygiea 1987 Mar 21

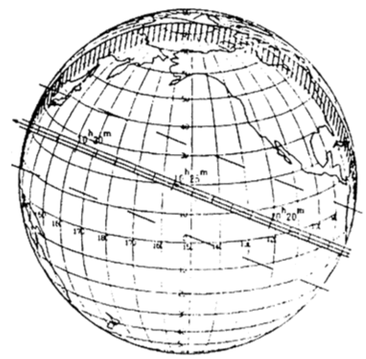
Anonymous by Hestia 1987 Mar 23

Anonymous by Hestia 1987 Mar 24

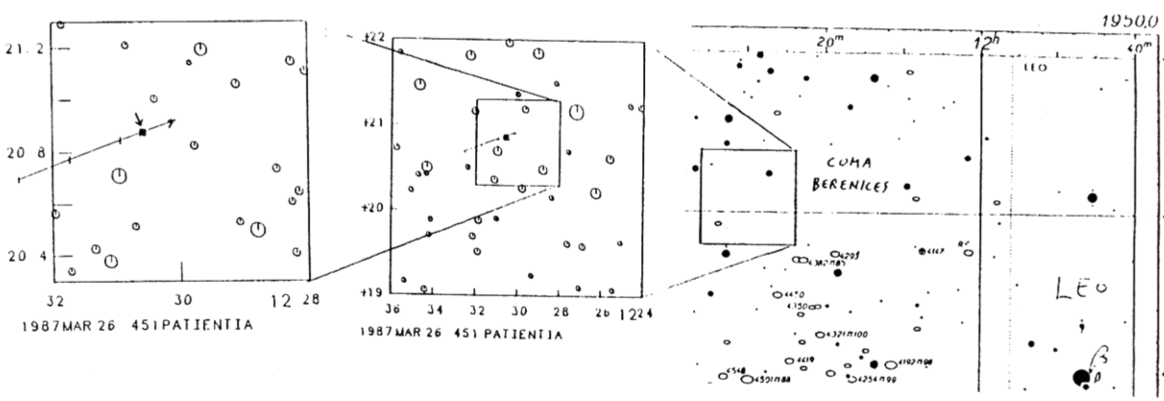
SAO 93396 by Mars 1987 Mar 25



SAO 164761 by Venus 1987 Mar 25

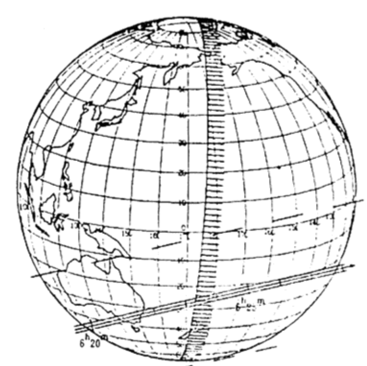


Anonymous by Patientia 1987 Mar 26

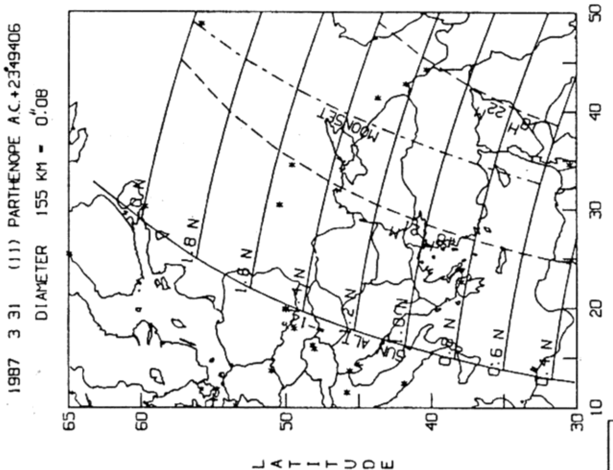


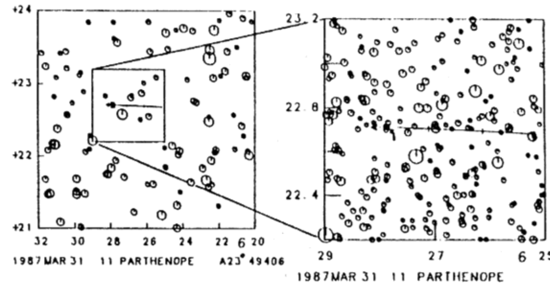
SAO 158896 by Hermione 1987 Mar 26

Anonymous by Victoria 1987 Mar 27

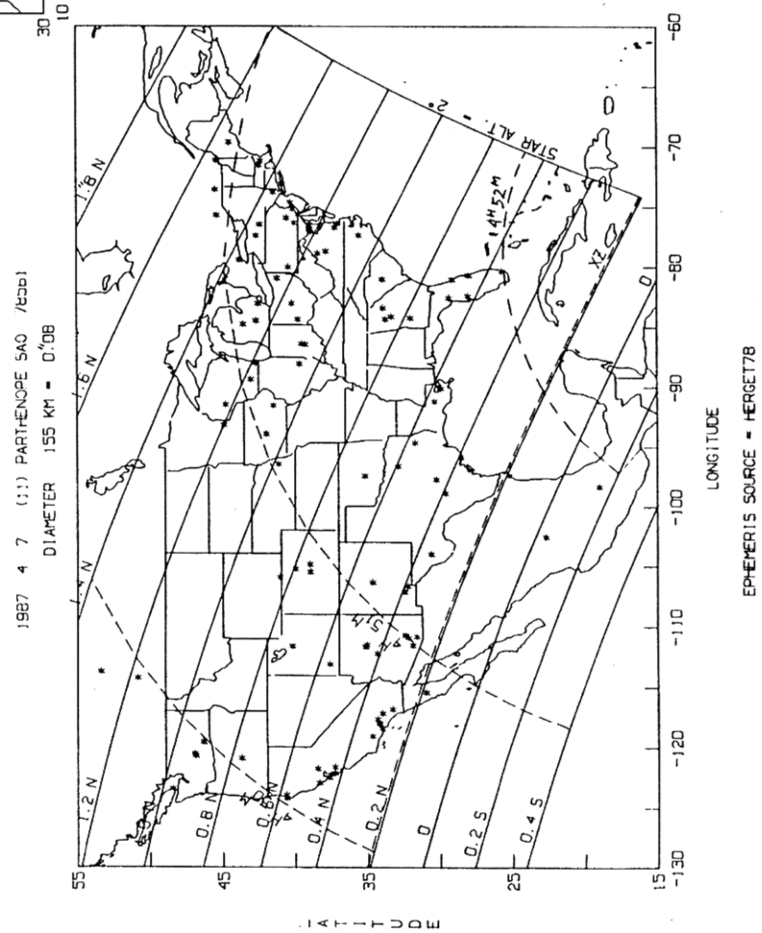


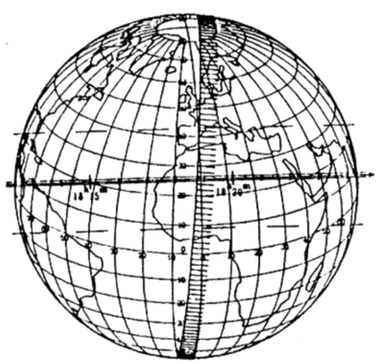
Anonymous by Camilla 1987 Mar 31





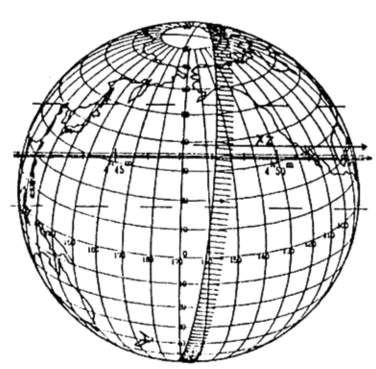
Anonymous by Camilla 1987 Mar 31



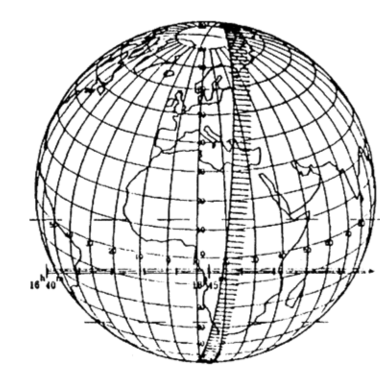


A2349406 by Parthenope 1987 Mar 31

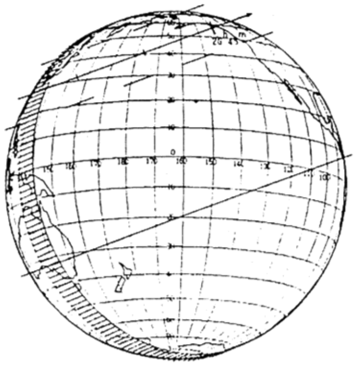
Anonymous by Hygiea 1987 Apr 3



SAO 78561 by Parthenope 1987 Apr 7



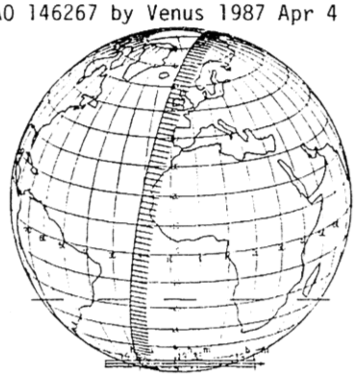
A2350548 by Parthenope 1987 Apr 7



SAO 146267 by Venus 1987 Apr 4

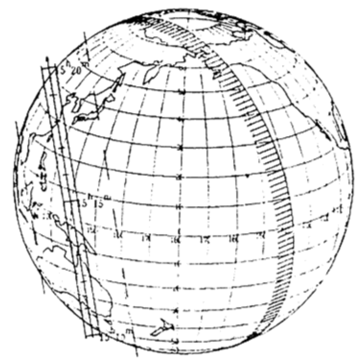
Anonymous by Sylvia 1987 Apr 6

