Occultation Newsletter

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FROM THE PUBLISHER

This is the second issue of 1983.

O.N.'s price is $1.40/issue, or $5.50/year (4 issues) including first class surface mailing. Back issues through *Vol. 2*, No. 13, still are priced at only $1.00/issue; later issues @ $1.40. Please see the masthead for the ordering address. Air mail shipment of *O.N.* back issues and subscriptions is 45¢/issue ($1.80/year) extra, outside the U.S.A., Canada, and Mexico.

IOTA membership, subscription included, is $11.00/year for residents of North America (including Mexico) and $16.00/year for others, to cover costs of overseas air mail. European and U. K. observers should join IOTA/ES, sending DM 20.-- to Hans-J. Bode, Bartold-Knaust Str. 8, 3000 Hannover 91, German Federal Republic.

IOTA NEWS

David W. Dunham

John Phelps has submitted his resignation as secretary-treasurer, effective as soon as an alternate arrangement for the work can be made or by the end of the year, whichever comes first. Since November, 1978, he has handled most of the routine work of maintaining IOTA's membership and finances, including receipt of all requests and renewals at the IOTA post office box, and has shouldered some of IOTA's responsibilities since we established the organization in 1975. So I agree with John that it is time for someone else to take care of these responsibilities for a few years. In addition, Berton Stevens also would like to pass on his work of maintaining the IOTA computer files to someone else, especially if the new secretary-treasurer does not live near Chicago; the current arrangement made in 1978 was supposed to be only temporary, as described in *O.N.* *2* (1), 1. Anyone willing to take on part of these responsibilities is urged to write me at P.O. Box 7488, Silver Spring, MD 20907, or to call 301,585-0989. Although perhaps a little less efficient, the work could be divided among more than two people, to lessen the burden on any one of them. Although I already have a couple of offers to assume part of the work, the situation needs to be described here so that other volunteers might be found and a number of options explored. As soon as someone willing to act as the main point of contact for IOTA is found, a new post office box probably will be opened, and the address will be publicized as soon as possible. The maintenance of the computer files can not be done with only a home computer. Although this would be sufficient for producing address labels, the station data needed for computing graze and asteroid-appulse predictions need to be generated on computer cards which can be read by a variety of large main-frame computers. The work conceivably could be done by two people, one producing address labels and maintaining financial information on a home computer and the other maintaining a file of station data which could be punched with a main-frame computer, but it might be better if one person, using a large computer, were to do both jobs, as is the case now.

Related to the change of officers is the effort to incorporate IOTA. Little work has been done on this during the last few months, but Paul Maley has pledged to undertake this so that we might obtain tax-exempt status this year. We will need to write some bylaws which probably will involve democratic elections. Since the problem has been finding anyone willing to do the work, we probably will have to hold some kind of election, although it likely will not be very democratic (that is, there will be few choices on the ballot). Since the incorporation almost certainly will be done in the state of Texas, we are especially interested in Texan volunteers for IOTA officers. We probably will be required to hold an annual meeting in the state of incorporation, and it would be desirable to have as many officers as possible attend such meetings. The lawyer's fees for preparing and processing the papers and forms to obtain tax-exempt status probably will be several hundred dollars. Although this could be raised with a small one-time increase in IOTA dues, the size of the increase could be reduced if some of those who will benefit most from the tax-exempt status (especially those who travel far to observe special occultations or to attend IOTA, or IOTA-related meetings) were to donate $25 or $50 (I think that such donations would be tax-deductible when we obtain tax-exempt status). We are not asking for donations now, but probably will in the next *O.N.* issue, which should contain more information about the incorporation effort and realignment of IOTA duties.

Speaking of volunteers, I also would appreciate some help with preparation of *O.N.* articles. More IOTA members have, or have access to, home computers with word processors which facilitate preparation of articles. I have not had time during the past year to adequately report asteroid occultation and appulse observations or lunar grazing occultation observations, not to mention new double stars, and the situation is not likely to improve during the next several months. Perhaps one volunteer could receive all asteroid appulse and occultation reports (I still would like to receive copies of actual asteroid occultation reports and will continue the computational analysis of them) for preparing regular summaries for *O.N.*, and someone else could do the same for grazes, including the lists of observed grazes which I usually prepare. The double star records are in such a mess that I can not turn over that work to anyone else at present. Perhaps with some other obligations removed, I would have time to straighten out the double star data, which also could be used to streamline the graze prediction process so that the problem of late predictions might be reduced or eliminated.

Wayne Warren has prepared the author and title index for *O.N. volume 2*. Anyone who volunteered to help with various aspects of the subject index for *volume 2* is asked to complete his work as soon as possible, so that we may publish the indices for both *volumes 1* and *2* relatively soon. It is clear that there will not be time to prepare a stellar index, of which I hope a comprehensive version can be prepared sometime during the next couple of years.

The International Lunar Occultation Centre apparently will be distributing residuals soon. They already have distributed preliminary information, including computer lists of 1981 timings, to some observers.

Since the last issue of *O.N.* was prepared, asteroid occultations by (52) Europa on April 26 and by (83) Beatrix on June 15 were observed from the U.S.A., in addition to the Pallas occultation discussed on this page. Low altitude hampered visual observation of the Europa event in Texas. Three well-spaced photoelectric chords were recorded by Lowell Observatory and University of New Mexico Observers, while a similar number of visual chords were timed in Texas. The occultation by Beatrix was recorded photoelectrically at McDonald Observatory, TX; no other reports of that event have been received. It probably would have been better observed if Paul Maley and I could have coordinated efforts to cover it, but we had not returned from observing the solar eclipse in Java. Lick Observatory astrometry for both possible occultations by Pluto in April (see p. 54 of the last issue) showed that the paths would miss the earth's surface. Several negative reports of the April 4th event have been received. There is an error on p. 55 of the last issue. It should have been specified that the two possible occultations found by Dennis DiCicco were the ones by Pluto.

Doug Varney mentioned design of a portable photometer for asteroidal occultations in the April issue of *Sky and Telescope*. He gives some information about it in the article on p. 85 of this issue. In the meantime, at least six copies of Peter Chen's photometer system have been produced. They are being used by Art Sweeney in Dallas, TX; David McDavid in Helotes, TX; Steve Preston in Houston, TX; as well as in New Zealand and at Shanghai Observatory, P.R.C. Chen recently was hired by Computer Sciences Corporation and is working at Goddard Space Flight Center, Greenbelt, MD, where he has the sixth photometer. Designs for the system have been sent to a company in Richmond, VA, for possible manufacture.

IOTA member Richard Binzel, Dept. of Astronomy, University of Texas, Austin, TX 78712, is now editor of *The Minor Planet Bulletin*, the revived publication of the Minor Planets Section of the A.L.P.O. The primary purpose of the *M.P.B.* continues to be to encourage and publish observations of minor planets by amateur astronomers and to provide general information on minor planet studies. The *M.P.B.* is open to papers on all aspects of minor planet study. Theoretical, observational, historical, review, and other topics from amateur and professional astronomers are welcome. The main emphasis seems to be on photometry of asteroids, to obtain rotational light curves. The *M.P.B.* generally will not publish articles on instrumentation, which is usually covered in *IAPPP Communications*. Also, the *M.P.B.* will carry only limited information on asteroidal occultations because more detailed information about them are given in *O.N.* Subscription payments for the *M.P.B.* (four issues are $7 a year, $9 for overseas air mail) should be sent to another IOTA member, Derald Nye, Route 7, Box 511, Tucson, AZ 85747.

Reports of lunar occultations observed in the U.S.S.R. during 1978 and 1979 have been received from Dr. A. Osipov in Kiev. Copies have been sent to Joseph Carroll, so that they can be incorporated into the tally for 1979 and correction information published for 1978.

I thank Bob Millis, Lowell Observatory, for sending me a print of a plate showing L680066, the star to be occulted by (451) Patientia on September 14th. The star is in a very crowded field in the Sagittarius star cloud, and the print was needed to prepare a blowup of the area very close to the star (included with the finder chart on p. 92) so that it can be identified positively.

In mid-July, I will work on the extended-coverage U.S.N.O. lunar occultation predictions, and I hope to distribute predictions before the northern Milky Way passages in early August. If possible, I will create another catalog by processing the southern part of the Southern Astrographic Catalog data, since the moon now is passing south of most of the C-catalog stars in the Southern Hemisphere. Unfortunately, I did not have time to do this before the June 25th partial lunar eclipse, which was not very favorable for occultations, anyway.

I may have time to prepare more material for another issue of *O.N.* in August, for publication in early September. However, I may be delayed in doing this until after the Sept. 11th occultation by (51) Nemausa, in which case, the next issue will appear in October.

PRELIMINARY REPORT ON THE PALLAS OCCULTATION

David W. Dunham

In spite of a number of setbacks, mainly a very difficult weather situation, over 100 observers timed the occultation of 1 Vulpeculae by Pallas on May 29th, making it the best-observed asteroidal occultation by far. The southern coordinators are to be congratulated on a job well done. The overall effort was coordinated by Lowell Observatory and the Planetary Science Institute (P.S.I.) as well as by IOTA. A short article stressing observation for secondary events was published in the May 14th issue of *Science News* using material supplied by me, giving IOTA wide publicity. Clark Chapman of the P.S.I. gave a presentation about the event on May 28th at the convention of the American Association for the Advancement of Science in Detroit, MI. He also sent a press release to over 200 newspapers, radio and television stations in the predicted path about ten days before the event. As far as we know, that effort resulted in no additional observations, although several timings were sent by Planetary Society members in response to Chapman's article in the March/April issue of *Planetary Report*. In addition, all of the satellite launch tracking cameras of the Eastern Test Range were used to obtain videotapes of 1 Vulpeculae during the appulse (weather permitting) at the request of the U. S. Naval Observatory.

The chords for 54 observers were plotted on a sky-plane diagram, similar to those prepared for previous asteroidal occultations, and distributed to the regional coordinators in early June. The chart is not reproduced here, since we want to include all of the observations before we publish it. The observed points fall close to a circular outline about 530 km in diameter. Paul Maley has reported the shortest chord on the north, a 3.4-second occultation of the primary star observed by Bill Darnell near Athens, Texas. The southernmost chord plotted was 36.4 seconds observed by Guillermo Gonzales at Hialeah, Florida. Another chord was obtained photoelectrically by members of the Southern Cross Astronomical Society at their observatory in South Miami, several kilometers farther south. Most of the remaining unreported chords, by observers organized by Paul Maley in Texas, will fill in detail on the northern part of Pallas; several short chords will be especially useful. In some cases, personal equation estimates and coordinates will have to be refined. One discrepancy involves the short Athens, TX, chord, since the chord for Doug Walker, who claims to have seen a miss at Rio Vista, TX, is about a km south of it, according to the approximate coordinates provided.

Especially interesting is the observation by Jim McGaha near the northern limit at Davis Ranch, AZ. The star disappeared for 12 seconds, then reappeared for half a second, then disappeared again for another second, apparently due to an irregularity on Pallas. Although nobody else saw such a "grazing occultation," the chords for Texan observers just north and south of McGaha's chord are in agreement.

So far, there are only a few reports of possible short secondary occultations by observers within the path; not enough information is available yet to see whether any of these confirm each other, or whether data from adjacent stations rule them out. A 2.5-second "possibly spurious" occultation nearly 9 minutes after the closest approach has been reported from Tempe, AZ, outside the path, near a shift value of 0"21 N. Two observers near Westmoreland, CA, close to the Tempe chord, saw no occultation, and they observed for over ten minutes after closest approach. The exact separations of these observers on the sky plane have not yet been computed. Four long secondary "occultations" videorecorded with the 48-inch Eastern Test Range telescope at Malabar, FL, were gradual and clearly caused by clouds.

Most observers noticed that the disappearance was gradual or occurred in steps. The star's spectroscopic companion was resolved clearly in photoelectric and video records, with events of it occurring a few tenths of a second after the primary star. The University of Arizona reports that the component magnitude difference was 0.9 in their blue photoelectric channel (observations made near Presidio, TX) and 0.6 in the red. The diameters of the components might be determined from the high-speed photoelectric records obtained at McDonald Observatory, Rosemary Hill Observatory, and probably others.

Unfortunately, unforeseen difficulties prevented updating the message on WWV after 22^h U.T. May 27, so the last-minute astrometry obtained at the Univ. of Virginia and Van Vleck Observatory on May 25, and at the U.S. Naval Observatory-Flagstaff on May 27 were included in the telephone update messages, but not on WWV. The final prediction, in essentially exact agreement with the nominal prediction (shift 0"007 north, time within 1 second), was based on the Flagstaff result. The actual path was apparently at about 0"01 south and about 8 seconds early.

I had planned to deploy our six observers from the Washington area south of Miami into the northern Florida Keys in order to get chords across the southern cap of Pallas, but rain and extensive clouds forced us to set up mainly west of Ft. Lauderdale instead. During the half hour before the occultation, when it was too late to move, the sky cleared rapidly to the south, but clouds remained on the southern horizon, probably still preventing any possible observation from the Keys. Extensive cloud cover in Texas and Mexico prevented any chords being obtained on the southern third of Pallas in those areas. Nevertheless, over 400 km of Pallas' 530-km diameter was covered, including an arc of approximately 270° of the circumference. The maximum reported durations were 45 seconds.

Richard Nolthenius and Steven Dale drove from Los Angeles, CA, to Bahia de Los Angeles, on the east side of Baja California. Satellite photoes showed that this area would not be affected by the usual low clouds along the Pacific Coast. They both timed 44-second occultations from locations about five miles apart. Astronomers from Lowell Observatory also travelled to Mexico with their portable photoelectric systems and 14-inch Celestrons. They set up at three locations in Sonora, but clouds prevented observation at the two southern sites. The successful station was near Imuris, about 40 miles south of Nogales, AZ.

Thomas Van Flandern, U.S. Naval Observatory, presented the preliminary results of the occultation during a meeting of the American Astronomical Society's Division on Dynamical Astronomy in Chicago, IL, on June 16.

EVEN MORE ASTEROIDAL OCCULTATIONS DURING 1983

Robert L. Millis and David W. Dunham

An expansion of the computer comparison of minor planet ephemerides with the AGK3 and SAO star catalogs at Lowell Observatory has resulted in the discovery of seven more occultations during the second half of 1983 which were not found during earlier work and have not been published in previous issues of *o.N.* Over 200 asteroid ephemerides were used during this new work, but the number of new events is small due to the success of previous searches and due to the rejection of unfavorable events, that is, those with angular diameters less than 0".08, with central durations less than 5 seconds, or with solar elongation less than 45°. We also include one event brought to our attention by W. Landgraf of Göttingen, Sweden, although the short duration and small angular diameter will pose difficulties.

1983 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	OCCULTATION Possible Area	El SUN	MOON El	MOON %Snl	MOON Up	Ephemeris Source
Jul 5	19^h13^m	Ekard	12.1	1.37		11.5	G0	$23^h37^m.9$	20°40'	1.1	6^s	13	21	southeastern Australia	99°	43°	27-	all	HERGET79
Jul 15	23 19-34	Aemilia	13.2	2.43	163629	9.4	G5	20 27.4	-17 12	3.8	10	23	25	Sri Lanka, s. Africa, s. Brazil	167	117	38+	w 5°W	EMP 1982
Jul 24	14 24	Leto	11.0	1.96		10.6	F8	1 47.1	4 08	1.0	8	17	22	New Zealand?n	94	89	100+	all	HERGET78
Jul 26	11 06-11	Sappho	11.1	1.46		9.3	K0	1 34.7	17 58	2.0	5	14	25	Hawaii?n; southwestern U.S.A.	94	71	98-	all	HERGET78
Aug 3	2 18-45	Lacadiera	12.3	1.18	127446	9.6	G5	22 16.7	0 16	2.8	11	33	25	n. Africa, n. South America	152	77	39-	e 30°W	EMP 1982
Oct 25	4 42-67	Galatea	12.3	1.64	95086	9.1	A0	5 56.5	18 59	3.3	38	85	21	central South America	122	19	88-	all	HERGET78
Nov 17	7 15	Ino	13.4	3.17	118571	7.9	K0	10 52.2	6 07	5.5	7	15	27	northern South America	72	146	89+	w 60°E	HERGET78
Dec 16	15 16-30	Astrid	15.0	1.95		11.0	B9	6 49.6	23 52	4.0	3	23	74	Samoa?s,Borneo,Malaysia,SriLanka?n	162	61	86+	w175°E	EMP'82

- - - - - - - - -Table 1 is above.- - - - - - - - - -Table 2 is below.- - - - - - - - -

1983 DATE	No.	MINOR PLANET Name	km-diam.	-"	RSOI	Type	MOTION °/Day	MOTION PA	STAR SAO No	STAR DM No.	D	STELLAR DIAMETER M"	M	Time	df	S	COMPARISON DATA AGK3 No	Shift	Time	APPARENT R.A.	APPARENT Dec.
Jul 5	694	Ekard	95	0.10	216	C	0.414	51°				0.04	40	2	0.2	A	N20°2645			$23^h39^m.5$	20°51'
Jul 15	159	Aemilia	141	0.08	739	C	0.185	250	163629	-17°5999						X				20 29.3	-17 05
Jul 24	68	Leto	128	0.09	425	C	0.276	69		+03 246		0.06	80	5	0.3	XA	N 4 210	-0.01	-0.0	1 48.8	4 18
Jul 26	80	Sappho	84	0.08	183	U	0.400	70		+17 229		0.23	242	14	1.0	A	N17 132			1 36.5	18 08
Aug 3	336	Lacadiera	69	0.08	158	C	0.181	261	127446	-00 4338		0.15	132	20	0.6	SA	N 0 2799	1.12	0.9	22 18.4	0 26
Oct 25	74	Galatea	113	0.10	359	C	0.060	139	95086	+19 1161		0.05	56	19	0.2	XA	N18 535	0.14	1.3	5 58.5	19 00
Nov 17	173	Ino	169	0.07	852	C	0.241	104	118571	+06 2368		0.55	1275	55	3.6	XA	N 6 1371	-0.43	0.9	10 53.9	5 56
Dec 16	1128	Astrid	38	0.03	88		0.202	277		+23 1519		0.02	27	2	0.1	XA	N23 739	0.01	-0.0	6 51.6	23 49

Information about the events is given in two tables in the same format as those in the main list of 1983 events in *O.N. 3* (1) 9. By the time this issue of *O.N.* is distributed, the occultations in early July will have occurred. Advance copies of the information about those events were sent in June to IOTA coordinators in the possible areas of visibility. You can receive local circumstances for these additional events by sending a self-addressed stamped envelope (for those in the U.S. A.) to Joseph Carroll, 4216 Queen's Way, Minnetonka, MN, 55343; see *O.N. 3* (1) 17 and (2) 37. But since the number of events is small, you might instead estimate approximate star and sun altitudes from Sôma's world maps for these events.

