Occultation Newsletter

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FROM THE PUBLISHER

This is the final issue of Volume Two. For subscription purposes, it is the second issue of 1982.

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IOTA NEWS

David W. Dunham

The work of augmenting the USNO C-Catalog with Southern Astrographic Catalog data (see p. 222) took much longer than I thought it would, delaying this issue and limiting the preparation time for it. The C-Catalog work was necessary in order to compute detailed predictions of occultations during the July 6th lunar eclipse. The calculation and distribution of these for many IOTA members in the zone of visibility of the eclipse further limited the time I could devote to *O.N.* Consequently, news of double stars discovered during occultations, and of asteroid occultations observed previously but not yet reported (with the exception of Lucina; (see p. 219), and an account of our trip to Somalia for last November's occultation of Nunki by Venus, will have to wait until a future issue.

On the positive side, we have obtained an electronic typewriter using Daisy wheels, which Joan has interfaced with our Apple II+ computer. Hence, I have been able to use the Applewriter word processor to prepare all of my text for this issue and type it with elite Letter Gothic type in the usual format for *O.N.* There are two drawbacks, namely, Applewriter doesn't know how to hyphenate or stop to change Daisy wheels for italic type. Also , it gets confused by long strings of blanks in a sentence, and always shortens them; hence, it is not possible to leave blanks and type in italics later. So I have used all capitals where I would normally use italics (Applewriter also can't underline; although that can be done manually, it is a nuisance). But the ease of using the text editor far outweigh these minor drawbacks; there would be much less text for this issue without Applewriter. If you have access to an Apple, you can prepare articles for *O.N.* in the form of Applewriter files, and are encouraged to use this medium. At a later date, it probably will be possible to modify the Applewriter software to allow adding italics. [Ed: In the meantime, it is no great problem to substitute italics when making the paste-up copy for the printer — less troublesome than filling in the page numbers referring to other articles in the same issue. Anyone using this scheme definitely should underline anything which needs to be italicized; freehand underlining is adequate, as it will be occulted in the final paste-up. Our enthusiasm for the Daisy wheel typewriter is tempered by finding that one of its columns is about ½ character narrower than if it had been typed with standard elite spacing.]

I have continued to use our video equipment to record occultations, including the graze of ZC 3078 at Villa Ridge, MO, on March 21. Using our 20-cm Schmidt-Cass, I have recorded several total occultations, emersions as well as immersions, one of the latter being of an 8.2-mag. star. On April 3, I used my video camera with the 61-cm Cassegrain at Sperry Observatory in Cranford, NJ, to record several occultations of Praesepe stars. I thank members of the Amateur Astronomers, Inc., for giving me permission to use the telescope and helping with the observations. These and other observations of Praesepe occultations will be described in a future issue. Unfortunately, time does not permit discussing our video equipment and occultation work in more detail in this issue. I plan to prepare a video tape giving a short introduction to occultations and describing our equipment, then showing some examples of our observations, to be shown at some of the conventions of amateur astronomers during the next few months. I won't be able to attend these in person due to limited vacation time, which we plan to use to attend the International Astronomical Union's General Assembly in Patras, Greece, during the 2nd half of August.

An interesting observation of a possible ring of Neptune, very close to its equator, is described in an abstract in *Bull. Amer. Astron. Soc. 14* (2), 658, the most recent issue. E. F. Guinan and Shaw photoelectrically recorded the occultation of BD -17° 4388 by Neptune on 1968 April 7 at Mt. John

Observatory in New Zealand. Coarse integration times made the data not very useful for deriving the atmospheric parameters of Neptune. From about 3 to 6 minutes after emersion, a well-defined decrease of about 30% in intensity in the U-bandpass occurred. Sky conditions were good with no indications of clouds. If the event was produced by a ring in Neptune's equatorial plane, the inner and outer radii would be 29,800 km and 36,125 km, respectively, where Neptune's radius is 25,045 km. This is consistent with other reported negative results, all based on observations which did not probe this close to Neptune's equator. The result was derived only recently due to a curious series of misfortunes. After making the observation in New Zealand, Guinan, who works at Villanova University, visited the Soviet Union, where the chart record of the event he had with him mysteriously disappeared. He was not too concerned, since the data had been punched on computer cards, which were shipped from New Zealand back to the USA. However, when they arrived at Villanova several months later, the cards were badly warped, having been exposed to too much moisture in a ship's hold. The cards couldn't be read into a computer, and Guinan had many other obligations at the time, so the cards were stored away for possible future use. A couple of years ago, Guinan obtained some grant support for a student assistant, and assigned him the job of manually copying the cards so that the data could at long last be analyzed. In another abstract in the same issue of *B.A.A.S.*, on p. 621, William Penhallow discusses asteroid occultation astrometry with his new 32-cm lensless Schmidt at Quonochontaug Observatory.