Anonymous by Psyche 1987 Apr 7

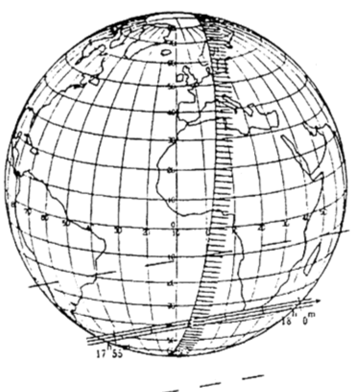


Anonymous by Cybele 1987 Apr 7

L 5 832 by Iris 1987 Apr 7

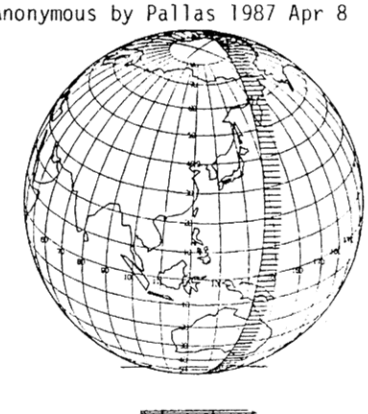


Anonymous by Pallas 1987 Apr 8



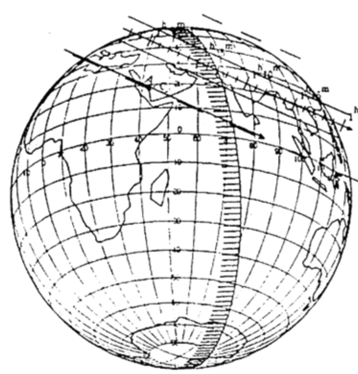
Anonymous by Camilla 1987 Apr 8

Anonymous by Metis 1987 Apr 9

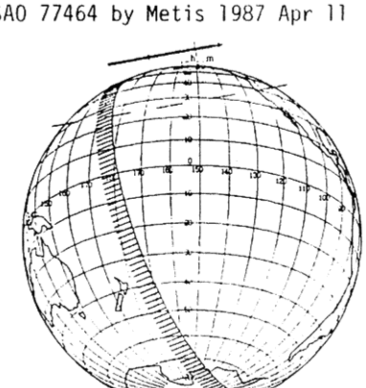


SAO 77464 by Metis 1987 Apr 11

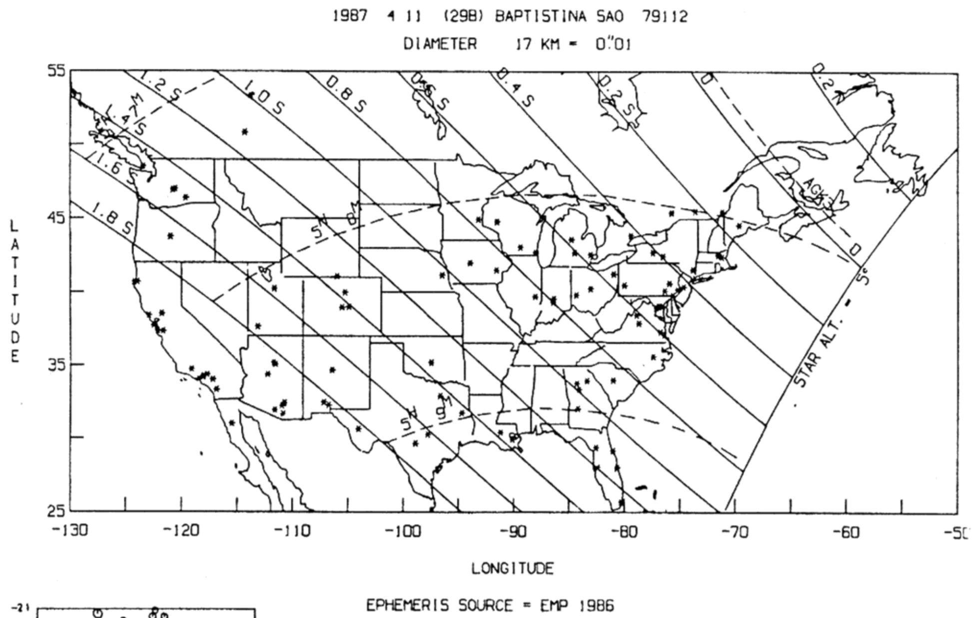
SAO 79517 by Aurora 1987 Apr 12

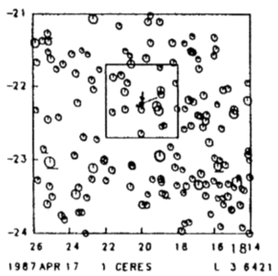


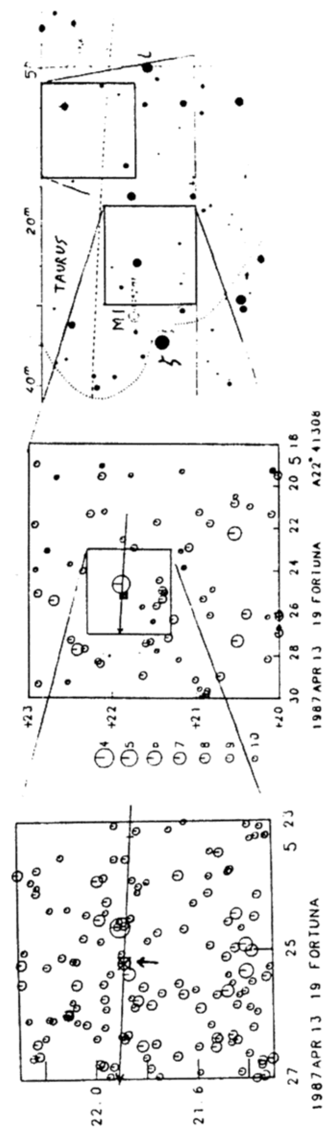
C2212902 by Ceres 1987 Apr 16

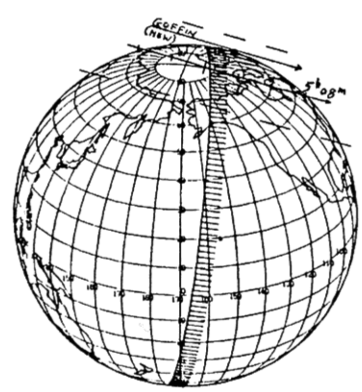


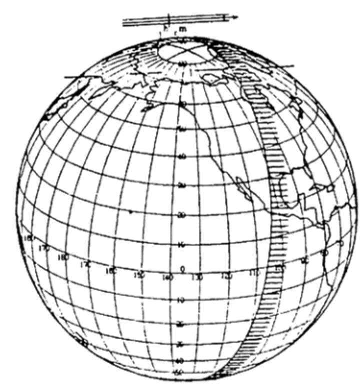
C2515451 by Aeternitas 1987 Apr 18



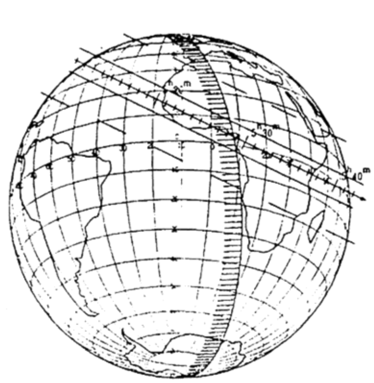


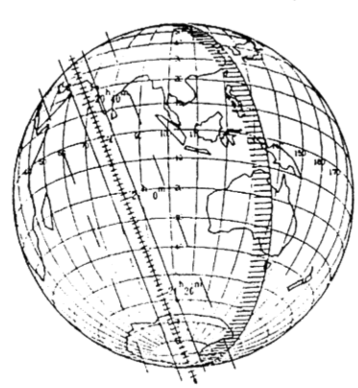






SAO 79112 by Baptistina '87 Apr 11 A2241308 by Fortuna 1987 Apr 13

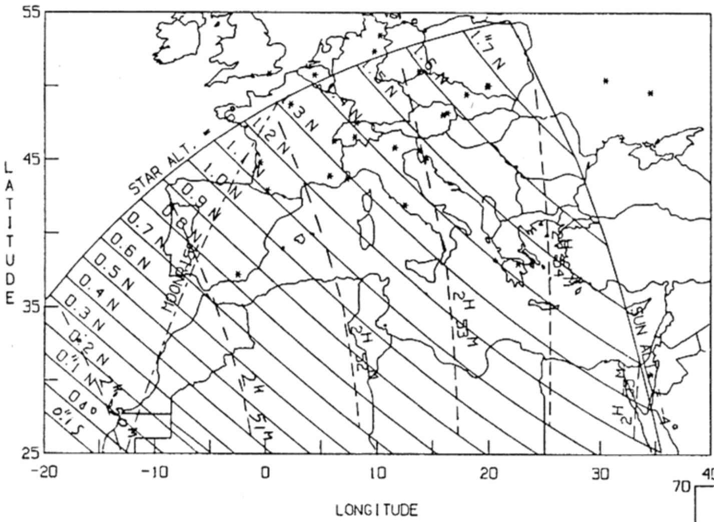




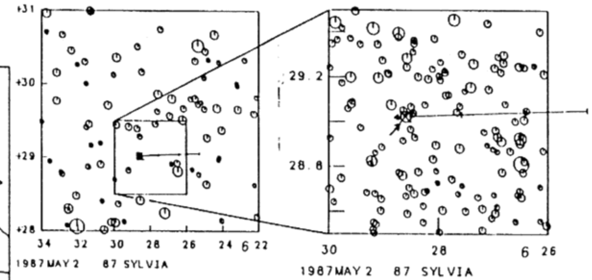
L 3 6421 by Ceres 1987 Apr 17 L 3 6955 by Ceres 1987 Apr 27 A1839319 by Chiron 1987 Apr 28