Table 3.

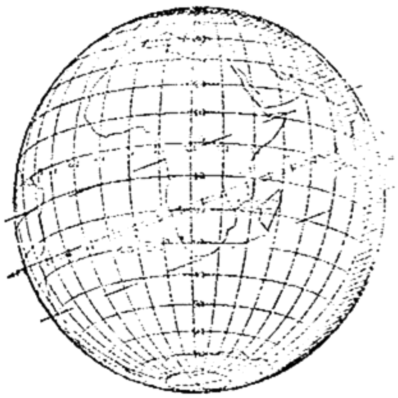
Ephemeris Differences for 1983

Date	MP#	Shift	Δt	EPHEM SOURCE
Jul 5	694	0".24N	$0^m.4$	EMP 1982
Jul 24	68	0.17S	1.3	EMP 1982
Jul 26	80	0.10S	0.5	EMP 1982
Oct 25	74	3.15S	10.2	EMP 1982
Nov 17	173	0.01S	-0.0	EMP 1980

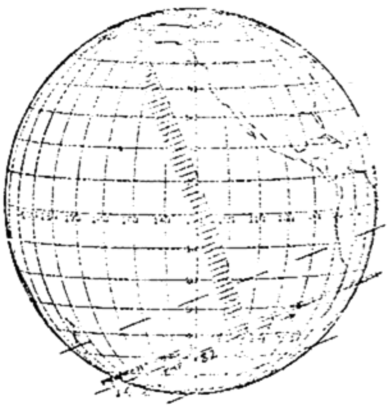
When possible, the predictions here have been computed using ephemerides generated from orbital elements published by Paul Herget in the Minor Planet Circulars. For these minor planets, shifts for predictions using other sources are listed in Table 3. The only large difference is for (74) Galatea on October 25th, when the asteroid is near a stationary point in right ascension. We have noted previously that ephemeris errors and differences tend to be large near stationary points. Since all observations of Galatea during the last several years were made near opposition, where the ephemeris differences are small, it is not possible to tell which prediction will be closer to the truth. If the EMP 1982 prediction is correct, there will be no occultation by Galatea on Oct. 25.

Dunham's finder chart and information about the occultation by (80) Sappho on July 26th was published in this July's issue of *Sky and Telescope*, p. 49. *O.N.* readers, particularly those in North America, should watch *Sky and Telescope*, especially the Celestial Calendar section following the monthly sky map, for information about astrometric updates or possible new events. *Sky and Telescope's* more frequent publication schedule often permits dissemination of new information before it appears in *O.N.*

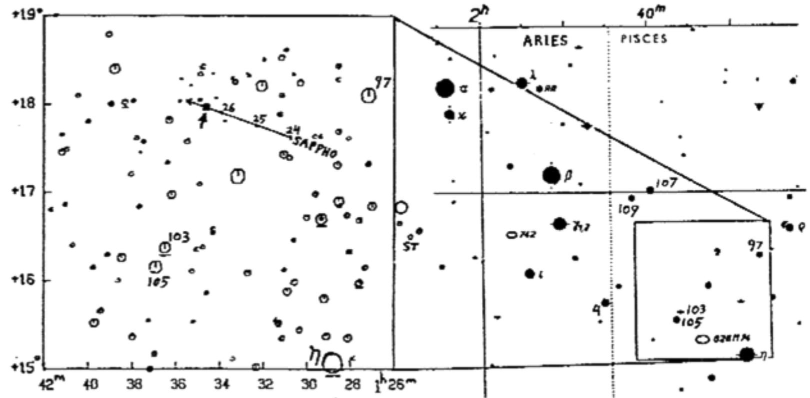
N20°2645 by Ekard 1983 Jul 5



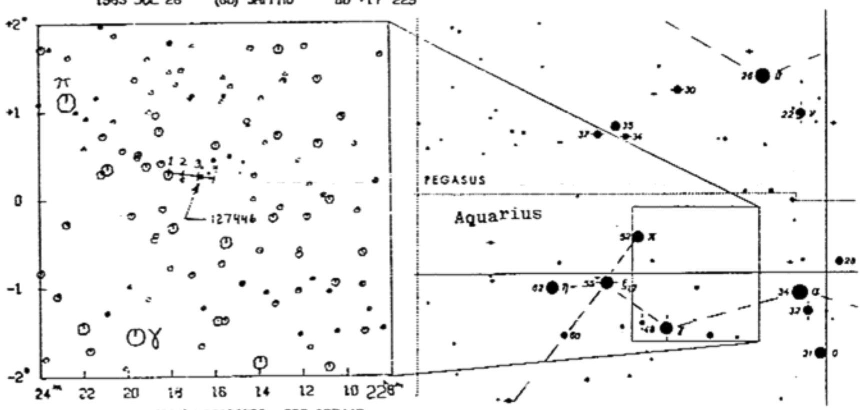
SAO 163629 by Aemilia 1983 Jul 15



+03° 246 by Leto 1983 Jul 24



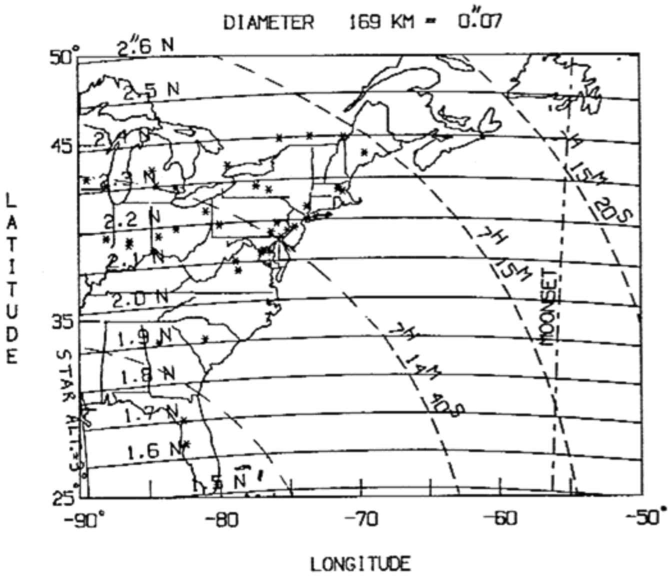
1983 JUL 26 (80) SAPPHO BD +17° 229



1983 AUG 3 (336) LACADIERA SAO 127446

1983 11 17 (173) INO SAO 118571

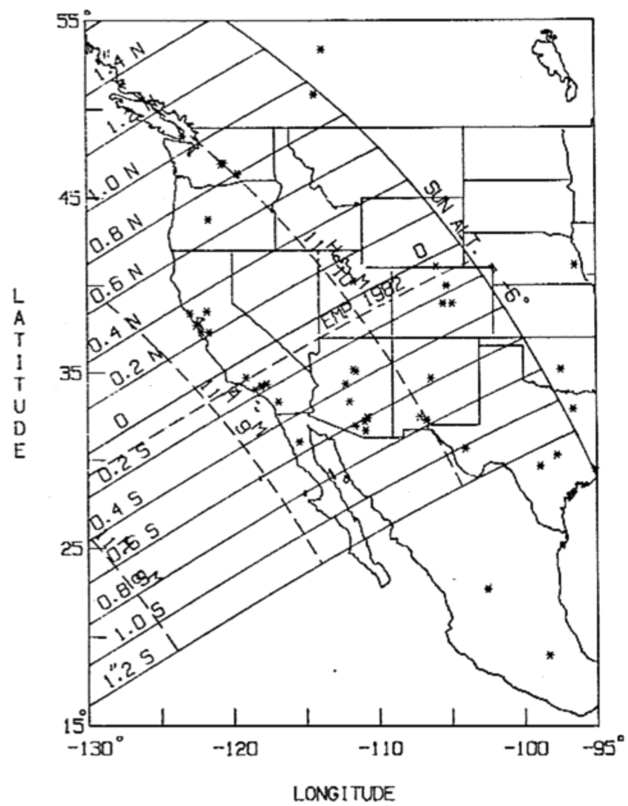
DIAMETER 169 KM = 0".07



EPHEMERIS SOURCE = HERGET78

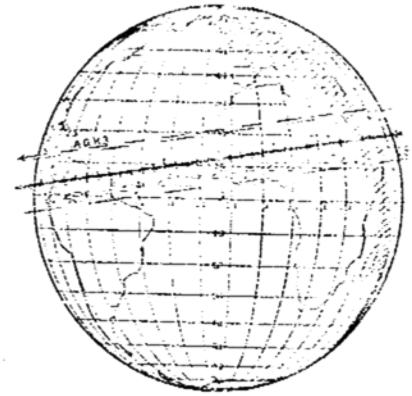
1983 7 26 (80) SAPPHO BD +17° 229

DIAMETER 84 KM = 0".08

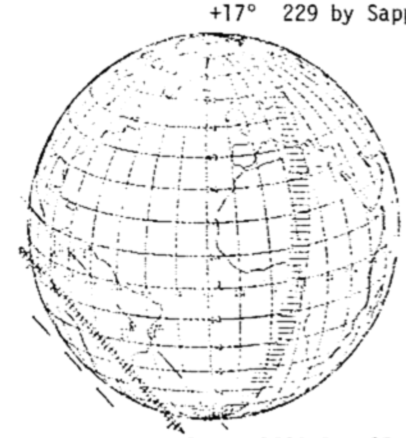


EPHEMERIS SOURCE = HERGET78

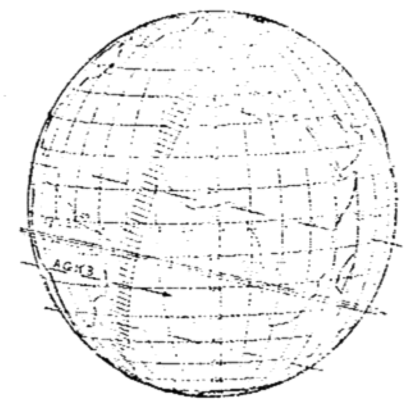
+17° 229 by Sappho 1983 Jul 26



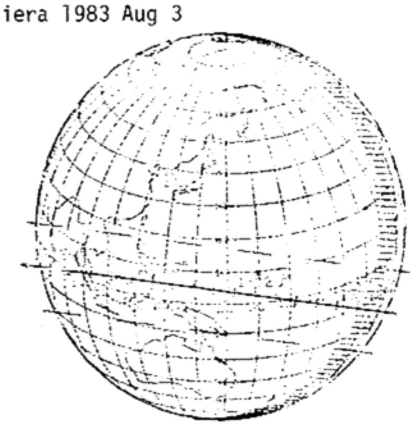
SAO 127446 by Lacadiera 1983 Aug 3



SAO 95086 by Galatea 1983 Oct 25



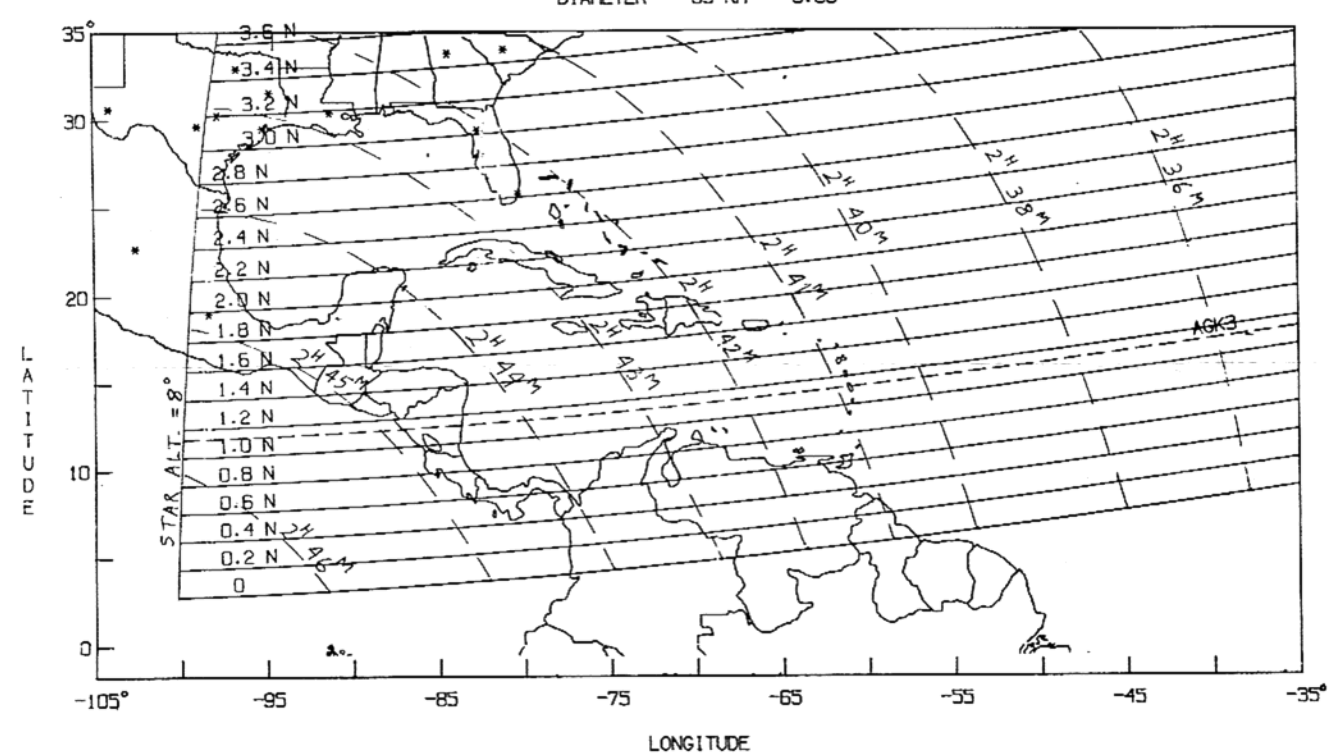
SAO 118571 by Ino 1983 Nov 17



+23° 1519 by Astrid 1983 Dec 16

1983 8 3 (336) LACADIERA SAO 127446

DIAMETER 69 KM = 0."08



EPHEMERIS SOURCE = EMP 1982

GRAZE CAUTION

David W. Dunham, Derald Nye, and Don Stockbauer

While checking predictions and profiles for grazes during the second half of 1983, Dunham noticed large values for HEIGHT given on the ACLPPP profiles for waning-phase grazes of stars in the Northern Hemisphere, usually around 0".50. The HEIGHT value mainly reflects the difference between the U.S.N.O. versions used to compute the limit line data and the profiles, which are 80F and 78A, respectively. The positions of at least the brighter (brighter than about 7th mag.) Northern Hemisphere stars in the XZ catalog usually are accurate to about 0".2. The HEIGHT differences are apparently due to different lunar ephemeris corrections, since they are positive for northern-limit grazes and negative for southern-limit events. The 80F are always almost a mile north of the 78A paths. If you follow the usual guidelines for using the predictions and profile, you will always correct to the latter, which utilizes U.S.N.O. version 78A. Since this is south of the 80F path, this will, at worst, err on the side of safety for northern-limit grazes, which are the ones which are usually on the dark side for waning-phase Northern Hemisphere events. However, since most northern-limit multiple-event regions are so narrow, it would be useful to know which version is better, so that everyone does not keep seeing only a long shallow total occultation. The differences are so large that only a few observations should tell which version currently gives the best prediction.