1987 4 22 (68) LETO SAO 188000

DIAMETER 128 KM = 0.″08

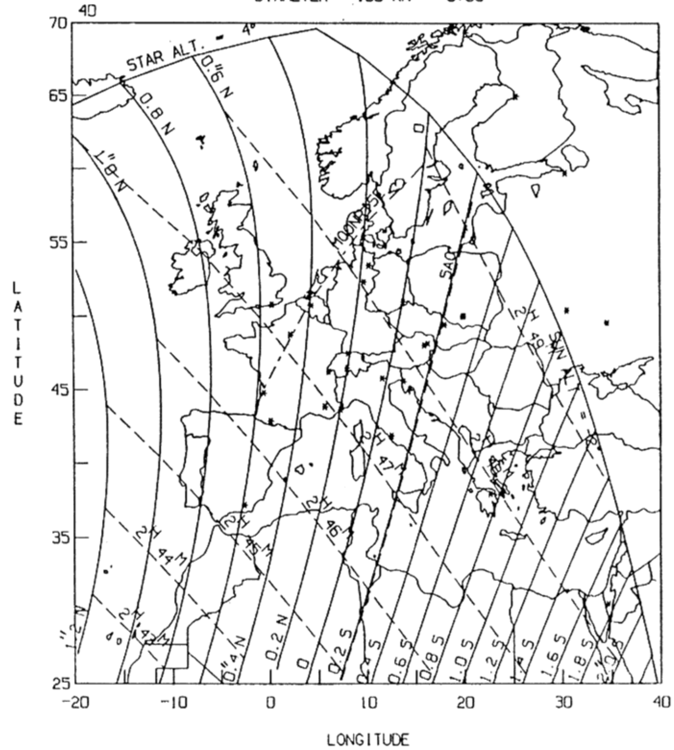


EPHEMERIS SOURCE = HERGET78



1987 4 22 (694) EKARD SAO 161166

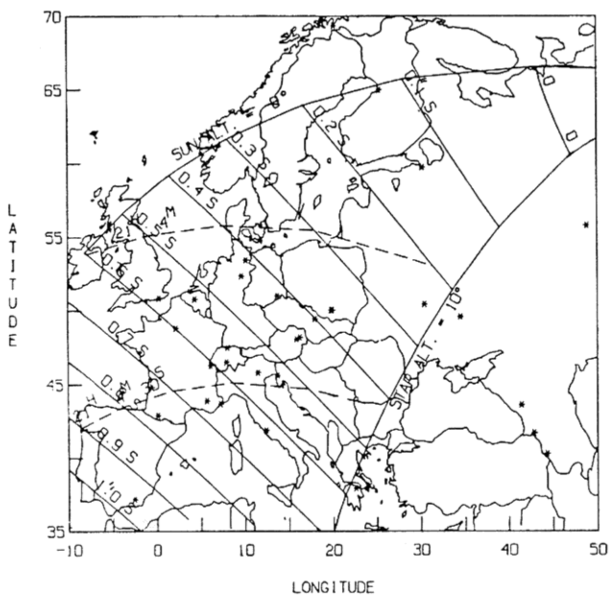
DIAMETER 100 KM = 0.″08



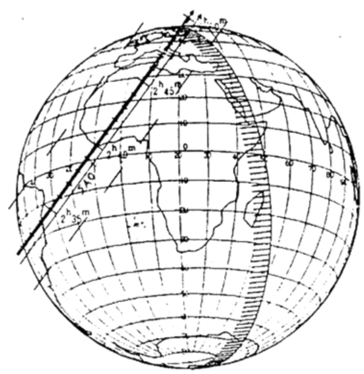
EPHEMERIS SOURCE = EMP 1986

1987 5 2 (67) SYLVIA

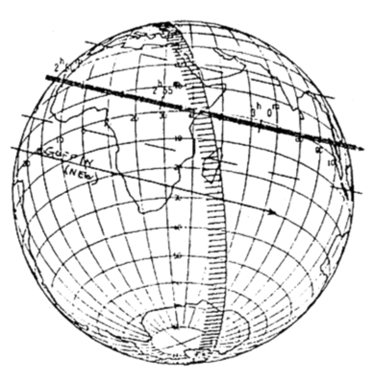
DIAMETER 275 KM = 0.″09



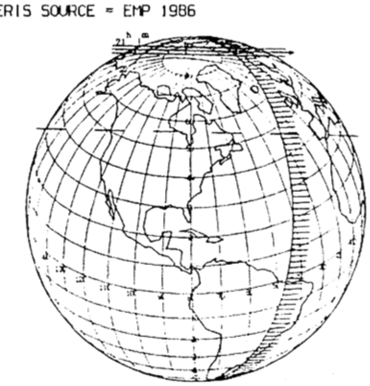
EPHEMERIS SOURCE = HERGET78



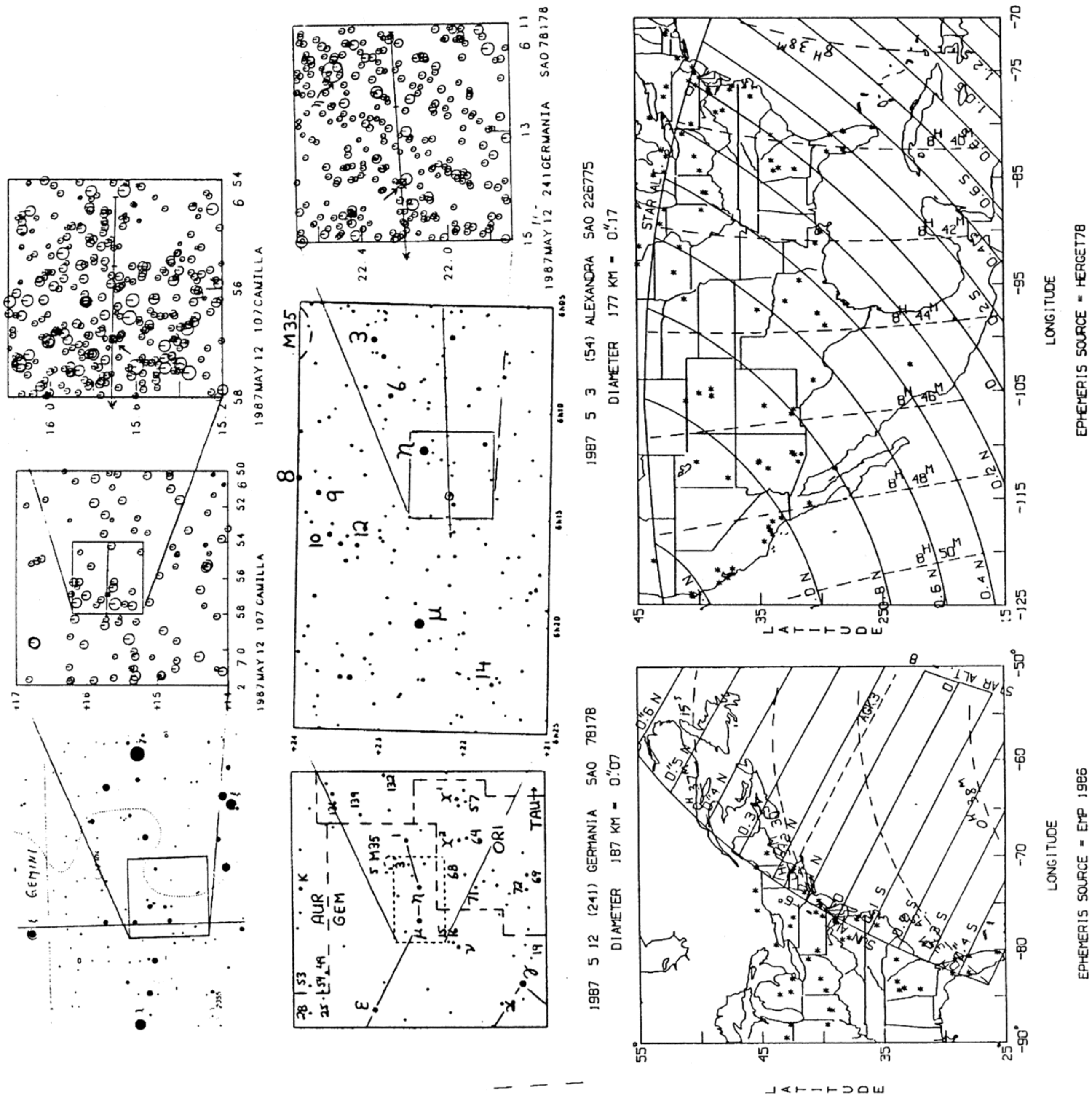
SAO 161166 by Ekard 1987 Apr 22

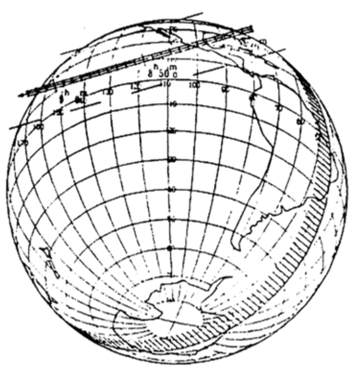


SAO 188000 by Leto 1987 Apr 22



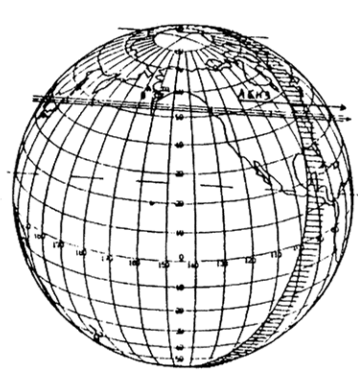
Anonymous by Sylvia 1987 May 2



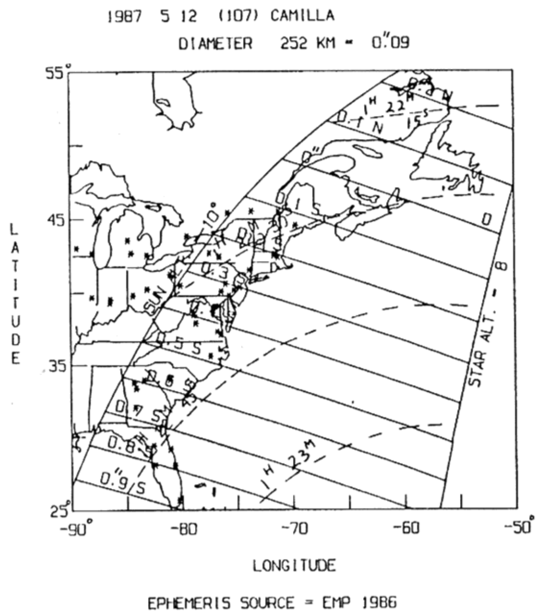


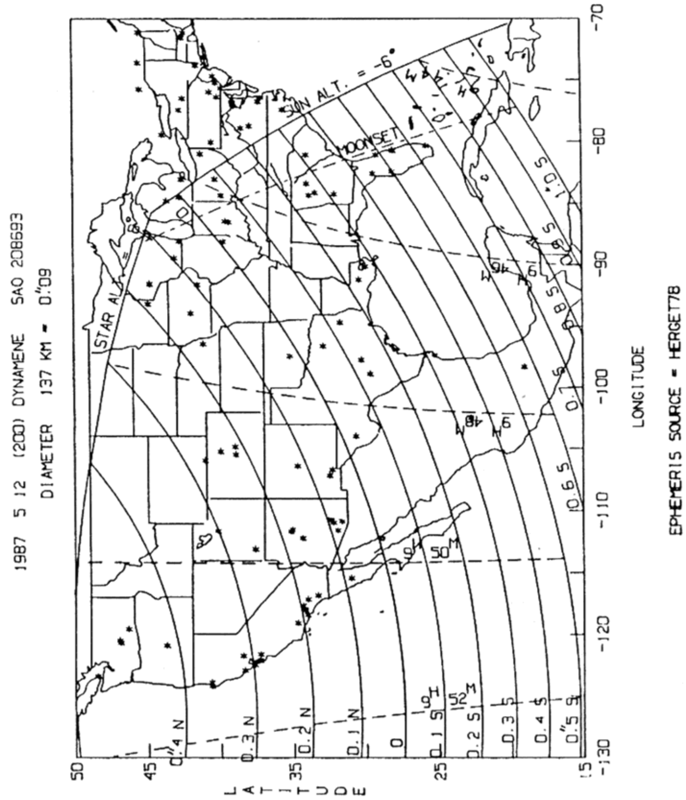
SAO 226775 by Alexandra 1987 May 3

Anonymous by Camilla 1987 May 6



SAO 78178 by Germania 1987 May 12