80F is the later version, based on more observations with improved (or at least more complex) modelling, so it should be better than 78A. However, the empirical corrections which are applied by A.C.L.P.P.P., including the observed Cassini-graze data, are referenced to 78A, so we would prefer to use it until the past observed data and corrections can be referred to 80F data.

Nye reports that 11 stations were set up near his home southeast of Tucson, AZ, for a graze of 4.7-mag. Z.C. 3536 (30 Piscium) on July 2nd. The graze was well observed, with one observer, Richard Hill, timing 24 events. Peter Manly, who travelled from Tempe, AZ, recorded 12 events at his station using video equipment. Many of the observed disappearances and reappearances were very slow, due to the combined effects of Fresnel diffraction and the spectral-type M star's angular diameter. The path was about 0".5 (or 0.9 mile) south of the 78A predicted path, whereas 80F predicted a north shift of 0".6. Although this might indicate that 78A is better, the case is complicated by the fact that 30 Piscium is in both the Perth 70 and FK4 catalogs. 78A used FK4 data, whereas 80F used a combination of the two; the perth 70 data alone implied a path shift of 1".2 south from a prediction based only on FK4 data. 30 Piscium, at a declination of -6°, is not in the Northern Hemisphere and is consequently not in the region of improved XZ star positions. So this case alone can not settle the question we are seeking to answer. The June 11th total solar eclipse path, which was computed using 80F, apparently shifted about 0".5 south, which also seems to favor 78A; see p. 88. But the sun is special, and might not be exactly in the same FK4 coordinate system used for the stars. Perhaps a better test came on July 4th, when Stockbauer and three other members of the Houston Astronomical Society observed a graze of 8.4-mag. SAO 109954 near Alvin, TX. In spite of the star's faintness, conditions were good and everyone was able to follow the star easily. The set-up was according to the 78A profile, and everyone had a single long occultation. The 80F path was 0".64 north of the 78A path, but Stockbauer calculates that the actual path shift was 1".0 north from 78A, or even 0".4 north of 80F. Since the star is relatively faint, its position may be more inaccurate than usual; but the observation certainly favored 80F.

Analysis of some of last year's graze observations may settle the problem, since although the 78A - 80F differences were probably smaller then, they may have been large enough to distinguish observationally. Unfortunately, unusually bad summer weather prevented all my local efforts to observe waning-phase Northern Hemisphere grazes in 1982. In two or three weeks, the question probably will be settled with either current or 1982 observations. In the meantime, you should use the predictions as usual, but extend the observing fence far enough north to get multiple events in the case that 80F might give the better prediction. Divide HEIGHT by VPS (vertical profile scale) to determine how far north the observing fence should be extended. If you are planning a large expedition before we publish the results of our analyses in the next issue of *O.N.*, check with me to see what we have learned.

THE SEPTEMBER 11TH OCCULTATION OF 14 PISCIUM BY (51) NEMAUSA

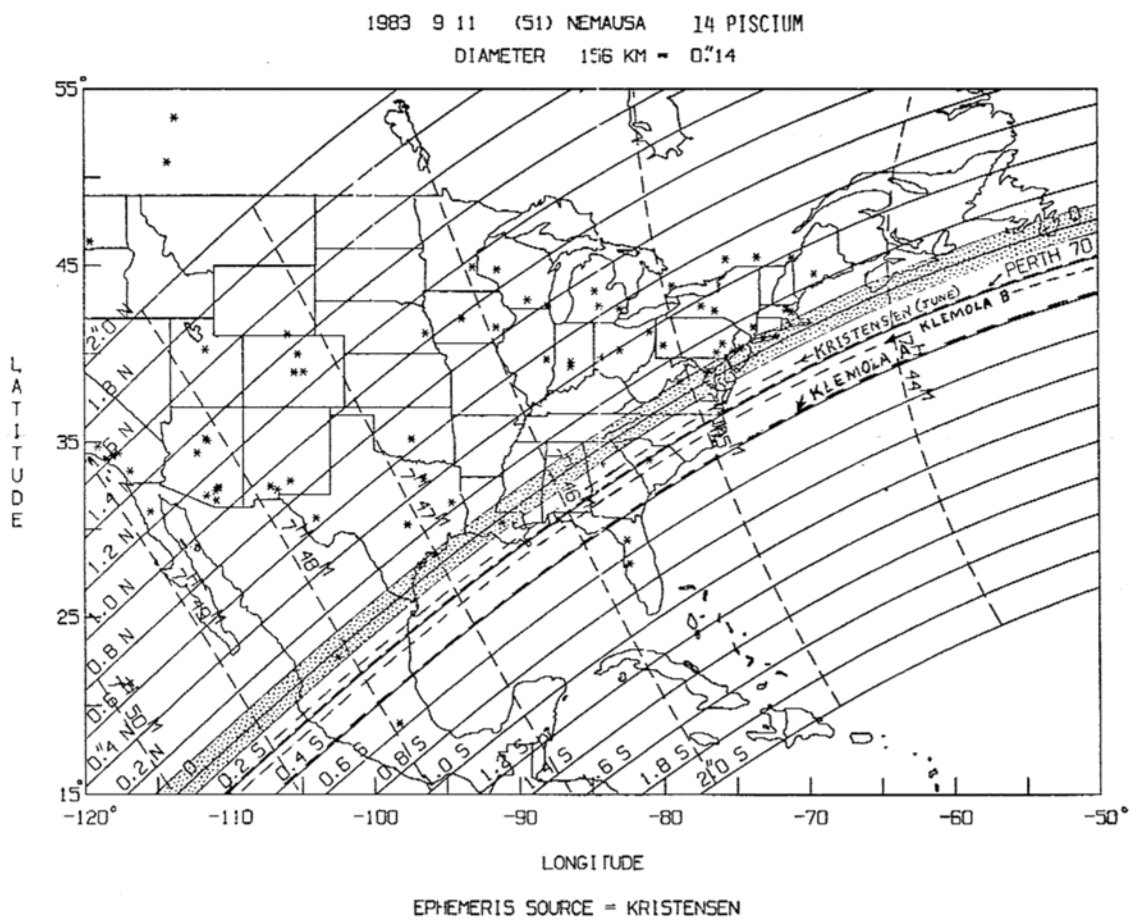
David W. Dunham and Leif K. Kristensen

One or two occultations of naked-eye stars by asteroids usually are predicted each year, but such events are much less frequent for a given region. We are fortunate to have two naked-eye stars occulted in the U.S.A. this year. The last one in North America before 1983 occurred in Mexico when (6) Hebe occulted 4th-mag. γ Ceti. That was in March of 1977, the first year that comprehensive asteroid-occultation searches were undertaken. Lowell and Royal Greenwich Observatory predictions show that no stars brighter than 8th magnitude will be occulted by asteroids for North Americans during 1984. We plan to organize for the September 11th occultation in the same way that we successfully did for the May 29th occultation of 1 Vulpeculae by Pallas. An article about the Nemausa occultation will appear in the September issue of *Sky and Telescope*.

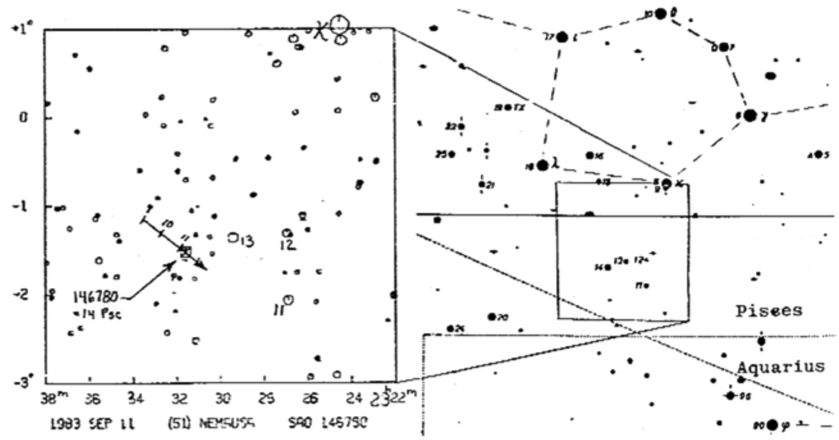
Since Nemausa's orbit is inclined to the ecliptic in such a way that the asteroid always remains within about 10° of the celestial equator, accurate measurements of Nemausa's position have special astrometric value for correcting the declinations of stars in the fundamental astrometric catalogs, especially the FK4, to which all other catalogs are referenced. Accurate astrometric observations of Nemausa can determine the location of the celestial equator probably better than any other method. And occultation observations can locate asteroids relative to stars more accurately than any other method. The position and proper motion of 14 Piscium, and of other stars whose occultations by Nemausa have been or will be observed, will be measured accurately by the European Space Agency's HIPPARCOS satellite, scheduled to be launched in 1986. Well-observed occultations combined with HIPPARCOS observations of the occulted stars will yield a substantial improvement of the determination of Nemausa's orbit and of the fundamental stellar reference frame. In addition, Nemausa's detailed shape can be traced with numerous accurately observed chords well-distributed across the minor planet. This may explain Nemausa's strange light curve, which contains three maxima during its 7.784-hour period of rotation, according to observations by Chinese astronomers and by T. Gammelgaard and Kristensen.

The nominal predicted path for the occultation is shown by the shaded region on the regional map. The zero line is the center of the path according to an ephemeris for Nemausa computed by Kristensen a year ago. The star position used is from the FK4 Supplement. The dashed curve at 0"19 south used instead the star's position calculated from Perth 70 data, which were used for my map on p. 58 of the January issue of *Sky and Telescope*. Kristensen recently issued an improved prediction shown by the dashed curve at 0"15 south. It is based on a better orbit determined from recent observations and a new star position calculated by R. Bien and H. Schwan at the Astronomisches Rechen-Institut in Germany. If this new position is correct, the path will miss Canada, New England, New Jersey, and Texas. The estimated uncertainty in the path is 0.16 arc second, or about one path width, so a more northern path near the nominal one is quite possible. In addition, Arnold Klemola has measured a plate taken at Lick Observatory in June, when Nemausa passed 3° north of the star. Reduction of these data at Lowell Observatory shows that the path will be 0"39 ± 0"08 south, with the time being 0.05 minute later than times indicated from the map, when Kristensen's new (June) orbit is used. This path is labeled Klemola A on the map. But we feel that the calculation of the new orbit, which utilized new values for the earth's orbit around the sun, may have been done too hastily. If the old (1982) orbit is used, we find that the Lick data give smaller ephemeris corrections. The Lick star position then causes most of the total shift of 0.25 arc second south, with the time 0.24 minute early; this is labeled Klemola B. Kristensen will re-analyze all available data to produce what should be a better prediction, which will be distributed to the regional coordinators.

Nemausa's diameter was determined to be 153 ± 15 km from two photoelectric timings of an occultation of SAO 144417 observed in the southern U.S.S.R. on 1979 August 17. Further astrometric updates will be critical for improving the location of the narrow path. Updates will be broadcast on WWV starting September 6th, and also will be available by telephoning recorded messages at 312,259-2376 (Astroalert) and 713,661-6180 (maintained by the Houston Astronomical Society, starting Sept.7). Observations by many observers near the northern and southern limits of the path will be especially important for defining Nemausa's outline. Everyone at fixed sites 0"2 or less outside of the finally predicted path is urged to watch for an occultation in case the astrometric error is much larger than expected.



Everyone attempting to observe the occultation, and anyone as much as 1"4 from the predicted path, should watch 14 Piscium for a 12-minute interval centered on the U.T. of closest approach for his location determined from the map, to check for possible secondary occultations. We are interested primarily in the main occultation since there is no prior evidence for satellites of



Nemausa and extensive observations of the Pallas - 1 Vulpeculae appulse apparently resulted in no confirmed secondary occultation observations (see p. 76).

We want everyone in and near the path, who is planning to observe the Nemausa occultation from home or from another fixed site, to inform his regional coordinator, who can see which chords will be covered. If you are mobile, and are either already in a region expected to be crossed by the path or plan to travel to such a region from a distant location, send the coordinator a self-addressed, stamped envelope, so he can send you a map showing specific sites or lines from which you should observe in order to fill in gaps of the fixed-site coverage.

Since the latter will not be known until a week or so before the occultation, you probably will not receive a site or line assignment from the coordinator until a few days before September 11th. The mid-week time of the occultation will facilitate travel by interested observers who live far from the path, and carpooling probably can be arranged to divide up expenses and driving.

The regions and associated coordinators were listed in the article about the Pallas occultation on p. 47 of the last issue of *O.N.* Names, telephone numbers, and addresses either were given there, or are in the 1982 November IOTA membership list, or are in the list on p. 441 of the May issue of *Sky and Telescope*. The "active" regions and coordinators for the Nemausa occultation, equivalent to the "southern" coordinators for the Pallas event, are listed below; addresses and telephone numbers are listed only if they are different from those given before, or are new.

For Canadian Atlantic Provinces: Roy Bishop, Physics Dept., Acadia University, Wolfville, N.S. B0P 1X0, phone 902,542-3992.
For New England and NY: Thomas McFaul, 870 Pequot Ave., Southport, CT 06490, 203,255-5547 (212,397-9201 weekday evenings).
For DC, DE, MD, NJ, PA, VA, and WV: David Dunham, 301,585-0989 (alternate message center via Wayne Warren, College Park, MD, 301,474-0814).
For KY and TN: Jim Stamm, London, KY, 606,864-7763.
For NC and SC: Bob Melvin.
For GA: Bill Roberts, 3136 Buford Hwy NE, Apt E-1, Atlanta, GA 30329, 404,636-0431.
For FL: Harold Povenmire.
For AL, AR, and MS: Benny Roberts.
For LA and TX: Paul Maley.
For Mexico: Guillermo Mallen, Cerrada Providentia 43, 10200 Mexico D.F., 905,595-6368.

All other North American coordinators listed on p. 47 of the last issue will be "inactive" for Nemausa, like the "northern" coordinators for Pallas, and will be activated only if there is a much larger shift than we expect. Of course, they might be used to organize for any other events which astrometry shows will be in their areas.

About 50 timings of lunar occultations of 14 Piscium (Z.C. 3474) have been made. But neither these nor other observations have yielded any evidence for duplicity of the spectral-type A2 star. Nevertheless, try to be prepared to time events occurring in quick steps in case 14 Piscium is a very close double star.

Accurate timing of this occultation will be important, since an error of a quarter second corresponds to 2% of Nemausa's diameter. Timings with larger errors will be of little use in defining Nemausa's shape, unless the observer happens to be very close to one of the edges of the path.

Several observers who wanted to buy Timekubes for the Pallas occultation discovered that none were available at any of the Radio Shack stores in their areas, since the useful timing device was discontinued several months ago. However, Radio Shack is planning to market a new Timekube, which will have a channel for monitoring weather reports in addition to the time signal channels. The last we heard in May, it was due to be available in July for $39.95, but it was not listed in Radio Shack's July catalog. If interested, you should check with a local dealer in August; we hope the new devices will be for sale before September 11th.

Visual observers in much of the eastern U.S.A. who do not have a source of short-wave time signals can tape record their observations along with WTOP, a 50,000-watt clear-channel AM station at 1500 KHz in Washington, DC. We will make a master recording of WWV and WTOP so that accurate Universal Times can be determined for any word in the WTOP broadcast. Since WTOP will be broadcasting the Mutual Broadcast System "Best of the Larry King Show," observers can use any MBS station broadcasting the same show, since this is done simultaneously in the Eastern Time Zone. Other stations broadcasting this show in the region of the occultation are listed on p. 89.

As with Pallas, observation reports should be sent to the appropriate regional coordinator, even if no occultation was observed. A report is not needed if you were unable to monitor 14 Piscium at any time during the 12-minute observing period due to clouds or other causes. Three other asteroidal occultations are predicted for North America during September, on the 1st, 9th, and 14th. Information about them appeared in earlier issues of *O.N.*; finder charts and regional maps are included elsewhere in this issue. Updates for the last two events also might be included with the Nemausa updates on WWV.

If the paths for any of these events are determined well from last-minute astrometry, coordinators in the affected regions will be alerted and attempts made to obtain good observational coverage of them.