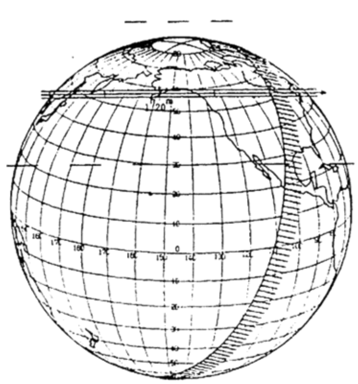




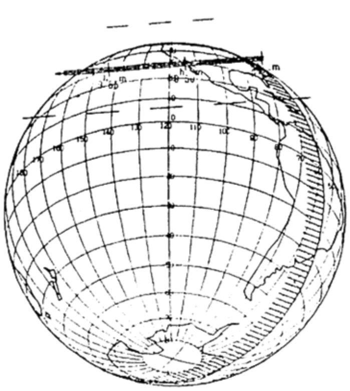
L 2 2016 by Aemilia 1987 Apr 29

Anonymous by Hygiea 1987 Apr 30

SAO 159932 by Hera 1987 May 9

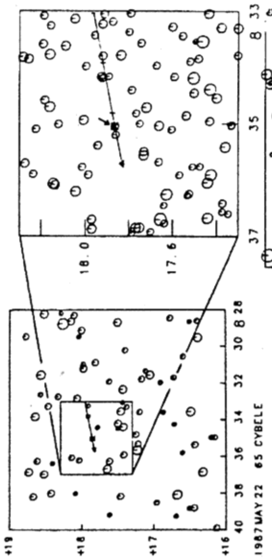


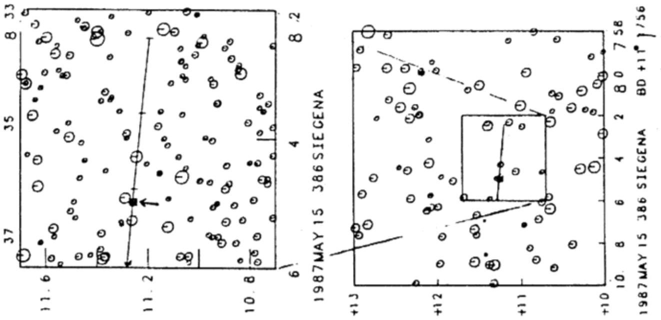
Anonymous by Camilla 1987 May 12

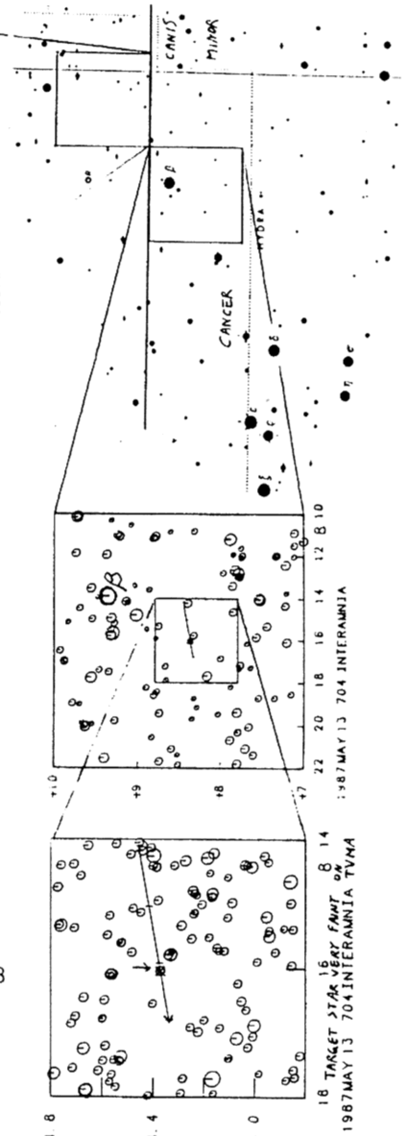


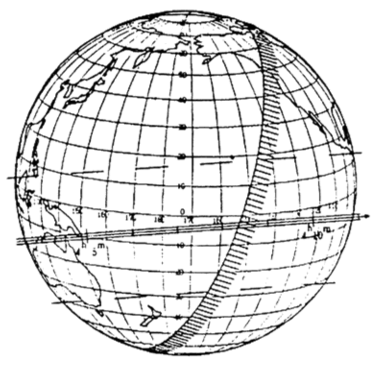
SAO 208693 by Dynamene 1987 May 12

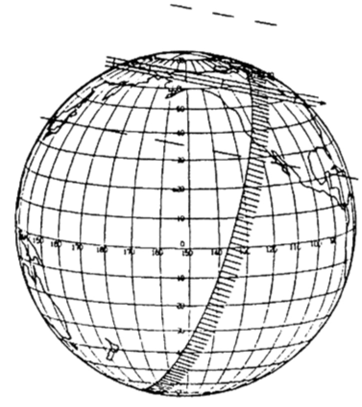
SAO 159480 by Edda 1987 May 14





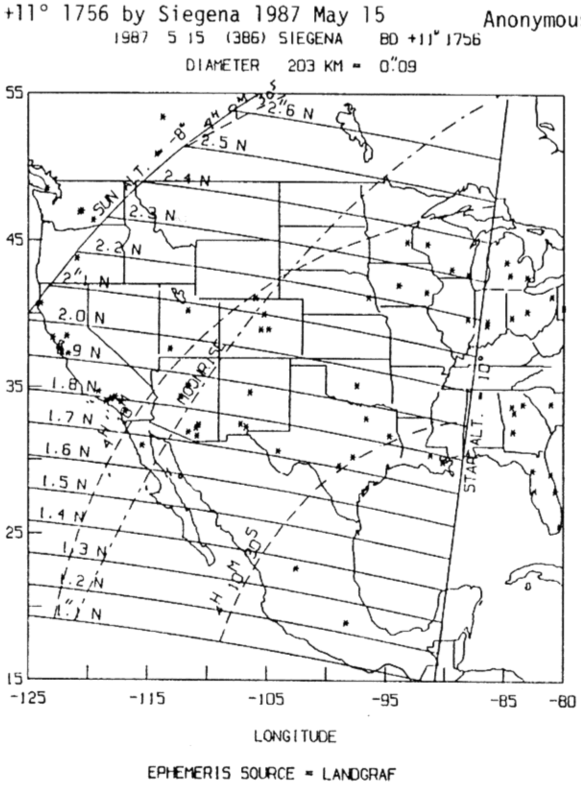


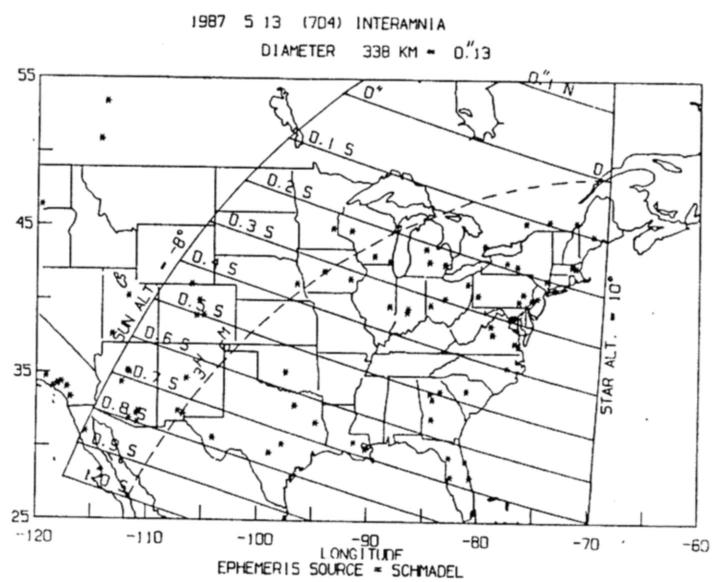


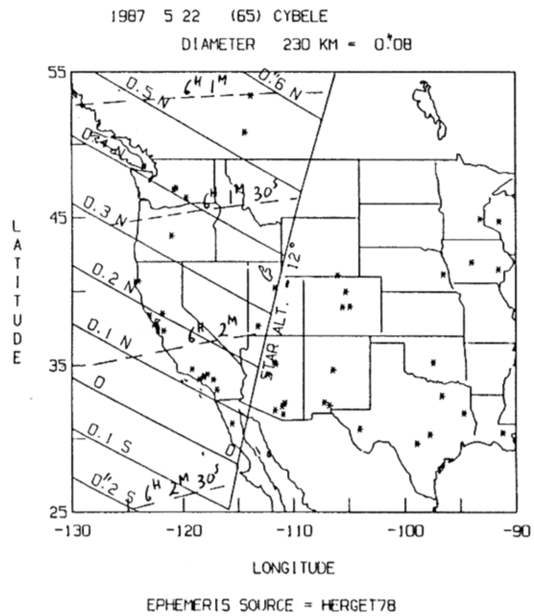


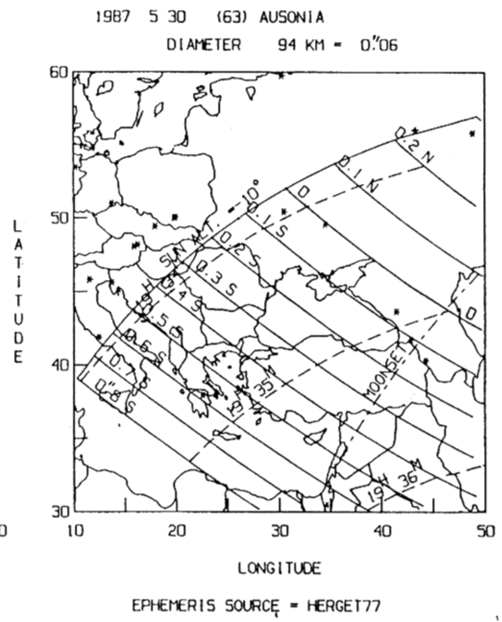
+11° 1756 by Siegena 1987 May 15

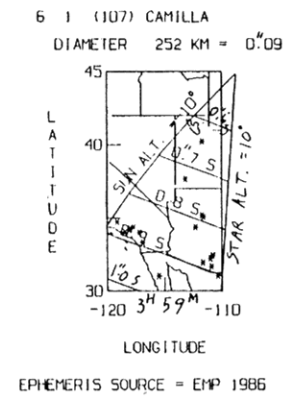
Anonymous by Interamnia '87 May 13

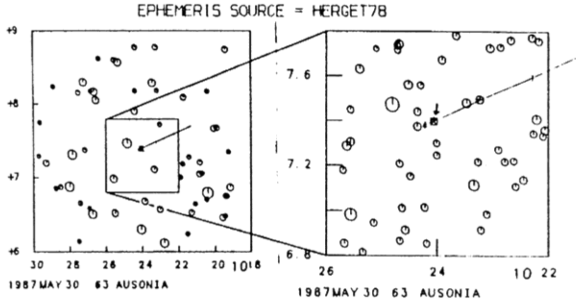


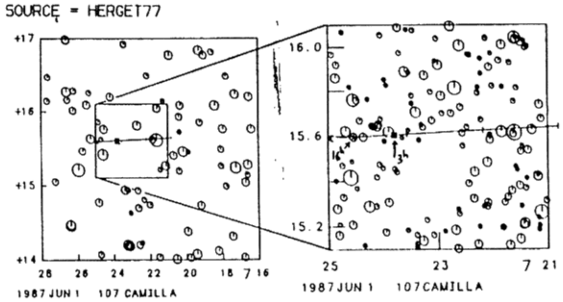








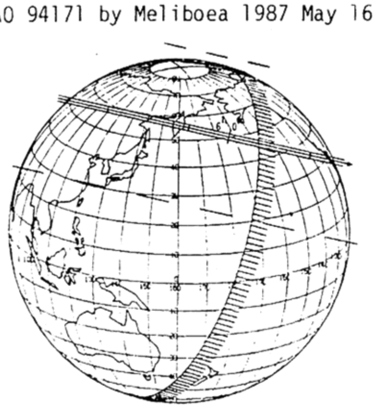