OBSERVED LUNAR PROFILE FOR THE GRAZE OF δ CANCRI ON 1981 MAY 10

David W. Dunham, Jared Zitwer, and Vince Sempronio

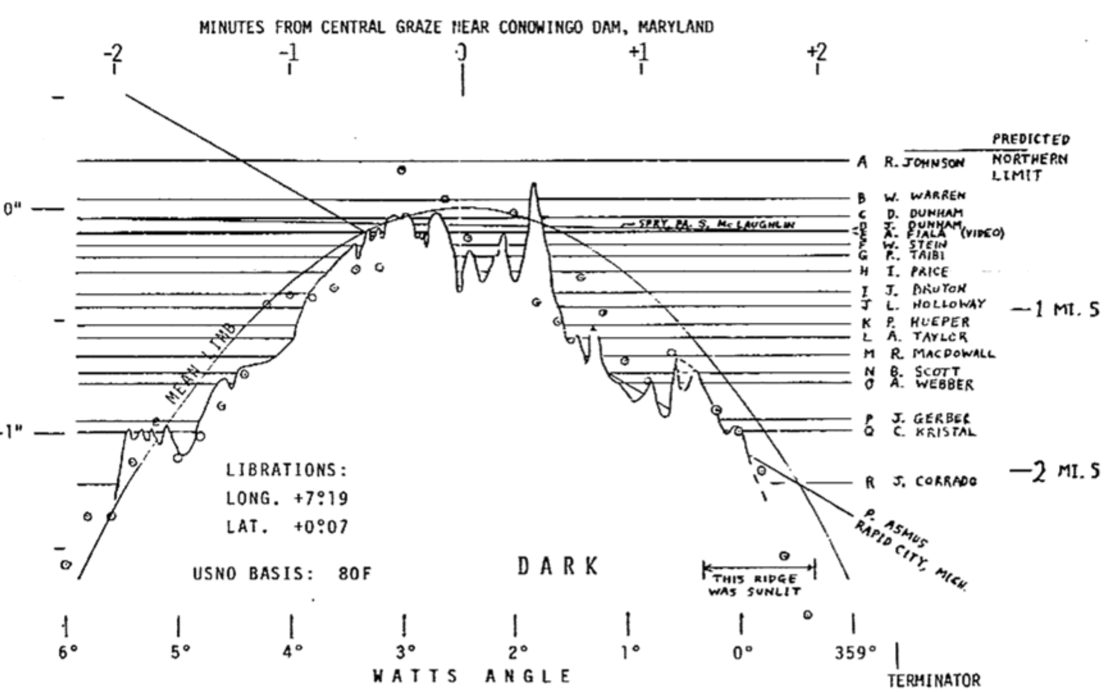
The first video record showing multiple events during a grazing occultation, a northern-limit event observed near Conowingo Dam, MD, on Astronomy Day 1981, was described in *O.N. 2* (12) 167. The video record made by Alan Fiala illustrates the phenomenon well, since 14 events occurred during 62 seconds, with most events appearing "slow" due to Fresnel diffraction. Hundreds have seen this graze played back on television sets at several meetings in the U.S.A. and Europe.

We finally measured the positions of all observers during that graze and reduced all timings at the U. S. Naval Observatory to produce the observed profile shown here. We did this in time for this year's local Astronomy Day display by the National Capital Astronomers at U.S.N.O. The profile proves the statement made in *O.N. 2* (12) 168: "To be sure, most of the information about the δ Cancri graze profile will be derived from the data of the 15 visual observers." Actually, the results of 19 visual observers are shown on the profile, which consequently is traced in great detail. Overall, the data are very consistent, with only a couple of minor discrepancies. Most reduction profiles are drawn with the mean limb a straight line, but we chose instead to draw it like a predicted profile in a style similar to that used by Robert Fischer for the reductions of several California graze expeditions which he led in the early 1970's. The vertical scale in arc seconds is shown on the left side, and in miles from the predicted limit on the right side. It is amplified by a factor of 32 over the horizontal scale, since the moon moved about 180 km during the time between disappearance and reappearance at the southernmost station manned by J. Corrado. The apparent paths for S. McLaughlin at Spry, PA (about 30 miles from Conowingo Dam), and Paul Asmus at Rapid City, MI (a few hundred miles away), are inclined to the other tracks, since the position angle of graze was different at those locations. The slope of their tracks is the tangent of the difference, their P.A. minus P.A. at Conowingo Dam, multiplied by the vertical amplification factor of 32.

With the help of Alan Fiala, Mark Trueblood, and Joan Dunham, we have made a television presentation showing this graze, part of it in slow motion, the equipment used to record it, and some other events which we have recorded. We also made a short demonstration of the geometry of lunar total and grazing occultations. If you can arrange for use of a video-cassette recorder and television display, and want to show this at a meeting or convention, Dunham can loan you a copy of the videotape, which is in standard VHS American format. Also, we now have video records of the occultation of 1 Vulpeculae by Pallas, and of Baily's beads during the total solar eclipse of June 11th described elsewhere in this issue.

Peter Manly reports that two members of the astronomical society in Phoenix, AZ, recently purchased RCA Ultricon cameras like the ones used by Fiala and Dunham. He notes that a local dealer is selling them for only $520, much less than the price we paid in 1981. They have tested the cameras with 8-inch Schmidt-Cass telescopes and image intensifiers, which allow recording stars as faint as 12th magnitude; they plan to use these systems routinely for asteroidal occultations. On April 2nd, Manly and Albert Vreeland in Tucson, AZ, got interesting video records of the lunar occultation of Jupiter, showing a couple of the Galilean satellites in spite of twilight. They used Nuvicon cameras, which are color, and less sensitive than the black-and-white Ultricon.

LUNAR PROFILE FROM GRAZE OF DELTA CANCRI - 1981 MAY 9-10



Circled dots are Watts' predicted limb corrections

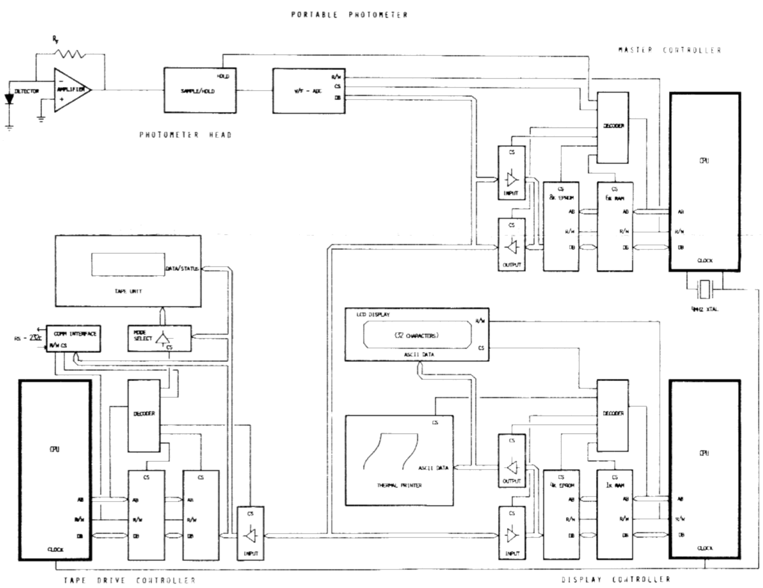
A PORTABLE PHOTOMETER FOR OCCULTATIONS

Doug M. Varney

A basic schematic diagram has been sent to Dunham. The display controller is nearing completion along with the I/O processor. Details willbe sent when appropriate.

At present, the computer system, which utilizes a collection of 6500 series microprocessors, has been designed and is in the process of debugging. A small (20 col.) thermal printer is used for diagnostics and will remain as an output for data similar to a chart recorder. The detected counts also will be displayed via a dot matrix display.

A 300kbyte digital tape drive (Electronic Processors STR-610) is used for data storage and RS-232C (HPIB is being considered as a later option) for off-loading to a host system, in this case my Hewlett-Packard-87. Power can be supplied with a twelve-volt car battery or similar supply; most of the electronics will be replaced with CMOS, when they become available in that form.



A WWV receiver will be built (60KHz) to provide the time ticks necessary to sync the data sample rate.

A Hamamatsu PIN diode (possibly cooled) will be used for a detector with the analog-to-digital conversion taking place within the photometer head and transmitted to the controller.

Currently, I am pondering the operating system and how to make the package as easy to operate in the field as out. I've considered writing a subset of PASCAL or MODULA-2 so it could be used as a general purpose I/O processing system. It surely deserves some consideration.

The prototype system will not be ready until August or so.

If you have any questions, feel free to ask.

3220 Altura #232, La Crescenta, CA 91214

TIMING OCCULTATIONS WITH A DIGITAL STOP WATCH

Brian Loader

One of the two sources of error inherent in using a stop watch to time an occultation is that arising from comparing its setting to a standard time signal. Using a digital watch, it should be possible to make this error negligible in comparison with the other error, that which is due to the estimate of the personal equation.

In order to be able to do this, the watch must have a "lap" facility – most, in fact, do seem to have this. Also, preferably, it should read out to 0.01 second so that timings can be rounded to the nearest 0.1 second. An audible "pip" or "squeak" when the watch is operated is an added advantage, as are reasonably sized operating keys rather than tiny keys on the side.

The cumulative running error or drift of a digital stop watch should be very small, certainly not more than a few seconds per month, and should be determined by the user. Unlike a mechanical watch, this running error should not fluctuate over a short period of time, although it may vary at different times of year.

For timing an occultation, the method generally suggested is to start the watch at the event, and to stop it at a time signal as soon as possible afterwards. This may be a suitable method for use with a mechanical watch, but is scarcely the best for use with a digital.

Rather, the watch should be started on a time signal before the event, preferably at an hour, as it makes arithmetical errors less likely, and the watch shows the correct minutes as the time of the event approaches. Even better, if the stop watch output reads up to 24 hours, then it is useful to start it at zero hours U.T. It can be used on this setting for several days, as it does not matter whether or not it is highly accurate.

Shortly *before* the event, the difference between the watch setting and the true U.T. should be found by a series of checks with a time signal. Using the rhythm of the signal as a guide (anticipating the signal) the watch reading is frozen, using the LAP mode. If the watch makes an audible "pip" as this is done, it is possible to hear how nearly the key press coincides with the signal. By noting the watch reading and repeating the test several times, the difference between the watch and the signal can be found to ± 0.02 second. Even better correlation can be obtained if repeated checks are made over a period of a few minutes and the readings averaged, but the ± 0ˢ02 accuracy is sufficient.

When timing the event itself, the LAP again should be used, so that the time base is not lost. A series of quite close events can be timed in this way. The STOP key should be used only when there are two events so close to one another in time, that there is insufficient time to record the first before the second occurs.

JOVIAN RETINUE LOST IN THE ALPS

Niels Wieth-Knudsen

Due to almost complete cloud cover in western and central Europe, little or nothing has been reported about the grazing (partial) occultation of Jupiter and of the Galilean satellites, on 6 March 1983. I had welcomed receipt of predictions of the Jupiter event from Jan Meeus, almost two years ago, not only as predictions, but also as a valued check of the results of my independent calculation methods, which I then extended to obtain graze predictions for the moons, and to communicate them to IOTA/ES. As it would be impossible for a single observer to witness all five objects as grazes, I chose the one, Ganymede, to observe as a graze, which would allow the others to be seen as near-grazing total occultations. As a compromise between having to travel too far from Denmark and having the objects at too low an altitude, I chose to go to Austria, where the low altitude problem was compounded by Alpine peaks. After considerable research of the topographic maps, I was able to choose a spot near Admont, from which the altitude of the events would be about 12°, in the southeast, whereas the peaks in that direction were no higher than 8°.

The important predictions with respect to the narrative were:

Jupiter 1st contact	$1^h54^m42^s$
Jupiter 2nd contact	2 00 10
Ganymede mid-graze	2 04 29
Jupiter 3rd contact	2 14 09
Jupiter 4th contact	2 19 37.

Despite fine weather on March 4th and 5th, the moon was entirely covered by clouds by 1^h50^m U.T. on the 6th. Then a rift appeared, allowing the lunar limb to show through some cirrus — what time? 2^h — now Jupiter, himself, must have finished disappearing; — I may hope for Ganymede, — I got the precise time, counting seconds (eye-and-ear); — what a curious star, so blurred, — may that be Ganymede, blurred by the cirrus still covering the field? — now it has disappeared in the clouds — no, it's still there, — no, now it's entirely lost in the damned cirrus — The cirrus effectively hid Ganymede until $2^h05^m21^s$, when the lower clouds took over that job until 2^h16^m 29^s, when Jupiter could be seen through the cirrus, his disk still cut by the lunar limb. Then there were more clouds during fourth contact, and still more that kept any of the satellites from being seen.

It was not until the following day that I came to realize that the "blurred star" was, of course, the last speck of the Jovian segment, probably with a blink in advance of the entire disappearance at 2nd contact, — and I, like a fool, had counted seconds during all that, without actually timing the events! — and have thus lost the only result I might have brought about from all those efforts!!

The only real justification for writing this article is that it should serve as a warning to other observers: When you are out to make timings, time anything whatsoever that you may see, whether or not you are aware of what it really is, leaving that to be decided afterwards!

OCCULTATION BY THE NUCLEUS OF COMET 1983c

Richard Nolthenius

Last year, Dan McKenna, at U.C.L.A., came to me with the idea of looking for occultations by the nuclei of comets. I talked with David Dunham about the idea, and it soon became apparent that the idea was not practical — the small diameters and poor ephemerides made useful predictions impossible. I more-or-less forgot about it, and when Comet IRAS-Araki-Alcock appeared, I planned only to try to take some good photoes. On May 11/12 Bruce LaFrance and I set up his eight-inch Celestron at Lockwood Valley, a dark site north and west of Los Angeles. The two-degree comet was quite impressive as it drifted south among the stars in Cancer. At 4:31 ± 4 U.T., I began a twenty-minute piggy-back photo, guiding on the nucleus at 275 power. I was amazed to see the comet actually move from second to second. I was even more amazed when, within thirty seconds of beginning the photo, the point-like, but distinctly fuzzy nucleus approached and passed directly over a bright star. A second or so after the images fused, the combined image faded by about 0.5 magnitude. A moment later, the nucleus and star separated. The gradual fading and brightening lasted only about 0.8 second, with no obvious interval of constant light. The seeing was 1 to 1.5 arc seconds, and steady. There was no rotation of the image, such as I have seen for some close asteroid events.

Later, I identified the star as SAO 98040. M_V = 8.7; spectral type = G5. The site was at west longitude 119°01'47", north latitude 34°47'51", elevation 1630 meters. I calculated that the 0.8-second duration corresponded to 31 km at the comet's distance. The nucleus appeared to be about 1.3 magnitudes fainter than the star, so that at the bottom of the dip, the star's light was reduced by about 48%. Evidently, the star passed through a region of relatively thick dust surrounding the nucleus.

All of this was relayed to Z. Sekanina, at J.P.L., and to Brian Marsden, who included it in *IAUC* 3817. Sekanina has been working on comet models for many years. He was quite excited, since it could help him put constraints on a model for Comet IRAS-Araki-Alcock. He knew of no one who had observed an occultation of such a bright star by a comet nucleus before. Unfortunately, the path diameter for the event was probably only about twenty miles, so it is unlikely there were other observers.

I was curious about the frequency of such events. The rate, E, of occultations per day by a given comet, for a given observer, will be

$$E = 3.82 \times 10^{-7}\ V\ S\ \frac{d}{a}$$

where V is the angular speed of the comet across the sky in degrees per day, S is the density of stars per square degree, d is the diameter of the optically thick region of the nucleus in kilometers, and a is the comet's distance in A.U. For Milky Way stars of magnitude brighter than or equal to 10, S is about 50. IRAS-Araki-Alcock, at closest approach, had a very favorable combination of V and a. Even so, a given observer would have seen an occultation of a 10th-magnitude star only about once every fifty hours, for d = 35 km. For Comet 1983d at closest approach, in mid-June, E was about 0.2, or one event every five days. For a more typical comet, with V approximately equal to three degrees per day, S = 25, d = 30 km, and a = 0.5 A.U., there is an event only about once every two years!

So, unless we can get much better ephemerides, it seems that comet occultation observations will remain few and mostly a matter of luck.

[D.W.D.: After learning about this observation, Peter Manly, Tempe, AZ, decided to follow the nucleus of Comet Sugano-Saigusa-Fujikawa (1983e) during its close flyby in June, to record any dimmings due to very close approaches to stars using an image-intensified television camera with a 20-cm Schmidt-Cass. Manly figured that, during the few days of fastest motion when the comet traversed the Milky Way, the nucleus would pass close enough to at least one star brighter than the nucleus during a night. Astrometric improvement of individual nuclear occultation path predictions for such fast-moving objects would be impractical. Unfortunately, clouds and a dust storm prevented the observation.]

ON ESTIMATING PERSONAL EQUATION AND ITS ACCURACY

Brian Loader

The current ILOC report forms require both an estimate of the observer's personal equation (P.E.) and of the accuracy (or uncertainty) of the timing of an occultation. In practice, the accuracy normally will be a compound of the uncertainty of the estimate of the P.E. and that of the setting of the stop watch.

In *O.N. 3* (2) 34, the editor noted that ". . . you should be stating that there is a 67% chance that your timing is within the stated uncertainty." This means that the standard deviation (S.D.) is required.

In an attempt to determine both his P.E. for an occultation observation, and its S.D., I have simulated occultations on the screen of a micro computer.

For a 'disappearance', a spot of light on the screen was made to go out after a randomly variable interval of time, between about 6 and 13 seconds from starting the programme. As soon as this 'event' occurred, the computer entered a counting loop which was stopped by pressing any key on the keyboard. The number of counts then could be displayed or printed. The count rate being known, this number was converted into the time elapsed between the 'disappearance' and the key being pressed, i.e., the operator's P.E. The brightness of the spot on the screen was varied to simulate stars of differing observability. 'Reappearances' were treated similarly except that, of course, the spot of light appeared on the screen at the time the count started. However, the tests were conducted in two different ways; either the spot came on at a fixed, predetermined point on the screen, or the spot could be made to appear at a randomly variable point along a predetermined vertical line on the screen. The latter was to simulate the possibility that a star might not reappear exactly where one is looking. Again, the brightness of the spot was varied.

Summary of Results

Rate of count in all cases = 149.1 per second.

'Observability'	Number of Observations	Counts Mean	Counts S.D.	Times Mean	Times S.D.
'Disappearances'					
Bright	328	38.92	4.71	0ˢ.261	0ˢ.032
Fairly dim	148	47.13	5.83	0.316	0.039
Very dim	282	63.84	13.50	0.428	0.091
'Reappearances' (fixed position)					
Bright	336	39.52	4.30	0ˢ.265	0ˢ.029
Fairly dim	158	46.43	4.47	0.311	0.030
Very dim	163	66.48	12.78	0.446	0.086
'Reappearances (variable position)					
Bright	174	43.20	5.51	0ˢ.290	0ˢ.037
Fairly dim	191	61.47	15.43	0.412	0.103
Very dim (could not time; too faint to attract eye)					

Bright = easy to see, comfortable screen brightness
Fairly dim = beginning to be difficult to see, much fainter than most would use on a screen
Very dim = faintest possible spot on the screen that could still be observed to appear at a fixed position or to disappear.

The distribution of any one set of results was noticeably Poissonian, particularly for bright events.

Comments on results

Obviously, the above results apply to me, sitting in front of a computer screen, not looking through a telescope. However, the repeated tests gave me a 'feel' for how quickly I had reacted; being 0ˢ.1 slower than normal for a bright event is noticeable. On the other hand, there was no 'feel' for being slower for faint events. Presumably it takes longer for the brain to realise that a difficult event has occurred.

Also, the results apply to only one person. Others will differ both in P.E. and S.D., e.g. my wife, who is not a practising occultation observer, tested 98 bright 'disappearances' and had a mean count of 47.1 with S.D. 6.55. With 46 bright 'reappearances', variable position, her mean count was 49.0 with S.D. 8.45.

To obtain the accuracy figure for an occultation we would have to combine the S.D. of the P.E. with that of the estimate of the stop watch setting. As the editor of *O.N.* also points out, to just add the two figures gives too large a figure for the accuracy, e.g., if the S.D. of the P.E. is 0ˢ.05 and that of the setting 0ˢ.02, then the combined S.D. is 0ˢ.054. I suspect that true S.D. for an occultation would be larger than those from the tests. If so, then in most cases, only the S.D. of the P.E. is significant.

I am reluctant to draw any hard conclusions from the results, for reasons indicated above. However, it does appear as though an accuracy of better than ± 0ˢ.1, perhaps as low as ± 0ˢ.05, could be attained for an observation of a bright star in good conditions using a stop watch. For reasonable stars an accuracy of ± 0ˢ.1 is also reasonable. For difficult stars in good conditions a figure of ± 0ˢ.2 might apply. However, this would be dependent on the observer being able to make a good estimate of his P.E.

NEPTUNE RINGLESS

According to *I.A.U. Circular No.* 3831, photoelectric observations of the occultation of Hyderabad A.C. -22° 58794 by Neptune on June 15th showed no evidence of rings, although some of the observers were in optimum locations for detecting any rings in the planet's equatorial plane. Jim Elliot and other astronomers from the Massachusetts Institute of Technology observed from the Kuiper Airborne Observatory near Guam, while University of Arizona astronomers recorded the event from Taiwan, according to W. B. Hubbard. Observations also have been reported from Mauna Kea, HI, and from Siding Spring Observatory, Australia. Any other successful observations should be sent to Dr. Elliot at Dept. of Earth and Planetary Sciences, M.I.T., Cambridge, MA 02139, U.S.A., so that a collaborative analysis can be made to determine Neptune's radius and oblateness. Klemola's Lick Observatory astrometry before the event indicated that the occultation was central in Antarctica, according to Doug Mink, M.I.T.

D.W.D.

TOTAL SOLAR ECLIPSE WELL OBSERVED IN JAVA

David W. Dunham

The total solar eclipse of June 11th was well observed near both the northern and southern limits in Java, Indonesia, by IOTA members and others. The observations seem to indicate that the path was about a kilometer south of where I predicted it would be, and a little closer to a prediction by L. Morrison and J. Parkinson in England. The path seemed to have about the predicted width, and Parkinson's timing of the duration at a site near the center line was also close to the predicted value. These impressions indicate a correction to the solar radius near zero, like the other recently observed eclipses.

David Herald, Byron Soulsby, and Graham Blow, from Australia and New Zealand, observed from a location about 2 km south of the predicted northern limit where it crossed the east coast of a peninsula north of Pati. Herald projected the solar image and timed about 120 Baily's bead events. Joan and I tried to observe near the northern limit on the west coast of the peninsula, near a beach north of Jepara. We arrived on site about two hours before the eclipse, accompanied by the local schoolmaster and English teacher. Although during the two previous days it had been relatively clear at Jepara and heavily cloudy or raining almost everywhere else on Java, the opposite was true on June 11th. So we drove south to get into clearer sky, which we could see in that direction (the roads only went south and northwest, where the clouds appeared even thicker). We ended up at a crossroad at Geneng, about 35 km south of the northern limit, where we successfully observed the eclipse through very thin clouds. Totality lasted 3 minutes 51 seconds. We projected the image onto white cardboard using a 5-inch Schmidt-Cass; I timed 41 bead events visually. We videotaped the projected image, but had problems with blooming and focusing; only a little bit of the record near 2nd contact will be of use, and we managed to be off target at 3rd contact (we were not prepared for such a long totality). Most of the bead events I timed were closer to the solar equator than to the north pole. Maria Firneis and another Austrian from the Institut für Astronomie in Vienna, accompanied by several Indonesians, had planned to observe at a site near ours north of Jepara, but they also decided to go south due to the clouds. They ended up about 18 km south of the limit, where they successfully observed the eclipse, primarily photographically with an array of cameras. Although we were disappointed that the government told the population to watch the eclipse only on television for fear of blindness, a holiday was declared, and this, combined with fear, kept almost everyone off the roads, considerably facilitating our travels.

Although Parkinson observed near the center, he had workers from *New Scientist* magazine stationed about 3 km inside the limits to time the duration of totality. In turn, they organized local English-speaking high school students to bracket the limits at about 200-meter intervals, and report whether the eclipse was total or not (using a series of questions, such as, "Was there any time that the corona was visible as a continuous unbroken ring around the moon?"). Omar Sataur did this south of Batang near Pekalongan, about 100 km west of our site, where skies were clear. Unfortunately, he missed the timing of 2nd contact. Although there were a few inconsistencies, he thinks that the high school students determined the northern limit to about 200-meter accuracy. He was glad that all of the students showed up, since their parents might not have let them observe, considering the hysteria about possible blindness. The similar effort at the southern limit was also successful, although there seemed to be more disagreement among the student observers, so that the limit was defined to perhaps only 800-meter accuracy.

Alan Fiala, U.S.N.O., observed from a location about 1 km north of the southern limit. He projected the solar image onto a translucent screen, and videotaped the transmitted image (which was brighter than the reflected image) using his Ultricon camera with filters. Ken Schatten, Goddard Space Flight Center, assisted Fiala. They obtained a spectacular record of the bead phenomena; during all of the 55 seconds of totality, the chromosphere also was recorded faintly. Fiala was glad that he tied down the projection screen, because right at second contact, a strong wind blew briefly. Paul Maley and other observers from Houston, TX, tried to make a movie of the projected image from a site near a mosque about 3 km from the predicted southern limit. Although many of the bead events probably were photographed, the camera malfunctioned at one time during the eclipse, and a specially constructed large-format digital time display failed. Many of the voice comments on their tape recording can not be deciphered due to worshipers in the mosque chanting and wailing, which became more frenzied around totality. But they were lucky in comparison with Robert McCracken (Bethesda, MD) and Derald Nye (Tucson, AZ), who were at sites about 10 km from Fiala. Clouds moved in about ten minutes before totality; I have not heard of any other observers who missed totality and all bead events due to clouds. The time signals we received at 10 and 15 MHz were apparently Soviet; comparison with WWVH at times when both signals could be heard seemed to show that the strong "minute" beeps were on the first, rather than on the zeroth, second of the minute.

Alan Fiala, Ken Schatten, Joan, and I gratefully acknowledge the support of the U.S. National Science Foundation and the National Center for Atmospheric Research, which provided all financial support for our travel and made most of the arrangements for us.

GRAZE CAUTION UPDATE

David W. Dunham, Rick Baldridge, and Paul Maley

We have on file reports of observations of eight northern-declination waning-phase grazes observed during 1982. Baldridge saw one of these near Rock Mountain, TX, on August 15th. Eight disappearances and eight reappearances of the 3.2-magnitude star, Z.C. 946 = η Gem = Propus, were timed and plotted on the version 78A profile, which had a HEIGHT of 0.52 arc seconds, similar in size to the large 1983 values. The observed data are in good agreement with 78A, and not 80F. Maley also reports that observations, by a ten-station expedition which he led for the same graze, were in good agreement with 78A. Multiple events were reported by most observers for the other grazes, implying that they were also probably close to the 78A profile predictions. So we feel that setting up stations north of 78A profiles for this year's grazes would be risky. We will reduce the 1982 data soon, to quantify the observed differences from both the 78A and 80F predictions.

RADIO STATION LISTING

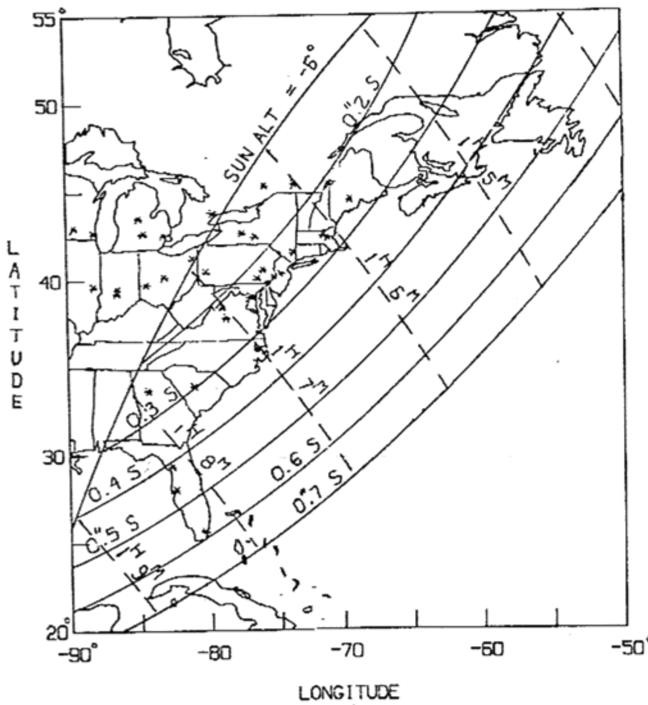
On July 13th, David Dunham phoned to us the following list of radio stations which may be used as secondary time references for the occultation of 14 Piscium by (51) Nemausa (see p. 83).

Alabama		
Birmingham	WAPI	1070
Mobile	WKRG	710
Selma	WMRK	1490
Tuscaloosa	WNPT	1280
Florida		
Daytona Beach	WNDB	1150
Jacksonville	WOKV	600
Lakeland	WONN	1230
Ocala	WTMC	1290
Orlando	WKIS	740
Pensacola	WCOA	1370
Pinnellas Park	WPLP	570
Tallahassee	WTNT	1270
Georgia		
Atlanta	WGST	920
Columbus	WRCG	1420
Macon	WMAZ	940
Rome	WRGA	1470
Savannah	WWSA	1290
Louisiana		
Baton Rouge	WJBO	1150
New Orleans	WWIW	1450
Massachusetts		
Boston	WRKO	680
Mississippi		
Jackson	WJQS	1400
New Jersey		
Atlantic City	WUSS	1490
New York		
New York City	WOR	710
North Carolina		
Charlotte	WSOC	930
Greensboro	WBIG	1470
Raleigh	WPTF	680
Wilmington	WMFD	630
South Carolina		
Charleston	WTMA	1250
Columbia	WIS	560
Spartansburg	WSPA	950
Tennessee		
Chattanooga	WMOC	1450
Texas		
Houston	KTRH	740
San Antonio	WOAI	1200
Virginia		
Norfolk	WTAR	790
Richmond	WLEE	1490

PLANETARY OCCULTATION PREDICTIONS FOR 1983

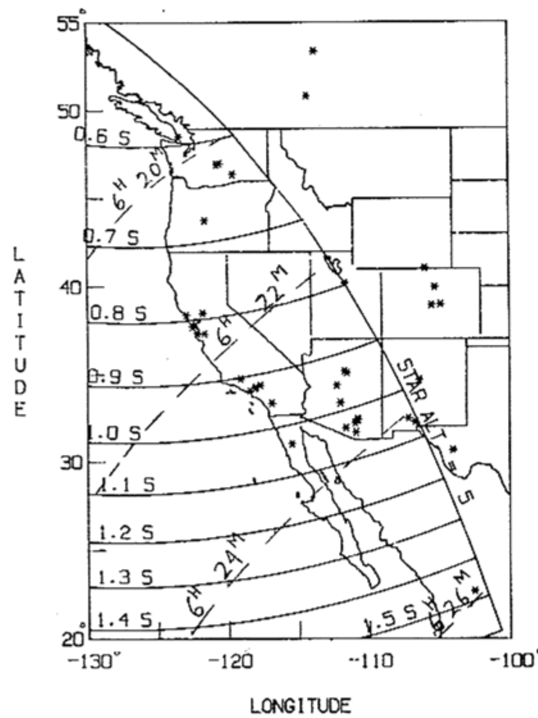
This is a continuation of the earlier articles bearing on this subject (see *O.N.* 3 (1) 9, (2) 25 and 37, (3) 54 and 60, and (4) 77. The figures consist of world maps by Sôma, regional maps by Dunham, and finder charts by Nolthenius.

1983 8 5 (747) WINCHESTER SAO 162242
DIAMETER 208 KM = 0".14



EPHEMERIS SOURCE = HERGET78

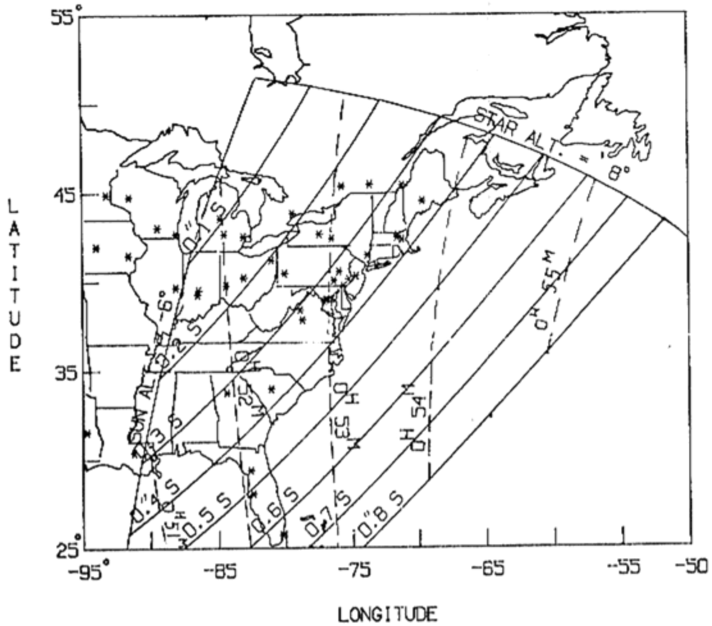
1983 8 9 (144) VIBILIA SAO 183812
DIAMETER 132 KM = 0".08