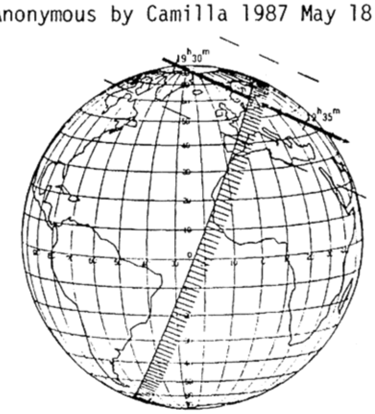
SAO 94171 by Meliboea 1987 May 16

Anonymous by Camilla 1987 May 18

Anonymous by Interamnia '87 May 19

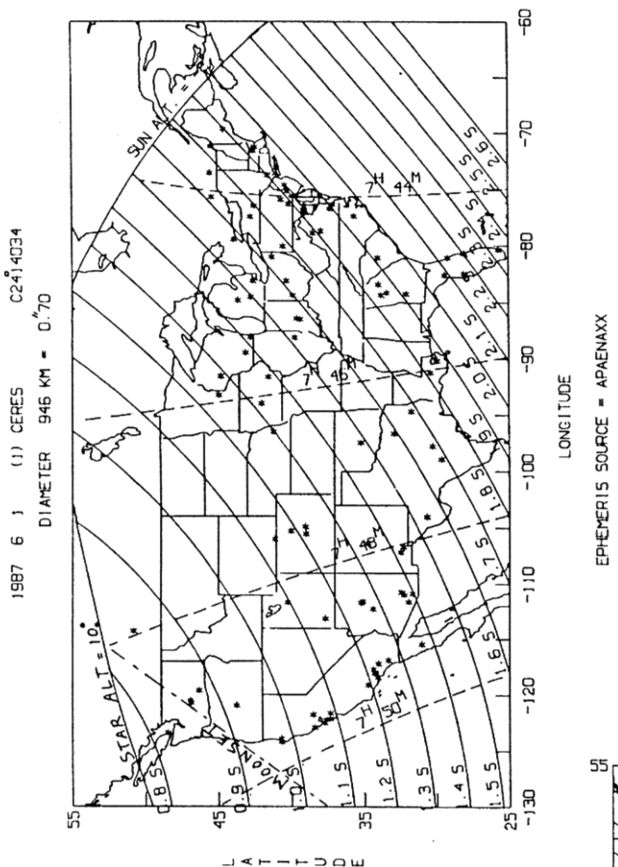


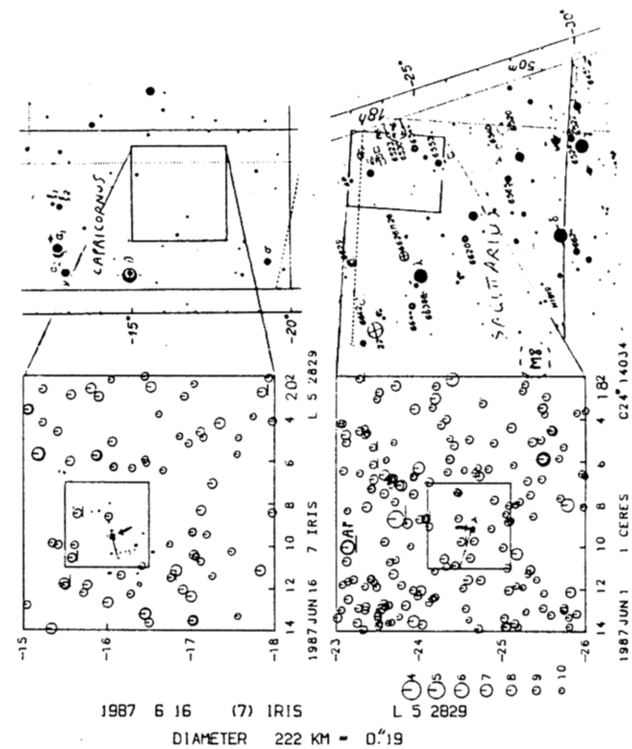
Anonymous by Cybele 1987 May 22

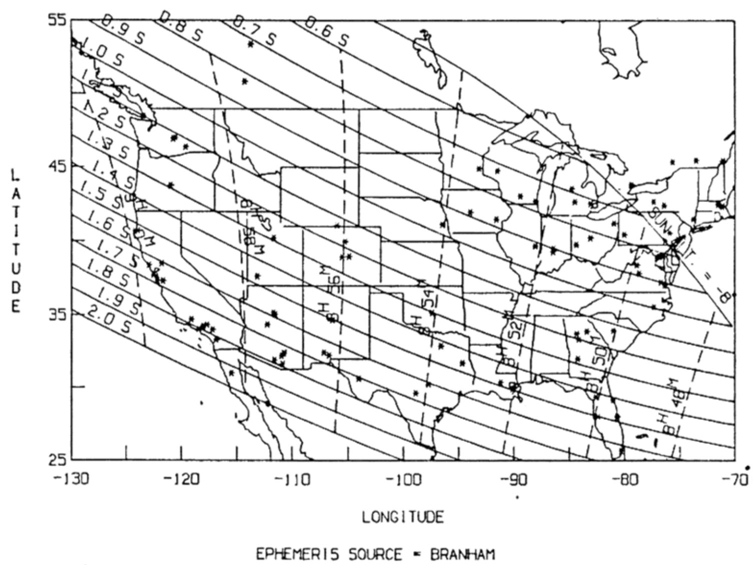


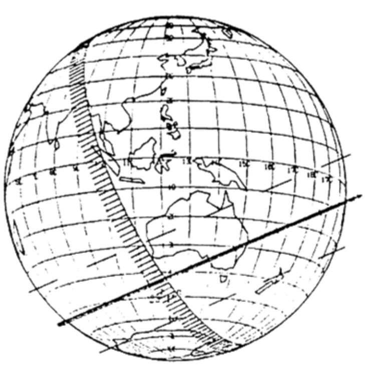
Anonymous by Ausonia 1987 May 30

Anonymous by Camilla 1987 Jun 1

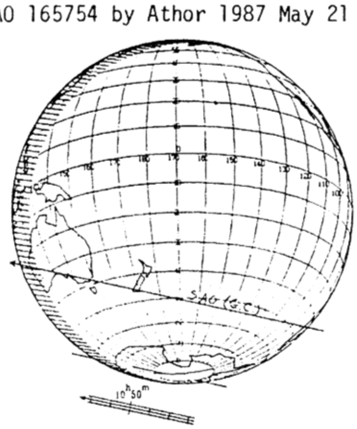




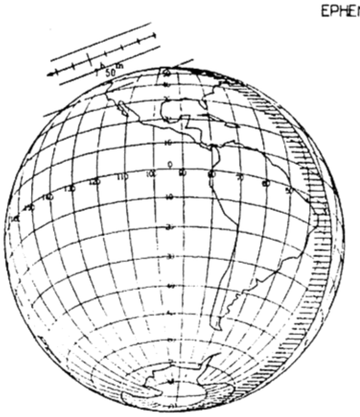




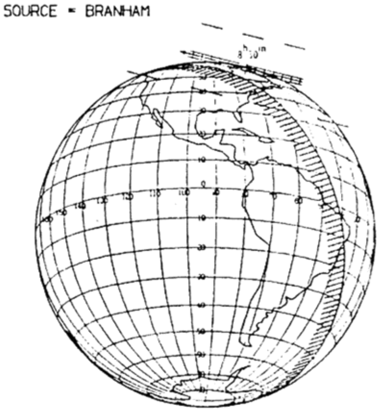
SAO 165754 by Athor 1987 May 21



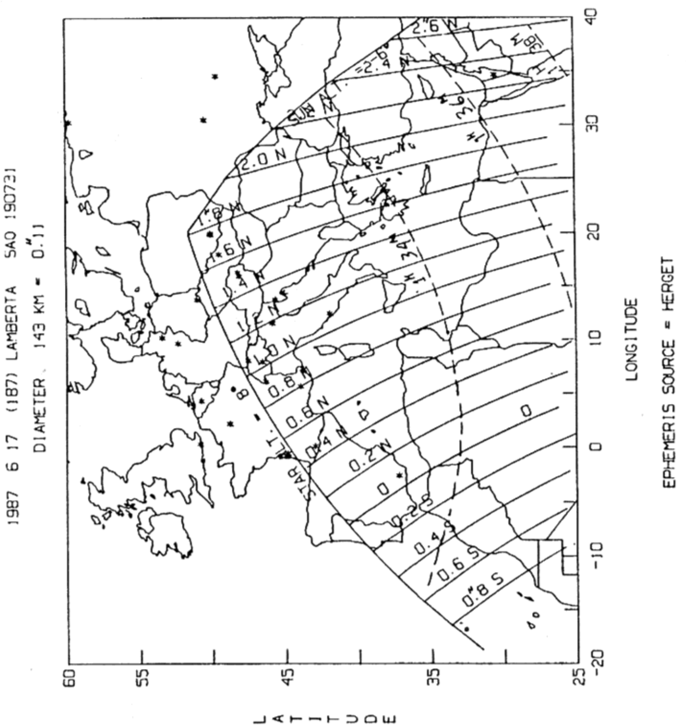
SAO 159402 by Themis 1987 May 23



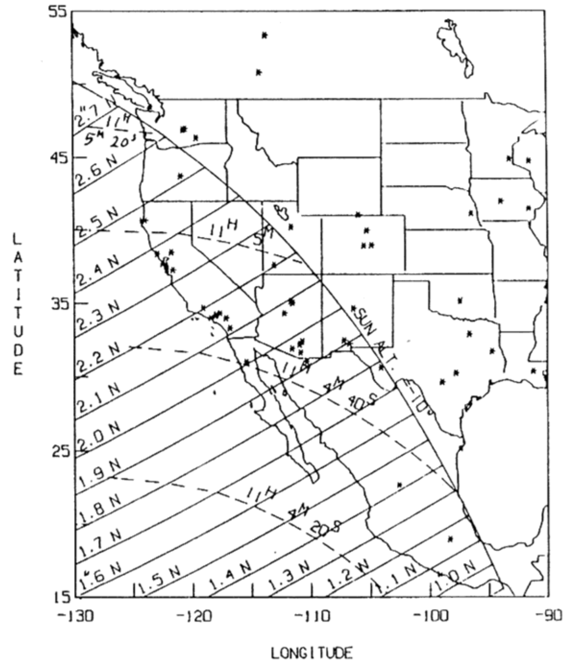
C2414034 by Ceres 1987 Jun 1



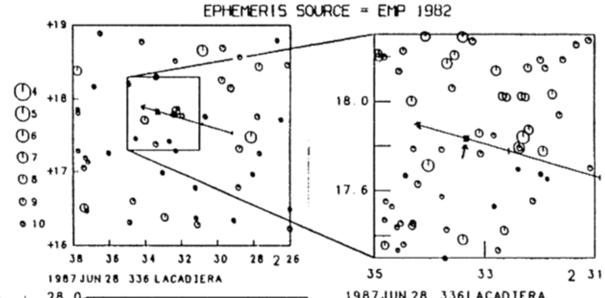
L 5 2829 by Iris 1987 Jun 16



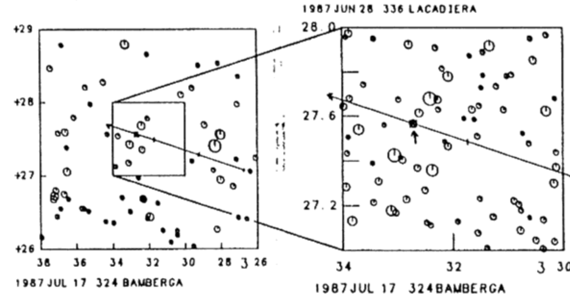
1987 6 28 (336) LACADIERA
DIAMETER 69 KM = 0.″03