EPHEMERIS SOURCE = HERGET77

1983 9 1 (120) LACHESIS SAO 208888

DIAMETER 175 KM = 0."09



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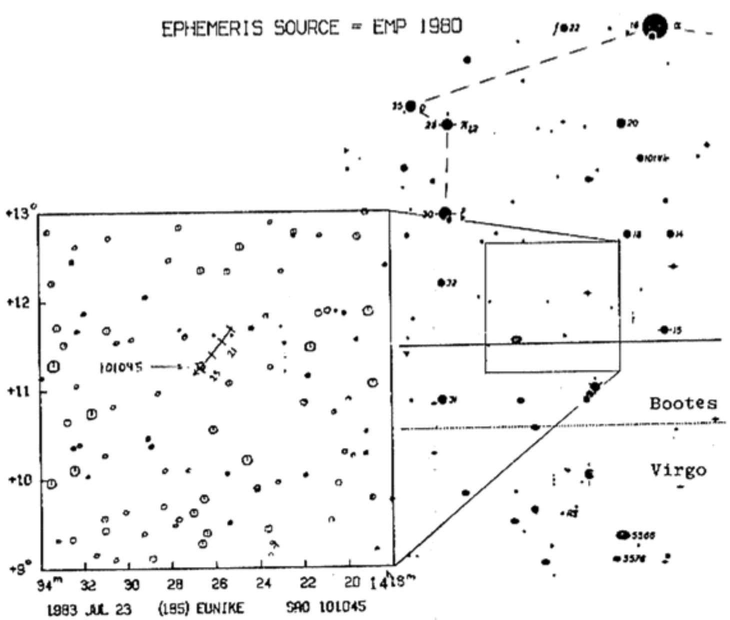
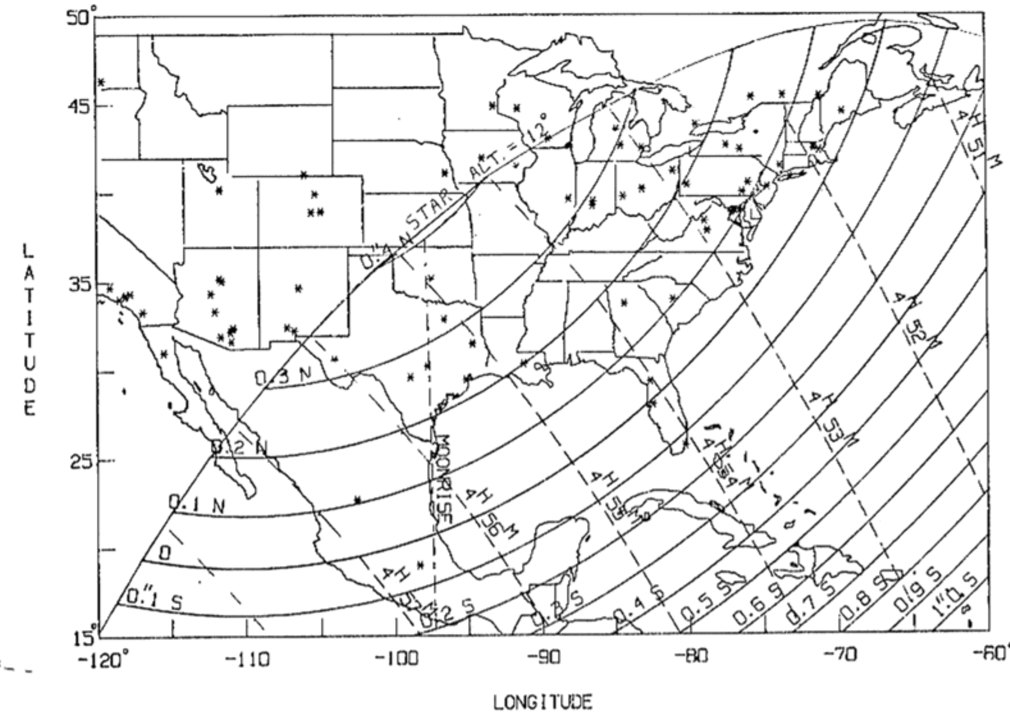
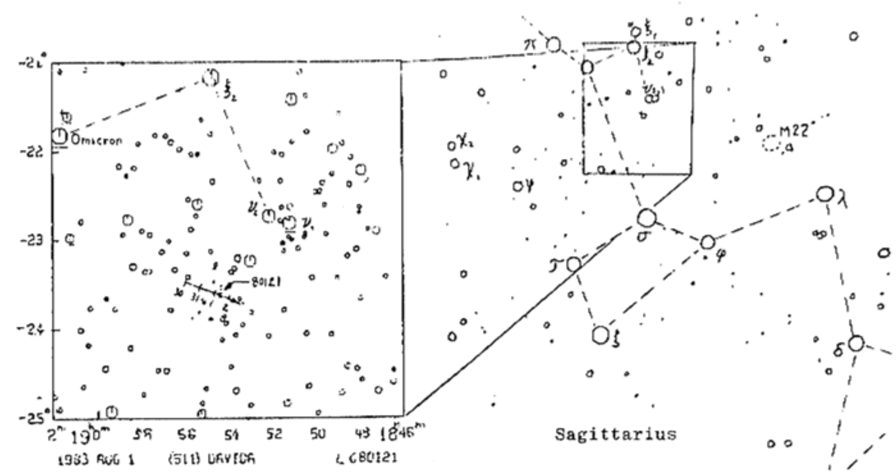


1983 7 31 (1) CERES L 680439

DIAMETER 1025 KM = 0."70

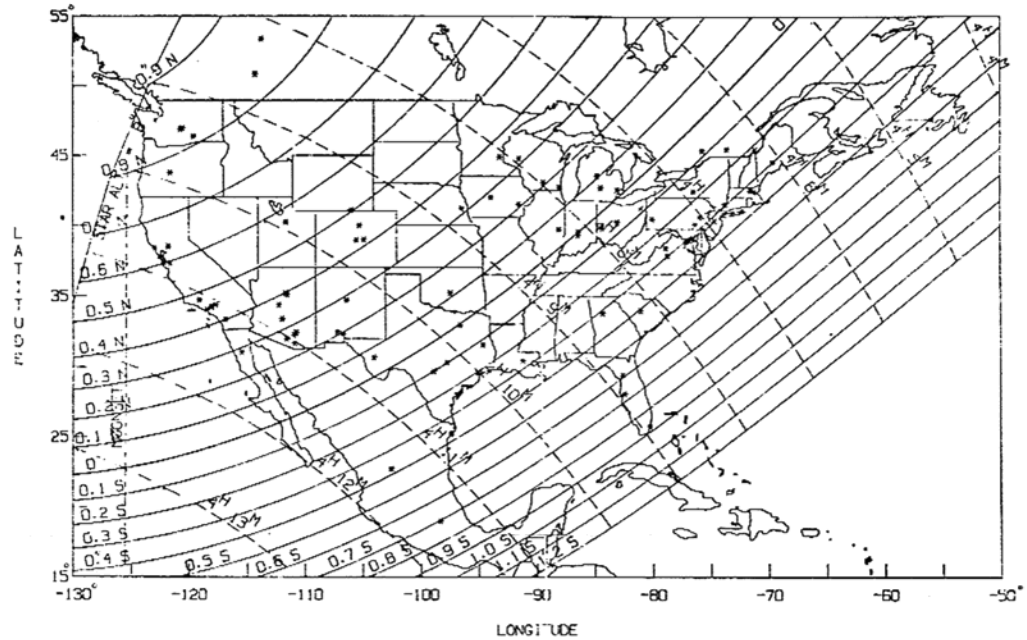


EPHEMERIS SOURCE = APAENAXX



1983 9 9 (53) KALYPSO SAO 146920

DIAMETER 110 KM = 0.″09



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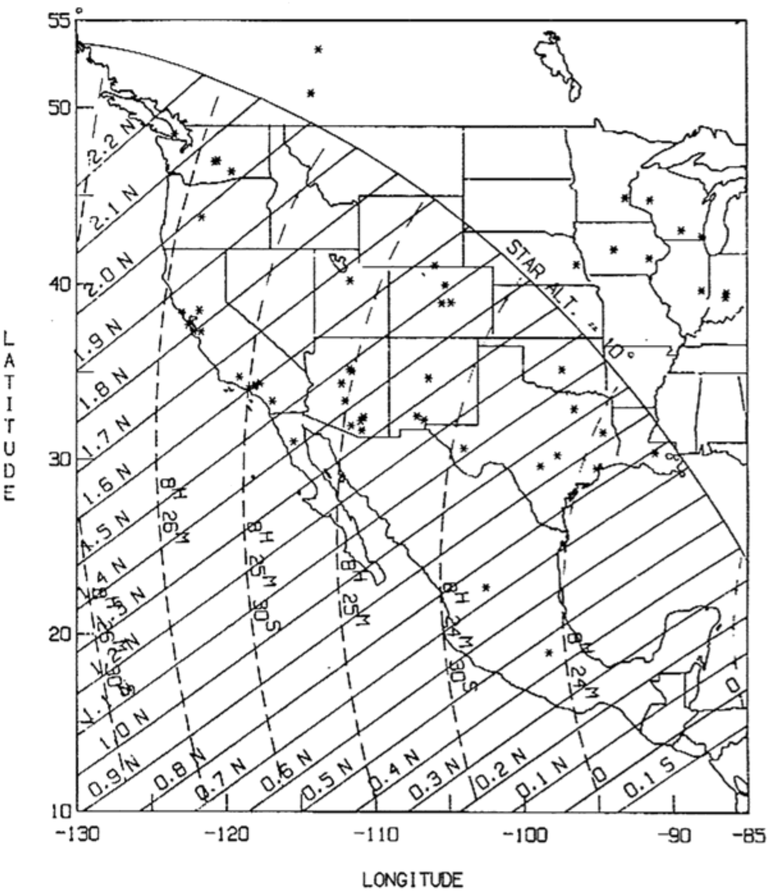
1983 8 1 (511) DAVIDA L 680121

DIAMETER 335 KM = 0.″17



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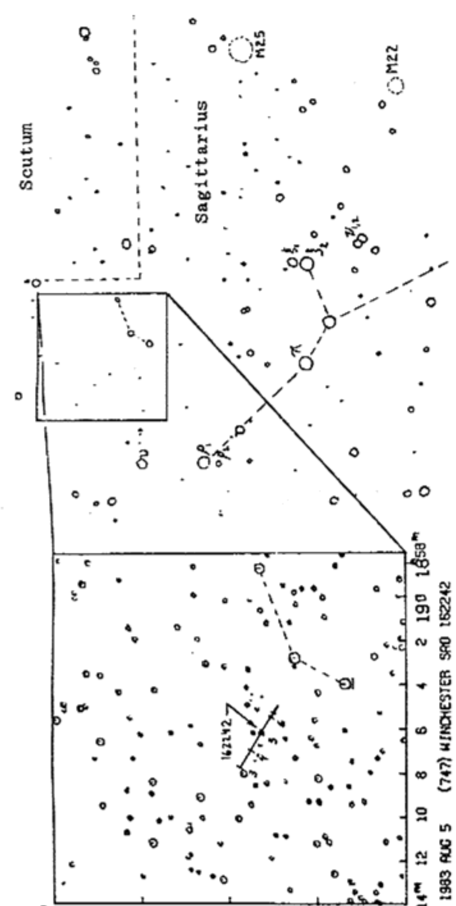

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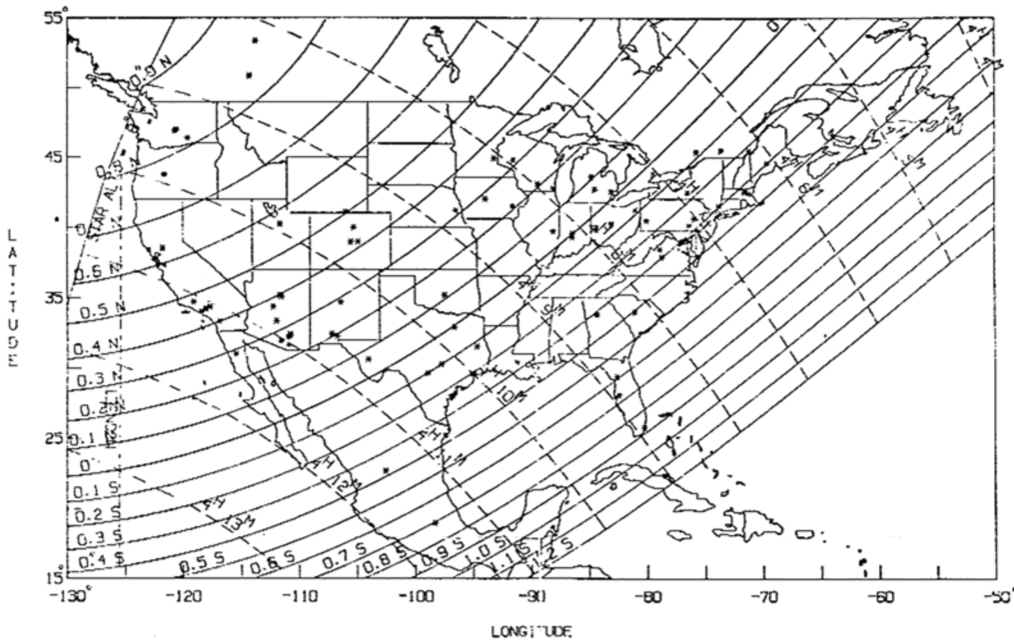
DIAMETER 110 KM = 0".09



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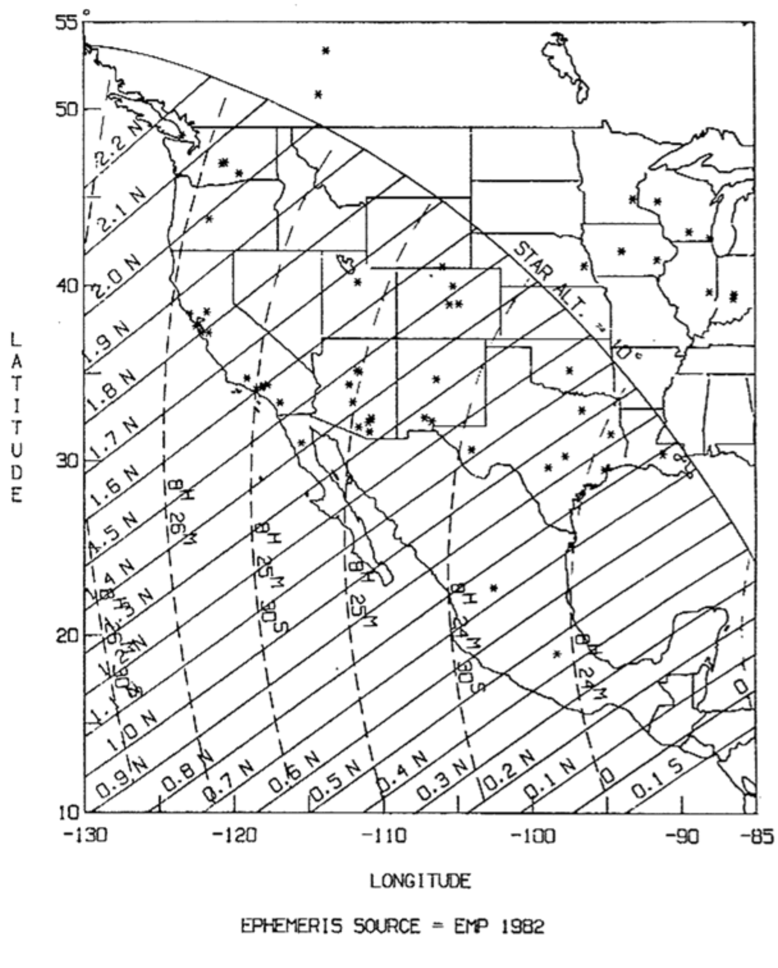