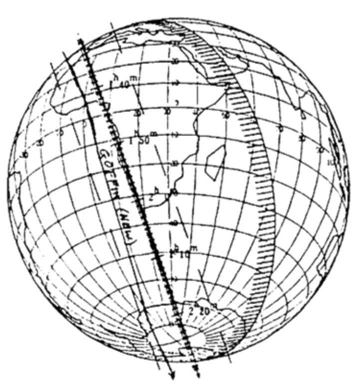


EPHEMERIS SOURCE = EMP 1982



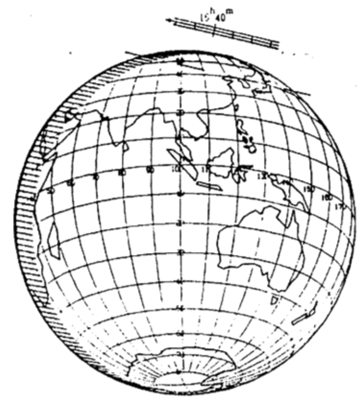
SAO 95624 by Aspasia 1987 May 22





SAO 190731 by Lamberta 1987 Jun 17 Anonymous by Lacadiera 1987 Jun 28 Anonymous by Bamberga 1987 Jul 17

A1748359 by Aspasia 1987 May 25

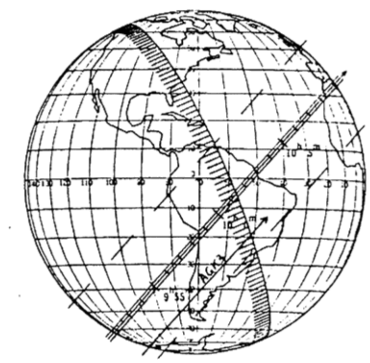


SAO 159377 by Themis 1987 May 25

SAO 82039 by Eleonora 1987 May 25

L 4 1082 by Camilla 1987 Jun 1

Anonymous by Pallas 1987 Jun 16



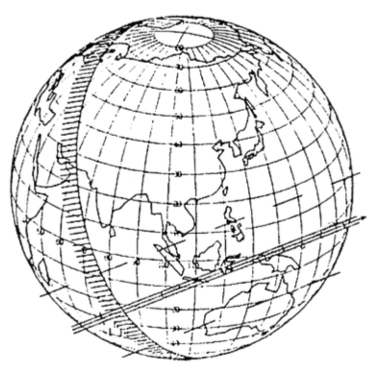
SAO 146423 by Loreley 1987 Jun 18

Anonymous by Interamnia '87 Jun 21

Anonymous by Patientia 1987 Jun 21

Anonymous by Davida 1987 Jun 23

SAO 119285/ Princetonia '87 Jun 29

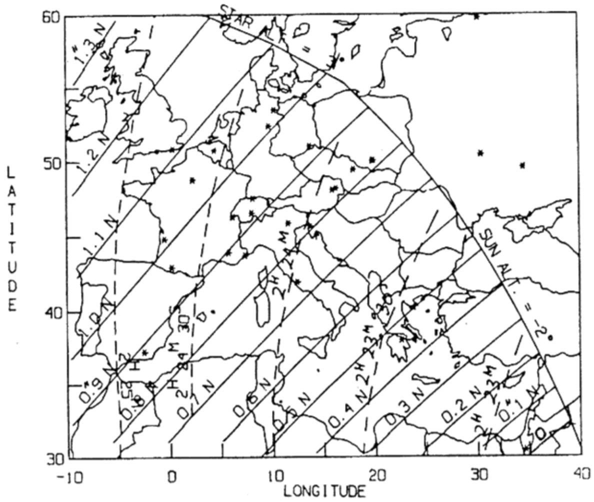


Anonymous by Bamberga 1987 Jul 7

Anonymous by Davida 1987 Jul 7

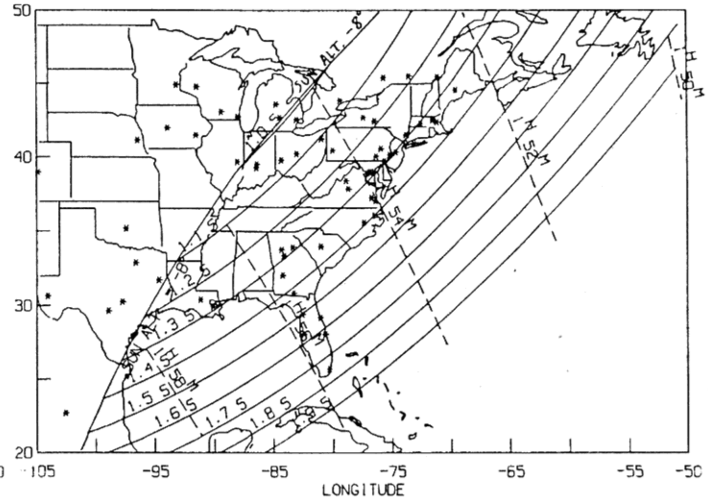
1987 7 18 (2893) 1975QD SAO 189192

DIAMETER 80 KM = 0."03

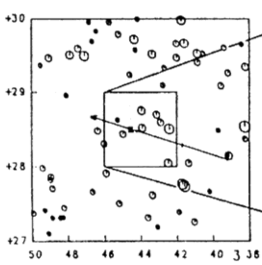


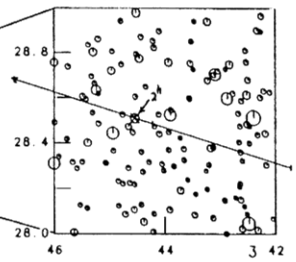
1987 7 24 (628) CHRISTINE L 3 4161

DIAMETER 54 KM = 0."05



EPHEMERIS SOURCE = EMP 1986





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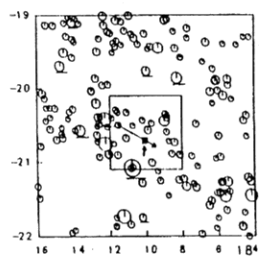
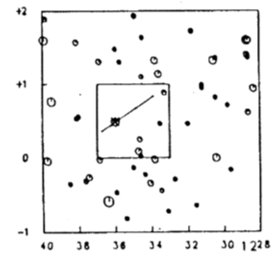
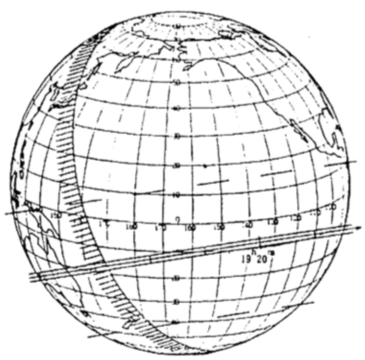
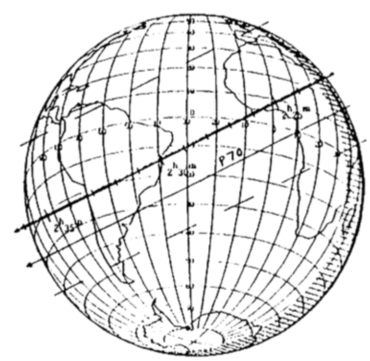




SAO 110578 by Roma 1987 Jul 11

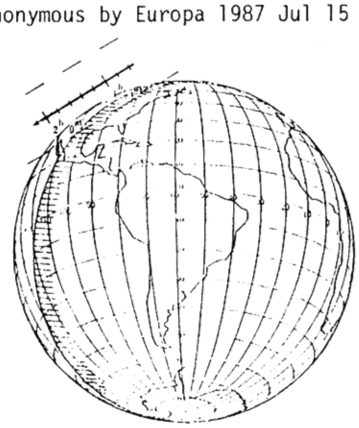


Anonymous by Europa 1987 Jul 15



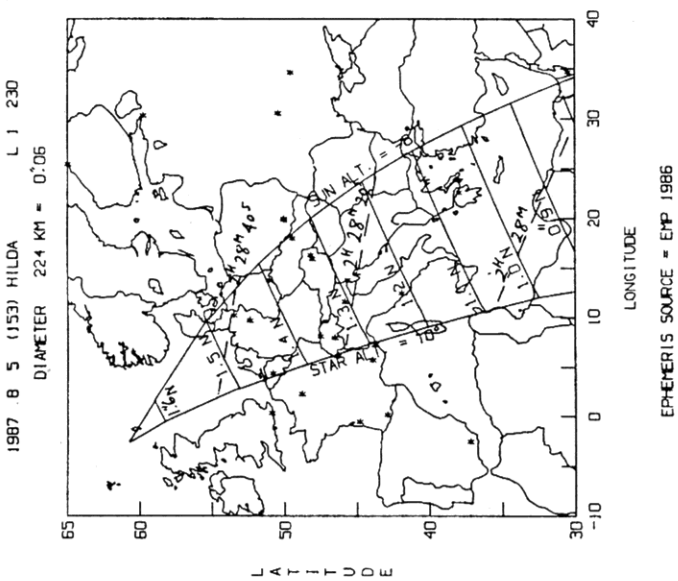
SAO 189192 by 1975QD 1987 Jul 18

Anonymous by Bamberga 1987 Jul 22

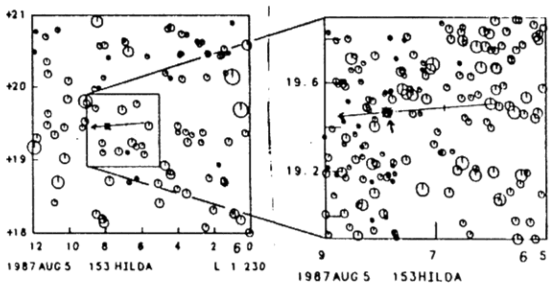


L 3 4161 by Christine 1987 Jul 24

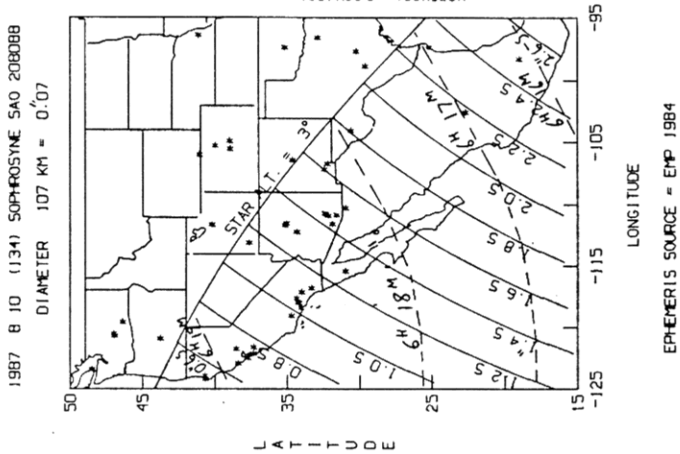
SAO 119510/ Princetonia '87 Jul 28

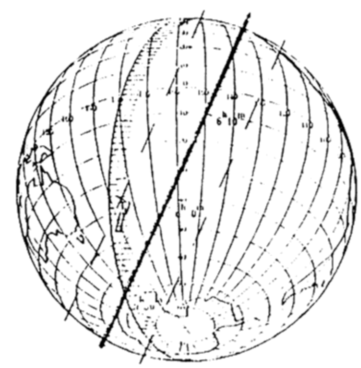


SAO 110026 by Sapientia '87 Jul 17

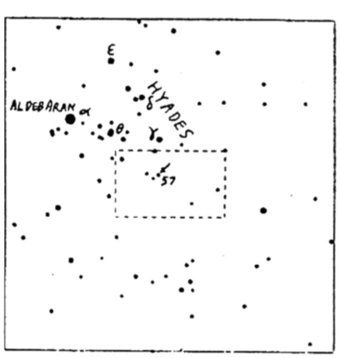


L 1 230 by Hilda 1987 Aug 5

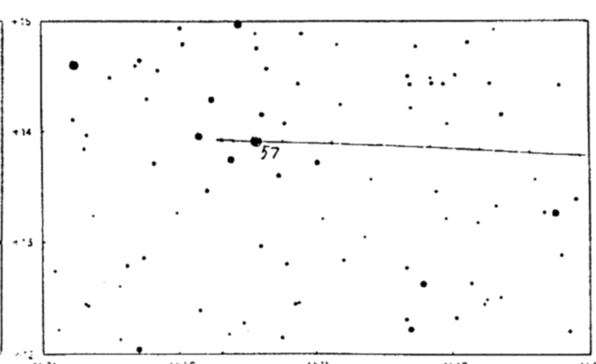




SAO 208088 / Sophrosyne 1987 Aug 10

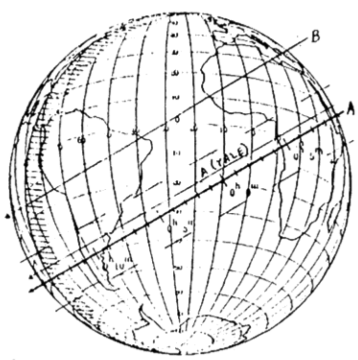


SAO 93872 by Chaldea 1987 Jul 28

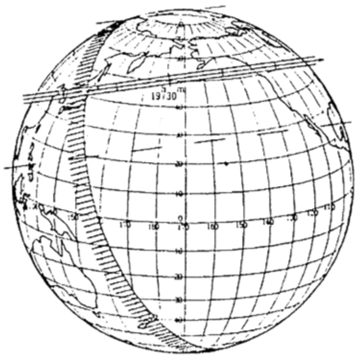


SAO 93872 by Chaldea 1987 Jul 28

SAO 93872 by Chaldea 1987 Jul 28

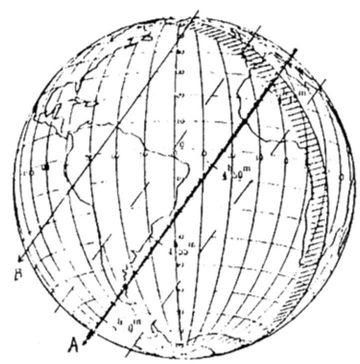


SAO 186544 by Christine '87 Jul 21



Anonymous by Europa 1987 Jul 21

Anonymous by Bamberga 1987 Jul 22



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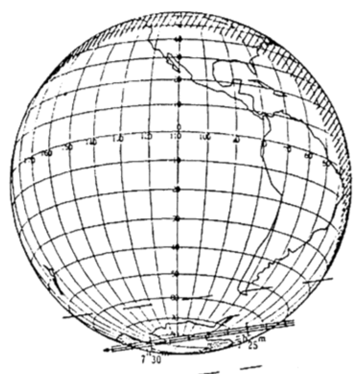
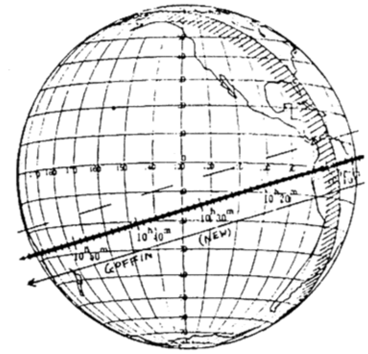
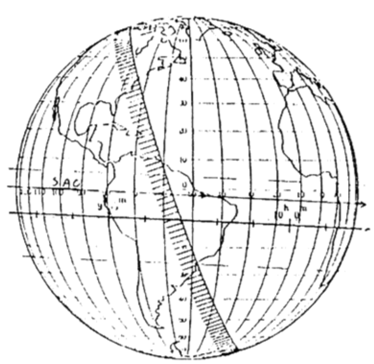


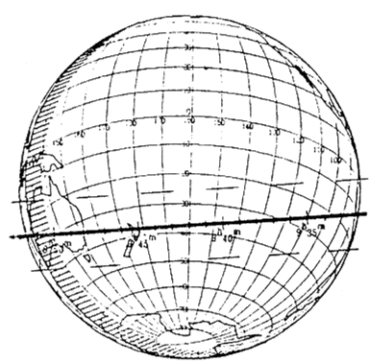
-18°5677 by Pales 1987 Jul 26



SAO 145932 by Galatea 1987 Jul 26

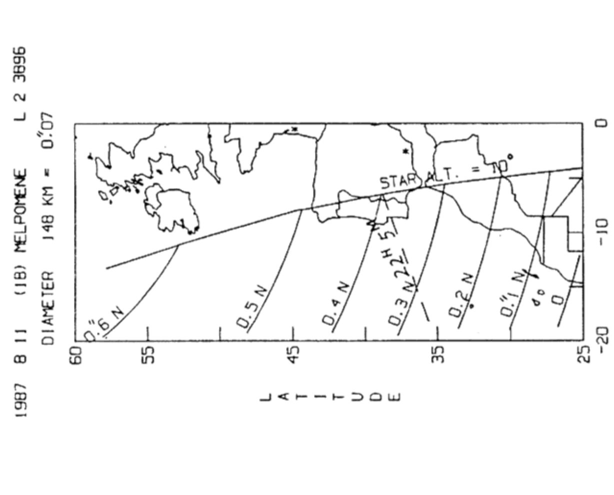


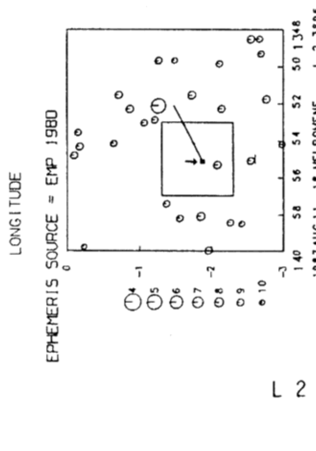
SAO 110838 by Roma 1987 Jul 29

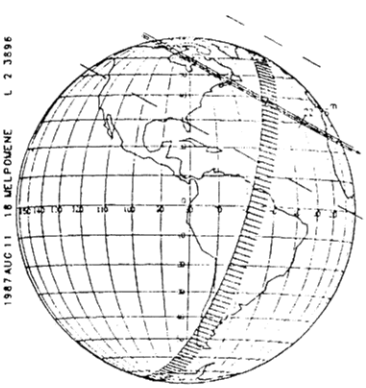


SAO 188689 by Pompeja 1987 Aug 5

SAO 188987 by Beatrix 1987 Aug 5

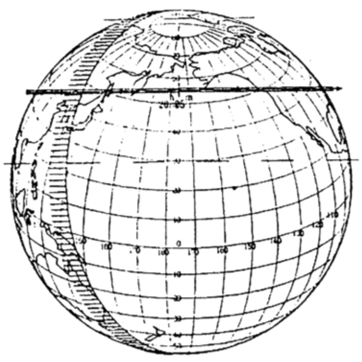




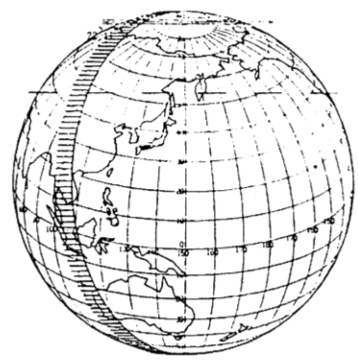


L 2 3896 by Melpomene 1987 Aug 11

SAO 92414 by Melete 1987 Aug 8



Anonymous by Ophelia 1987 Aug 10



Anonymous by Ophelia 1987 Aug 12

ASTEROID ORBITAL ELEMENTS UPDATED FOR OCCULTATION PREDICTIONS

Edwin Goffin

I have analyzed all available observations of several asteroids that will occult stars this year, to compute improved orbital elements, which I have then used to update the occultation predictions. The corrections relative to previously distributed predictions are given in the table. Six-digit star numbers are SAO numbers; other star numbers are AGK3 numbers, as given in my predictions. For most events, there are two corrections, one to be applied to my previous prediction (G in notes) and the other to be applied to the IOTA prediction as shown on the maps by Sôma and Dunham (I in notes). "N" in the notes indicates an event that was in the North American supplement distributed in January. "M" indicates that the mean position of a double star was used in the calculations. The April 22nd event was not included in the predictions that I originally sent to IOTA.

1987 Date	Asteroid	Star No.	Path Shift	Time Cor.	Notes
Apr 11	Baptistina	+28° 756	0".19S	-1.6	GN
			0.66N	-0.9	I
Apr 22	Leto	188000	1.85S	+0.6	I
Jun 17	Lamberta	190731	0.25E	+6.6	G
			0.75W	+5.6	I
Jul 6	Ausonia	+02°1467	0.45S	-0.1	G
			0.00	+0.7	I
Jul 23	Mandeville	165095	0.49N	-0.7	GM
Jul 26	Galatea	145932	0.77S	+7.6	GN
			1.00S	-2.2	I
Jul 28	Chaldea	+13° 342	0.23N	-0.1	G
			0.00	+0.9	I
Aug 15	Leto	210421	1.94S	+13.7	G
			2.88S	+2.8	I
Sep 8	Galatea	145609	1.45S	+3.6	GN
			0.98S	-2.9	I
Oct 18	Angelina	+20° 946	0.47S	-1.2	GN
Nov 13	Chaldea	+04° 777	0.10W	+1.1	GN
			1.1 W	+1.2	I

ERRORS IN ASTEROID OCCULTATION PREDICTION TABLE

David W. Dunham

There are some errors in the "Possible Area" column for some of the events in Table 1, Part C on p. 46 of the last issue. The correct areas are listed in the table below.

Date	Asteroid	Possible Area
May 16	Meliboea	Tahiti? for both components
May 21	Athor	southerh Indian Ocean
Jul 7	Davida	Australia?n

REPORT OF ESOP-V

Eberhard Bredner

The annual European Symposium on Occultation Projects in 1986 was arranged by Marek Zawilski, as representative of the Planetarium and Astronomical Observatory of Lodz, in connection with the Occultation Division of the Polish Amateur Astronomers' Society (Polskie Towarzystwo Milosnikow Astronomii). It was held from August 29 to September 2 in the Nicolaus Copernicus Astronomical Centre, Warsaw, with a trip to Lodz (Aug 31 - Sept 1). About 35 participants joined the sessions (Poland, G.D.R., G.F.R., Czechoslovakia, U.S.A.).

We had a first meeting the evening before the symposium when the participants arrived.

ESOP-V was opened August 29 by Marek Zawilski and the Vice Director of the Astronomical Centre, which was donated in 1973 by the U.S.A. to the people of Poland on the occasion of the 500th anniversary of the death of Nicolaus Copernicus, as a central facility for Polish astronomy. Today, it shelters the Section Asyronomy of the Polish Academy of Science. Hans-Joachim Bode, President of IOTA/ES, started the lecture sessions, pointing out that this was the third ESOP outside West Germany.