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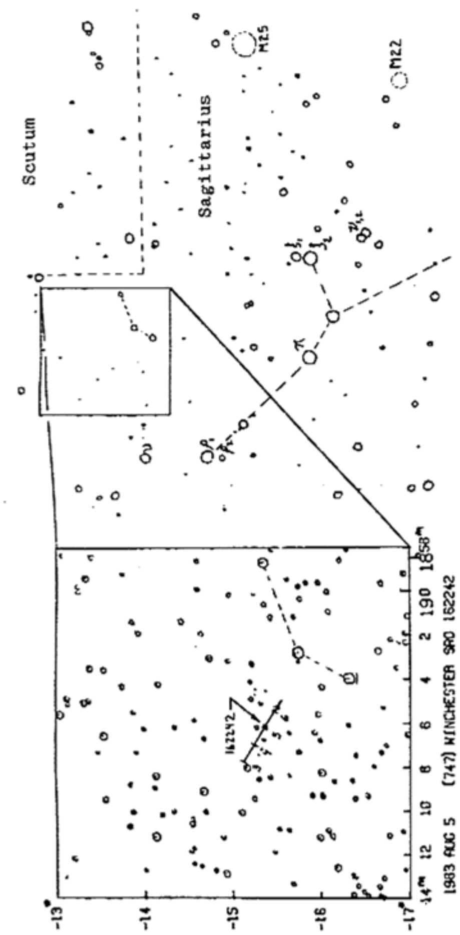
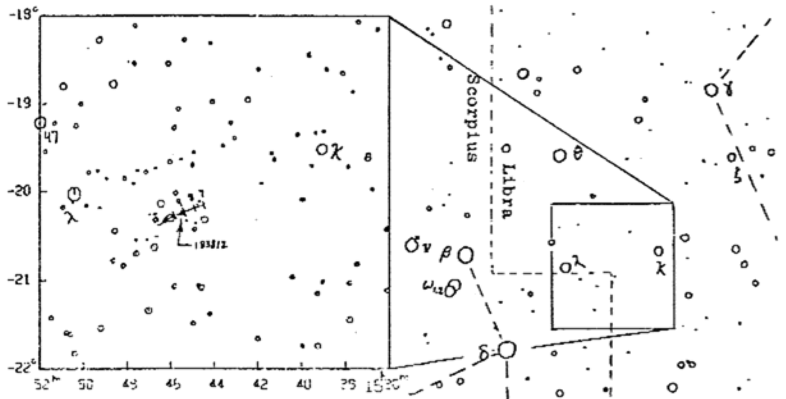
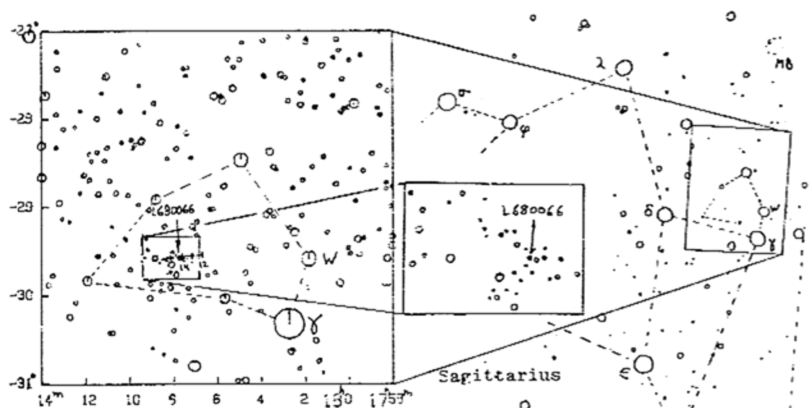
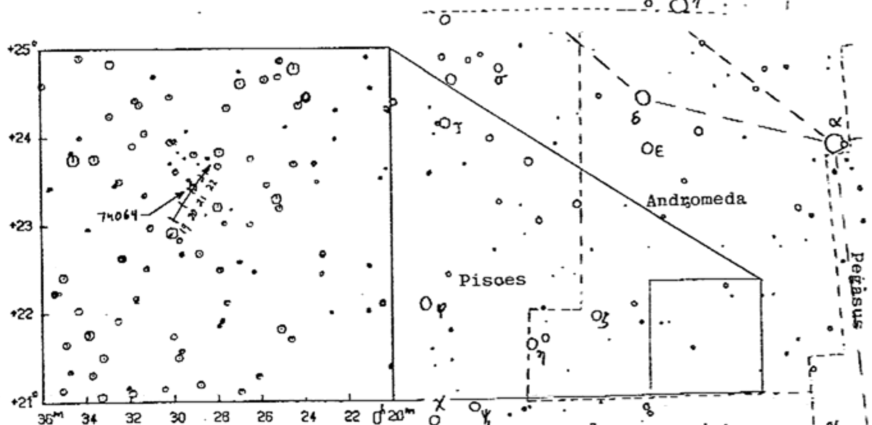




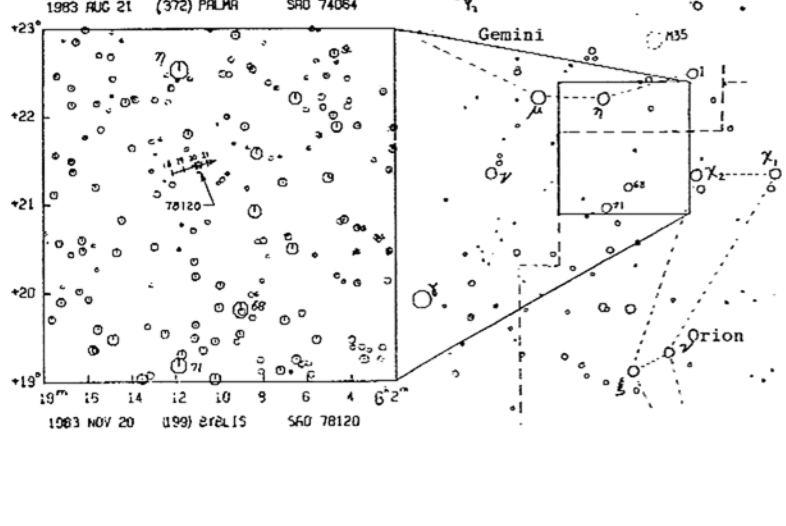
1983 AUG 9 (144) VIBILIA SAO 183812



1983 SEP 14 (451) PATIENTIA 6 L680066



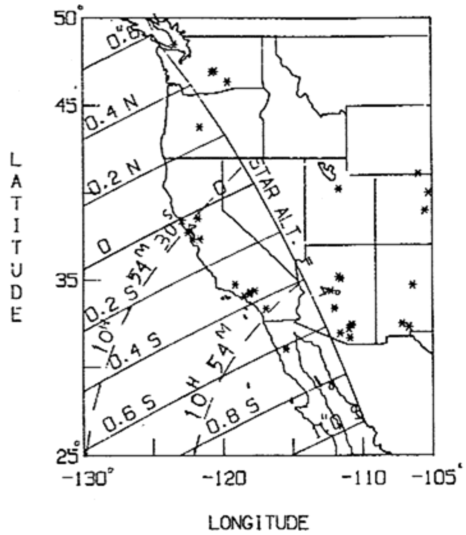
1983 AUG 21 (372) PALMA SAO 74064



1983 NOV 20 (199) BYBLIS SAO 78120

1983 8 15 (65) CYBELE SAO 163239

DIAMETER 311 KM = 0."20



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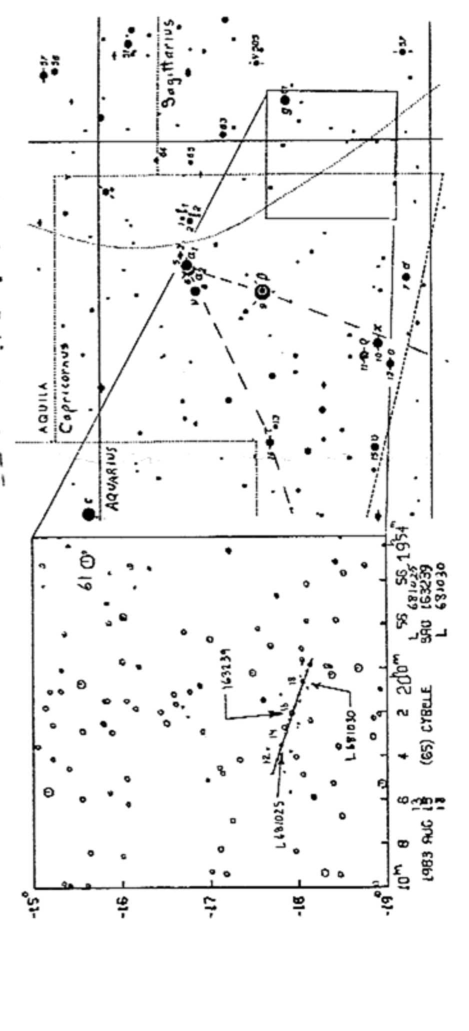
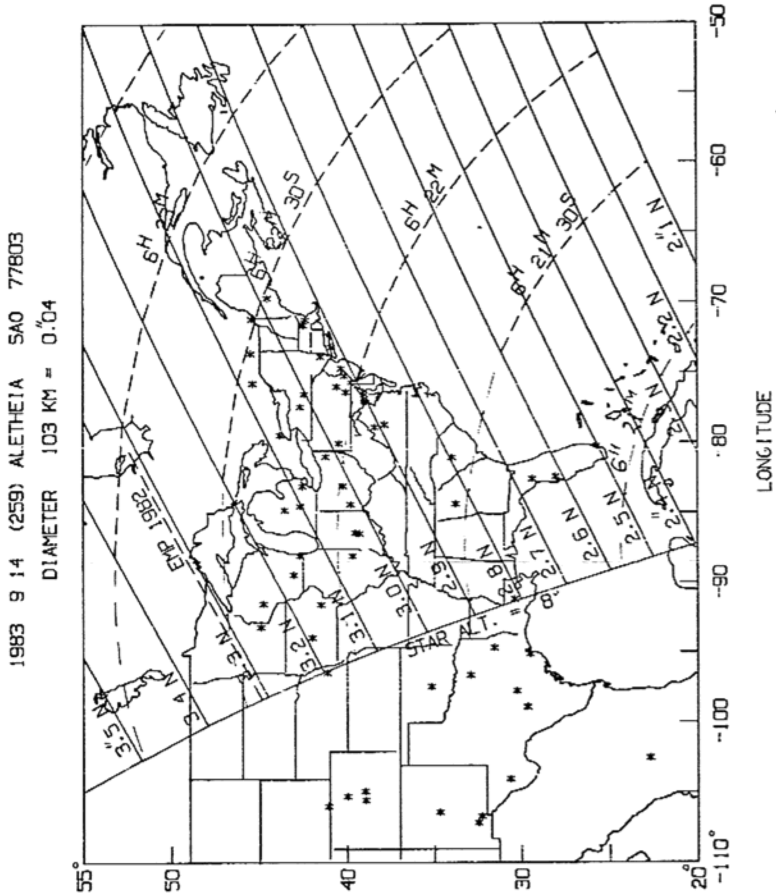
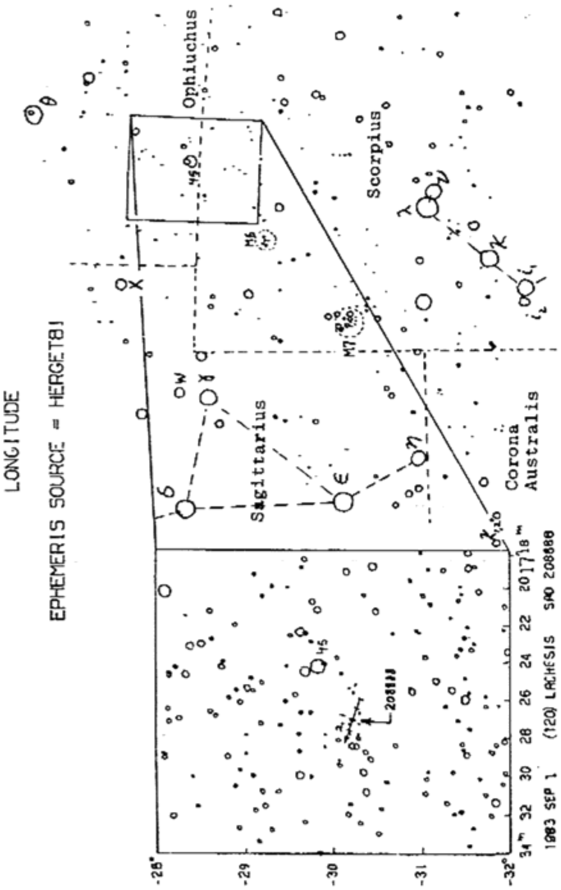
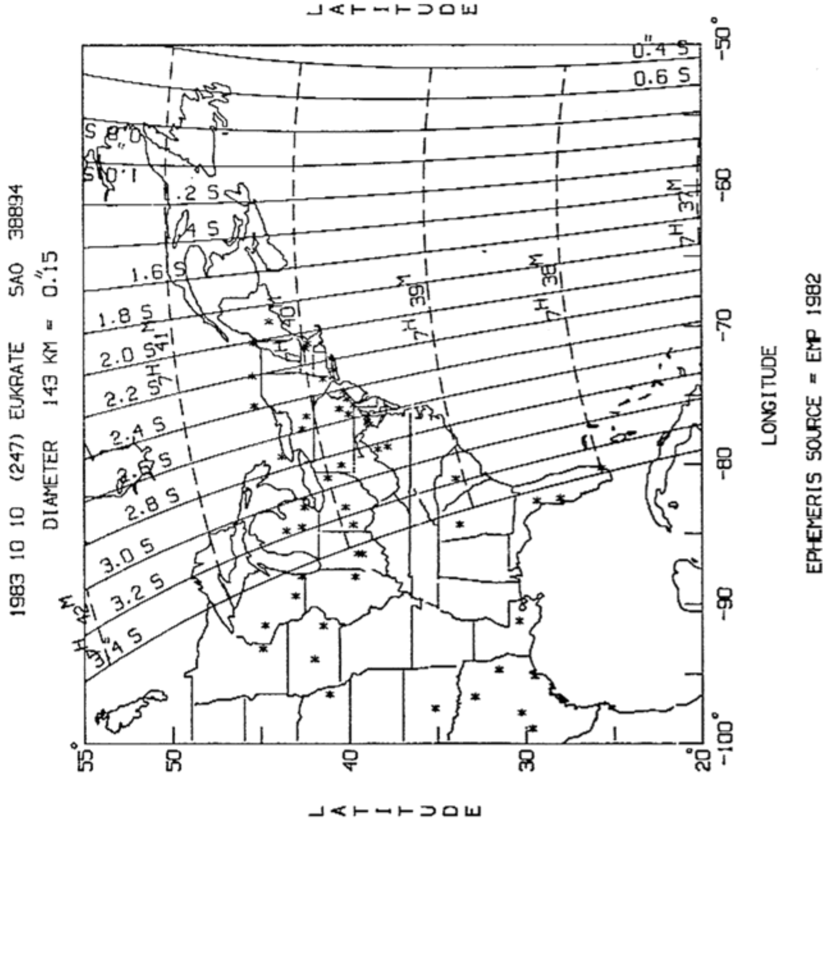
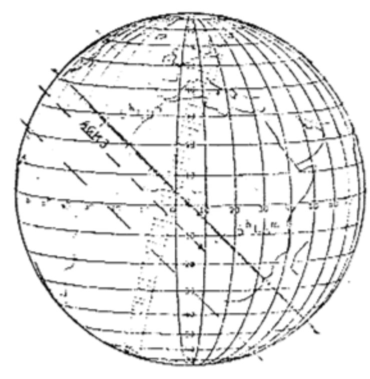