A short slide review by Dr. Eberhard Bredner, Secretary of IOTA/ES, gave an impression and connection to last ESOP-IV in Antwerp, Belgium. Charles H. Herold, Executive Secretary of IOTA, presented the greetings of IOTA President Dr. David Dunham, emphasizing that IOTA work is without restriction, necessary, for example, to clarify whether the Sun shrinks or not. As a standard, one has to measure, first, again and again, the diameter of the Moon. Peter Lipski gave a report on observations of total occultations (more than 2000, 600 of them reappearances) made during 1984/85 in the G.D.R. He was the first to regret the insufficient service from ILOC. Marek Zawilski presented measurements of the Polish organization (several hundreds) SOPiZ-PTMA in 1984/85. Roman Fangor showed methods of timekeeping, complaining of the difficult situation to get electrical devices in Poland. Now his clock has an accuracy of about 0.02 second. Bohumil Malacek gave a report of asteroidal occultation observations in Czechoslovakia and problems related to last-minute predictions. The calculations have to be checked in advance as to whether an observation is possible. The service of IOTA/ES, as clarified by Eberhard Bredner, should be perfected; several possibilities were discussed.

After a visit to observing facilities of the Polish Amateur Astronomers' Society, we had dinner in a typical restaurant.

Next morning, the lectures were continued by a video presentation (Hans-Joachim Bode) of a grazing occultation, slides of an eclipse in New Guinea and the U.S.A. Charles Herold showed video tapes, including the alpha-2 Librae graze in Sudan. Dietmar Büttner presented his reflections on ILOC's problematical work (*o.n.* 4 (2), 35, 1986 December) which is even now very disappointing. Marek Zawilski assisted him, showing false reductions from ILOC, so that the observer is not able to get a clear information of his ability for measuring occultations. The audience agreed to an appeal to ILOC for a more supporting work.

After lunch, the whole conference started by bus for a visiting tour, with breaks at Frederic Chopin Museum, and at a well-known pilgrimage church, to Lodz, where we all settled, impressed by the landscape and culture, in a first-class motel.

The next morning we were welcomed at the Lodz School Planetarium and Astronomical Observatory, where Agnieska Wlodarczyk introduced us to their work of basic astronomical education. Bazy Feret gave us a computer session with a survey to astronomical programs for microcomputers. We then had an impressive guided sightseeing tour around the town of Lodz. A more practical computer session followed, with lots of discussion and a vist by Polish television camera crew after lunch.

The closing ceremony of ESOP-V gave, once more, the opportunity to discuss in detail the connections to ILOC. We tried to check our facility for reducing European occultation timings before giving them to ILOC to support the normal amateur astronomer. [Herold notes that some Polish observers were interested in undertaking such a project, and wanted to use available microcomputers for other computing projects related to occultations.] Only by chance, but with great acknowledgement of the audience, Peter Lipski showed a photomultiplier measurement of high quality. The whole symposium then had their closing dinner at the hotel, a great opportunity to show the Polish hospitality which was so anxious about us.

Most of us then had an additional trip back to Warsaw, visiting the astronomical observatory of Warsaw University, with a rustic open fire roasting Polish specialties. The very last day gave us a sightseeing tour in Warsaw to old and new points of interest with a once-more closing dinner at an old inn. We then had to part from our Polish friends who had enabled to us a very gracious stay, new impressions, and a lot of engaged discussions. Oh, what a lovely time it was!

CORRECTIONS TO 80H GRAZING OCCULTATION PREDICTIONS

David W. Dunham

Recent analyses of past graze observations, especially Pleiades grazes (see p. 61) and Antares grazes observed near Sendai, Japan, last November 4th (28 stations tried it, the largest graze expedition in Japan) and near Baker, CA, and Gila Bend, AZ, on January 25th (at least 6 videorecordings were made, a record; David Werner reported a 0".16 north shift at Baker), indicate that a correction needs to be applied to most northern-limit grazing occultation predictions distributed by IOTA, those generated with the 80H USNO OCC program and the ACLPPP of 1986 Dec. A hint of the correction was implied in the discussion of southern-declination stars in the last issue, but the correction seems to be a little smaller than indicated there. The cause of the recent shifts is probably the empirical latitude-libration-dependent correction applied to northern-limit grazes. In the 1986 Dec. version of the ACLPPP, I changed the correction factor to 0".043/° of latitude libration, the same value as that determined at the Royal Greenwich Observatory several years ago. But when used with USNO-based predictions, which include other empirical corrections, the correction factor should probably be 0".08/° of latitude libration, the previously used value. For most IOTA predictions for the 2nd half of 1987, I plan to change the ACLPPP back to the 0".08/° value, so IF THE ACLPPP VERSION DATE AT THE TOP OF YOUR PROFILE IS LATER THAN 1987 FEBRUARY, YOU SHOULD NOT APPLY ANY CORRECTION, unless one is recommended in a future *o.n.*

For all northern-limit grazes from now until 1987 June 30 (and for predictions for later dates that have already been distributed), you should apply the following corrections:

For stars in:	Shift the path:
The Pleiades	0".25 south
Taurus (except the Pleiades) and Gemini	0.3 south
Aries and Cancer	0.2 south
Pisces and Leo	0.1 south
Aquarius and Virgo	0
Capricornus and Libra	0.1 north
Scorpius and Sagittarius	0.2 north

Note that NO corrections should be applied to ANY southern-limit graze predictions. Use the arc-second scale on the left side of the profile for applying these corrections; convert the shift to miles or kilometers using the scale on the right side of the profile, or divide the shift above by the vertical profile scale (VPS) given in the lower part of the profile to determine the amount of the shift on the ground measured perpendicularly to the limit. We are anxious to receive reports of observations of northern-limit grazes, especially of stars whose source is FK4, PLDS, P70, or ZP70, to assess the accuracy of the above values.

For the predictions (actually, only the profiles) for the second half of 1987, I want to update the XZ catalog to merge the improved Lick Voyager catalog data into it. Apparently, SAO-G.C. or Z.C. data are still in the XZ for some southern stars that are in the much more accurate Perth 70 catalog; I hope to replace the data for any such southern stars with

Perth 70 data. If either of these changes is made, the USNO OCC program version will be changes to 80I. But I am not sure that my busy schedule will permit this work to be accomplished before profiles for the second half of the year need to be calculated.

THE SUMMER OF 1986 – A PERSONAL REVIEW

Charles H. Herold

The summer of 1986 was astronomically a very fruitful one for me. It was that summer that I attended two super conferences in astronomy in Europe. One was in Helsingor, Denmark, and the other was in Warsaw, Poland. The first one, GIREP, at Helsingor, was funded by the Danish Ministry of Education, the Danish Natural Science Research Council, the Royal School of Educational Studies, E.S.A., and some other well-known institutions of Europe. It was well-funded, well-planned, and executed according to the plan. The week was spent discussing "Cosmos, an Educational Challenge." It was attended by 128 people representing 25 countries, all around the world. All in all, it was very enlightening and very educational.

The second conference I attended was in Warsaw, Poland. It was IOTA/ES's yearly conference, called ESOP-V, and hosted by the Polish Academy of Sciences. Unlike the former, it was not as amply funded, but like the former, it was very well planned, very well executed, and presented in a professional manner. The ESOP-V conference, although having only attendees representing five countries, had an equivalent level in presentation of papers. As noted by Secretary Bredner's report, the subjects were diverse and presented with enthusiasm and concern for IOTA's goals (observation, timing, recording, and reporting of astronomical events). The conference was also a great place to meet and converse with fellow members about similar ideas. To add to this, new friendships arose between the attendees, which cut across national boundaries, and brought together Amateur astronomers with common ideas. The new friends placed an IOTA emblem in the lobby of the hotel in Lodz. We also placed another sticker on the wall, next to IOTA's emblem, which said "astronomy is universal." All members agreed and applauded.

With this in mind, it would be good if IOTA and IOTA/ES could get together for a joint conference, or something in that vein, in the very near future. It was suggested that IOTA and IOTA/ES members could get together this summer to discuss common problems, goals, and future plans. Many thanks to IOTA/ES and ESOP-V committee people for a conference well done.

U.S.G.S. OFFICE FOR EASTERN MAPS CLOSES

American observers no longer have to figure out whether they are east or west of the Mississippi River for ordering U.S.G.S. maps by mail. Harold Povenmire and Richard Taibi inform us that the eastern map distribution office in Arlington, VA, has closed. Now all U.S.A. map mail orders, including requests for free state topographic mapping index maps, must be sent to the previous western office, whose address is: Distribution Branch; U.S. Geological Survey; Box 25286 Federal Center Building 41; Denver, CO 80225.

FEBRUARY 18TH SPICA GRAZE OBSERVED

David W. Dunham

On the morning of February 18th, Spica was occulted across most of North America, the first of a series of occultations of the first-magnitude star. The grazing occultation was timed by observers at several locations near the southern limit across the western U.S.A. shown on my map on page 68 of the January issue of *Sky and Telescope*.

Richard Linkletter organized an 8-station expedition at Lacey, WA. It was cloudy most of the night, but the graze occurred during a 20-minute clearing, and timings of the spectacular graze were made at all stations. Three mountains occulted the star at most stations. Only one event timing was lost, when a police dog nuzzled one of the observers: The dog became excited when the observer started calling out the contacts. Smaller expeditions in Oregon and British Columbia were clouded out.

David Werner got at least eight timings through thin clouds near St. George, UT: A second observer was also successful at a nearby site. The last reappearance took place in two distinct steps. The star's duplicity also modified the diffraction patterns recorded photoelectrically by Nathaniel White with the 42-inch telescope at Lowell Observatory's Anderson Mesa Station. The possible third component may also be in the record, but computer analysis will be needed to be sure; the observation was made through thin clouds. Both disappearance and reappearance were well on the dark side: The multiple-events zone passed about a mile southwest of the observatory, as predicted. A few observers did time the graze within this path at Flagstaff, AZ. Gene Lucas reports that video recordings were made at two of the stations. Thick clouds obscured the Moon until about ten minutes before the graze.

Paul Maley, Charles Herold, and Gary Nealis (all from Houston, TX) and I traveled to New Mexico to observe the graze. We were the same observers who went to Sudan for the alpha-2 Librae lunar eclipse graze in 1985. As in Sudan, we decided to split into two groups, near Gage and Columbus, due to partly cloudy skies, and as in Sudan, all of us observed the graze. Since we each had videorecorded the graze, six videos were obtained altogether, possibly equalling the previous maximum number obtained during the Antares graze on January 25th (see p. 89). The observers at Gage got six events each, while Chuck and I recorded four events near Columbus. I thank Don Stockbauer for loaning me his equatorial wedge, picked up by Gary Nealis on his way to the Houston airport. I discovered that I had left mine at home shortly before my flight left Washington Dulles.

Although the last reappearance was gradual at all our sites, lasting a full second at my location, no step events were videorecorded. The Lowell photoelectric record indicates that the two components were too close to produce step events for most lunar slopes. Glare from the 79%-sunlit Moon prevented video or visual detection of the possible faint third component. These were the first video records of multiple events during a dark-limb graze of a first-magnitude star.