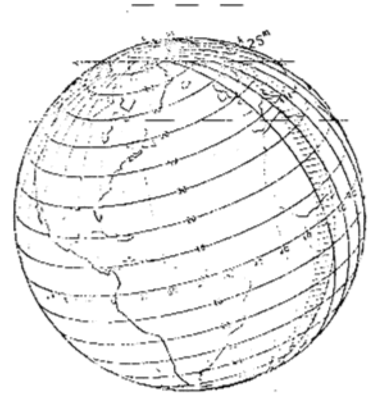




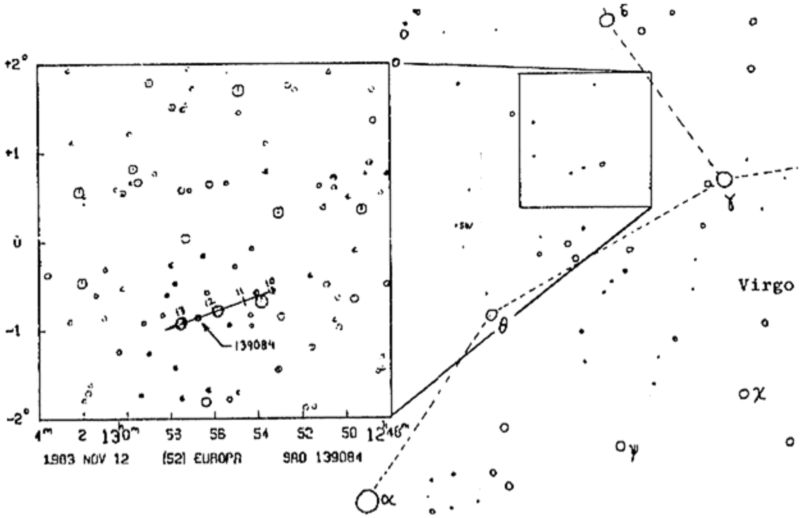




SAO 117317 by Lanzia 5 Nov 1983



SAO 78120 by Byblis 20 Nov 1983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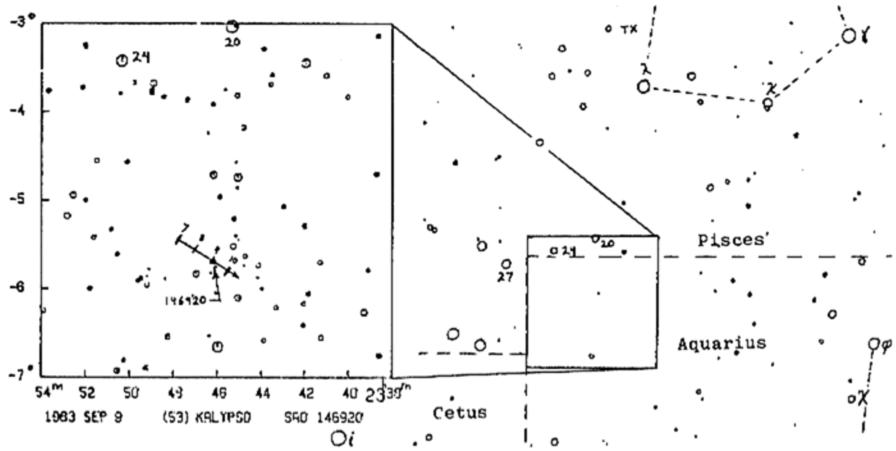
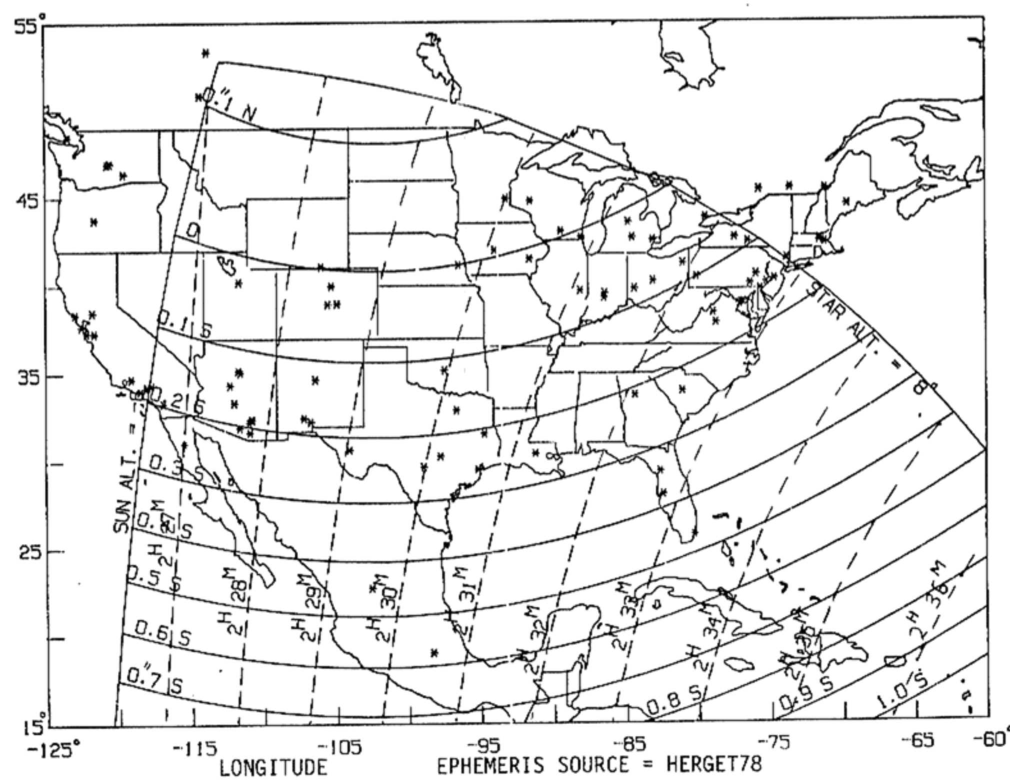
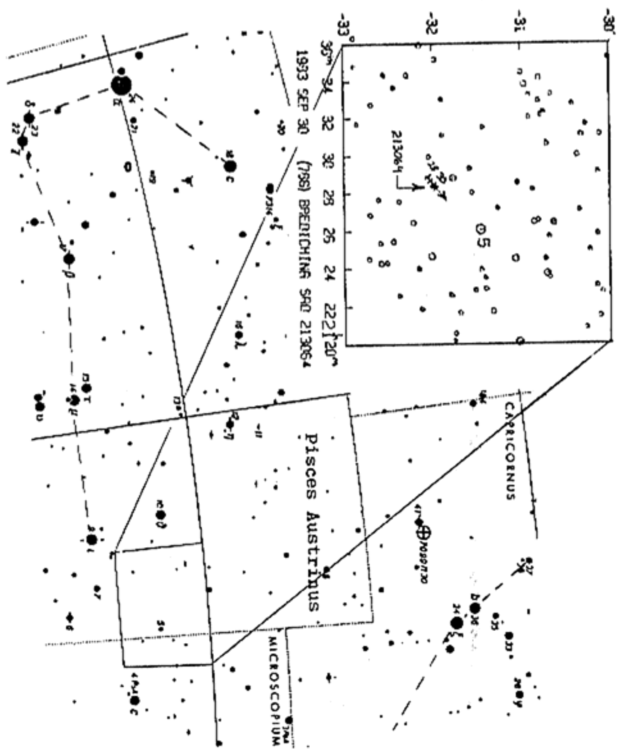
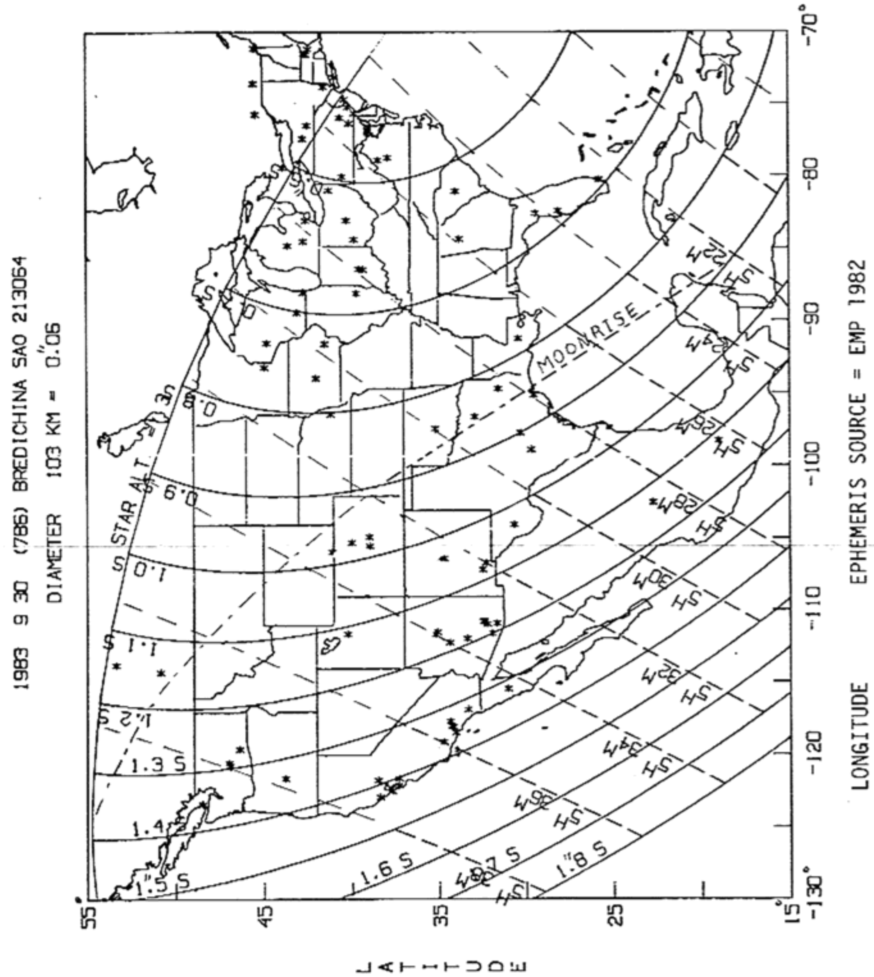
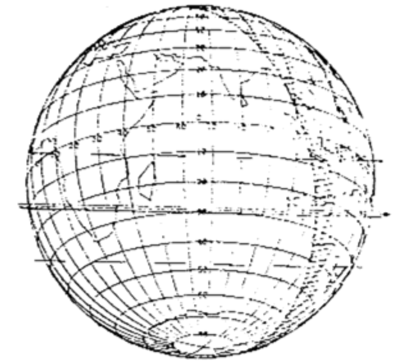
(52) EUROPA
SAO 139084
139084
Virgo


1983 SEP 9
(53) KALYPSO
SAO 146920
146920
Pisces
Aquarius
Cetus

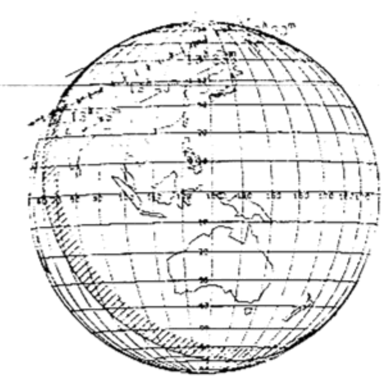

1983 9 14 (451) PATIENTIA L 680066
DIAMETER 281 KM = 0."14
LATITUDE
LONGITUDE
EPHEMERIS SOURCE = HERGET78
SUN ALT. = 0
STAR ALT. = 8


1983 SEP 30
(766) BREDICHINA SAO 213064
213064
CAPRICORNUS
Pisces Austrinus
MICROSCOPIUM

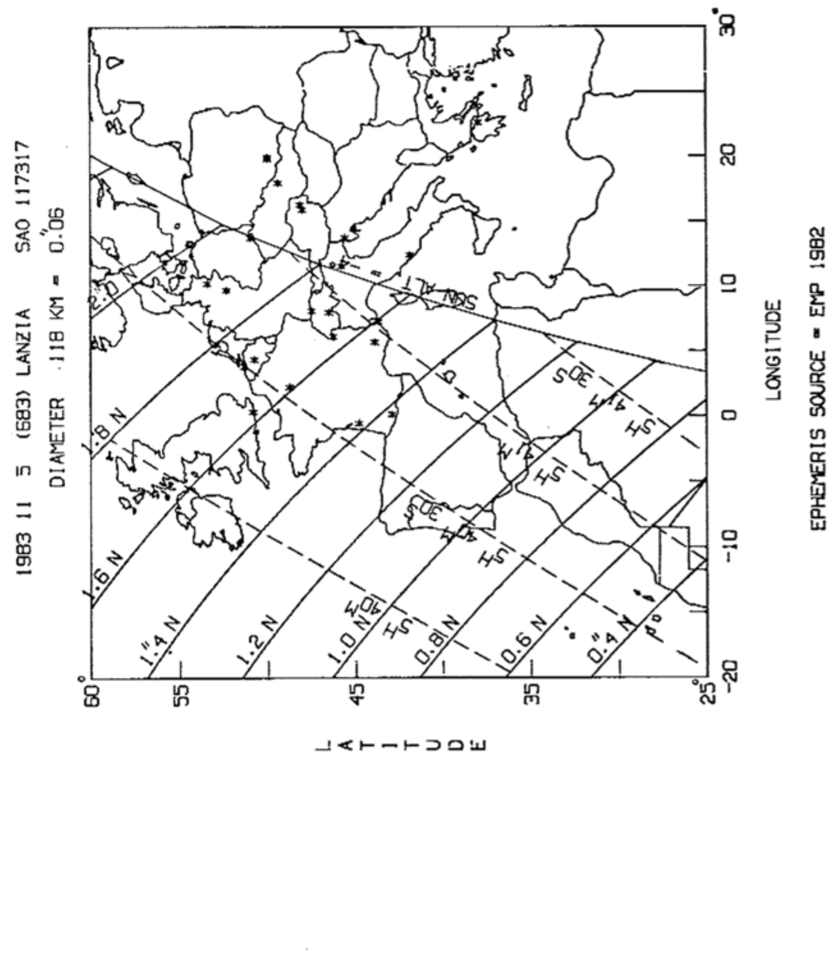




SAO 187870 by Hebe 20 Nov 1983

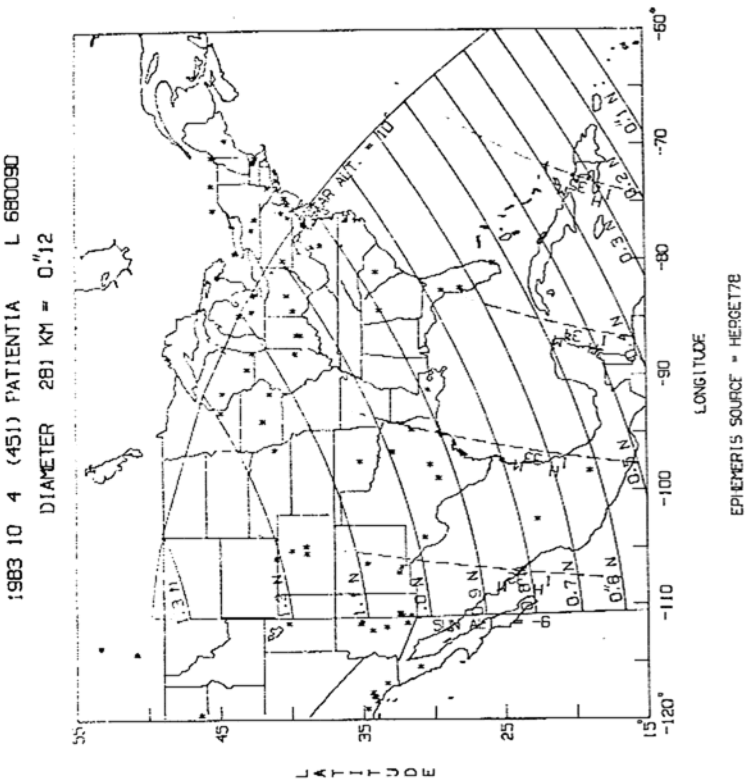


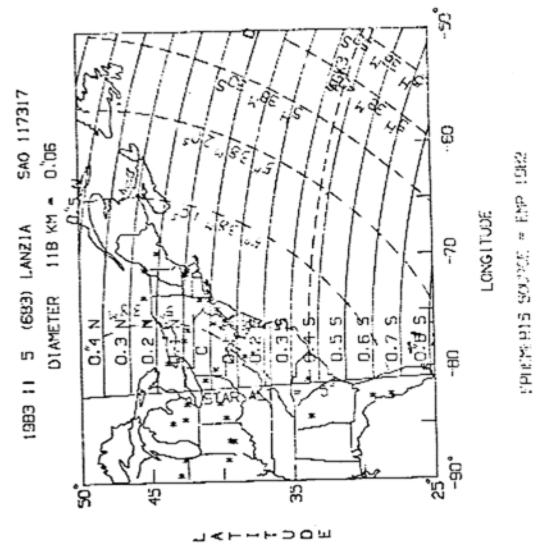
SAO 129646 by Chaldea 20 Nov 1983

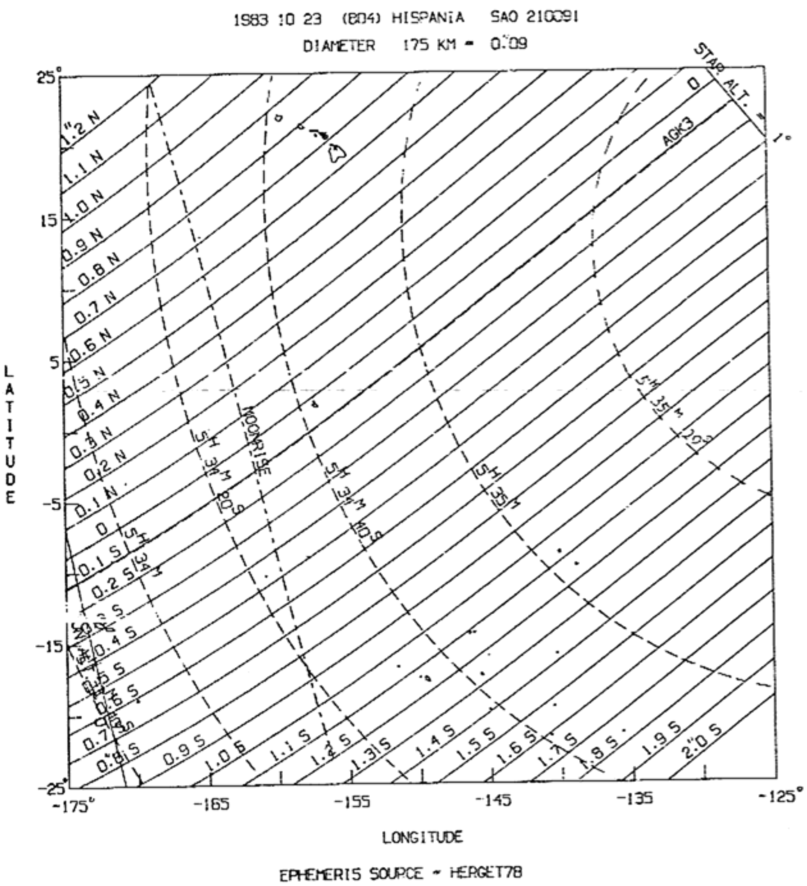


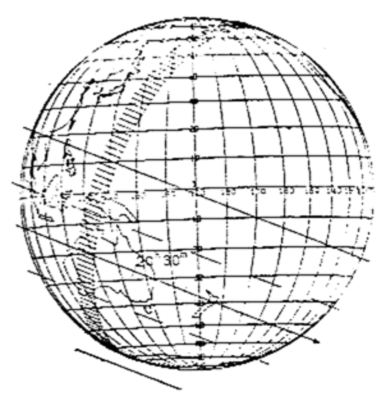
SAO 128200 by Messalina 24 Nov '83

L 680825 by Ceres 27 Nov 1983

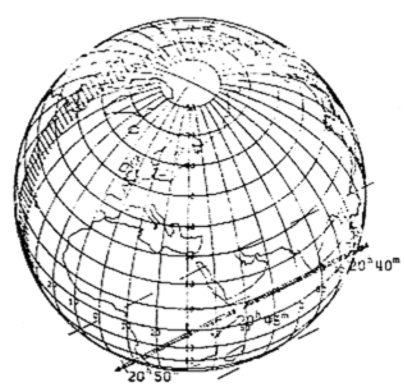








SAO 138836 by Mars 1 Dec 1983



+49°1016 by Mashona 5 Dec 1983