Concerning asteroid occultations, Klemola obtained a plate of (164) Eva and SAO 100452 on May 26, which showed that the June 13th occultation would occur at a shift of 1"7 ±0"6 northwest, so that it might be visible from Hawaii or New Zealand, but not from North America. Gordon Taylor took a plate of (56) Melete when it passed close to SAO 139812 on May 25. His calculations place the path for the July 7th occultation of the star within 0"1 of my nominal path, crossing the northeastern Pacific Ocean and hitting the southwest coast of Mexico, where low altitude will probably prevent observation.

Paul Maley, Houston, TX, recently bought an automatic phone answering machine on which he can put short messages about ateroid occultation updates; his number is 713,488-6871. He later hopes to be able to record messages a full minute long. Through his efforts, we have also gotten permission from WWV to broadcast updates for the occultation of 1 Vulpeculae by Pallas on 1983 May 29. A message up to 42 seconds long will be broadcast once each hour for a week before the event. In the meantime, plans are already underway at Lick and Lowell Observatories to obtain early astrometry to improve the prediction for this rare event. Earlier this year, I sent information about the occultation to several groups organizing expeditions for the 1983 June 11 total solar eclipse, pointing out that this rarer event 13 days before the eclipse probably will be visible from the USA. I suggested that they plan their tours to at least avoid a conflict, or perhaps even arrange to gather together in the region of the Pallas occultation and to leave for the eclipse a few days later. I have had no response to my letters, and the Bok and Gall tours are planned to depart before May 29. Occultation observers should avoid those tours.

OCCULTATIONS DURING THE TOTAL LUNAR ECLIPSE OF 1982 JULY 6

David W. Dunham

The lunar eclipse of July 6 will have the longest totality since 1859 August 13, according to the article on p. 602 of the June issue of *Sky and Telescope*, which gives information about the eclipse phenomena. My following article on p. 604 describes occultations of SAO stars during the eclipse, including some useful observational notes. This article discusses occultations of stars as faint as 13th magnitude obtained from the *Astrographic Catalog* (see p. 222), including two detailed charts, additional observational considerations, and information about detailed local occultation predictions.

Special circumstances could make this eclipse the best in decades, perhaps in a lifetime, for many occultation observers. Not only is the eclipse of exceptionally long duration, with the moon passing through a rich Milky Way star field in Sagittarius, but it could also be an exceptionally dark eclipse due to a massive volcanic eruption in Mexico. C. Simon describes the large April 4th eruption of El Chichón on p. 326 of the May 15th issue of *Science News*. The amount of material injected into the upper atmosphere was estimated to be about 10 times that injected by Mt. St. Helens in 1980, making it one of the largest eruptions this century. The material has been confined mainly to low northern latitudes, where colorful sunsets have been reported, but by July 6th, it should have diffused throughout the Northern Hemisphere, and probably to low southern latitudes as well. Since the blocking of sunlight in the earth's atmosphere may be stronger in the north, the northern part of the moon may be slightly darker than the southern part during the eclipse, which is almost exactly central. I have not seen a comparison of the El Chichón eruption with that of Mt. Agung in Bali, which apparently threw enough dust into the stratosphere to cause the moon to virtually disappear during the total lunar eclipse of 1963 December 30.

The total lunar eclipse of 1975 May 25 was the most memorable for me. For that eclipse, I travelled to a site near Redford, in the desert in western Texas, to observe a graze of a 9th-mag. SAO star which occurred at an umbral distance of 90 (that is, 90% of the way from the center of the umbra to its edge) during the partial phase before totality. At that umbral distance, the graze contacts were just barely observable due to the brightness of the lunar limb. However, as the moon moved deeper into the umbra, occultations became easier to see, and I timed 17 events, including 11 reappearances, with 13 of them involving non-SAO stars, using a 25-cm reflector, as reported in *O.N. 1* (5) 38. I was able to time one 13th-mag. star which disappeared near the dark center of the umbra. Although the eclipse was slightly darker than average, the moon's orange orb made an interesting sight sitting in the head of Scorpius. Others measured its integrated brightness to be 1st magnitude at maximum eclipse.

In contrast, the moon's integrated brightness was measured to be 4th magnitude at maximum eclipse on 1963 December 30. A cirrus overcast prevented observation, or even finding the moon during totality, at my location, but members of the Wayne County Astronomical Society in Wooster, OH, had clear skies and tried to time occultations. Using a 10-cm refractor, they saw at least two dozen occultations, not counting two unpredicted grazes, during one of which 14 events were seen. Subsequent calculations showed that the graze stars were neither in the SAO nor in the BD catalogs; we did not have A.C. data for occultations then. Temperatures at Wooster during the eclipse were under -20° C, freezing tape recorders, stopwatches, and even short-wave radios, not to mention observers. That should not be a problem during the July 6th eclipse, unless someone tries to time the graze of Omicron Sagittarii in Antarctica.

If, on July 6, my experience with the 1975 eclipse can be combined with an eclipse 3 magnitudes darker like the one in 1963 December, somebody with a large telescope in the southern USA might be able to observe even the occultation of the 16th-mag. asteroid (1529) Oterma, shown on my chart in *Sky and Telescope* but not on the charts here. It should be possible to time occultations of many of the 12th-mag. AC stars shown on the chart with 15-cm telescopes.

The special value of accurate timings of occultations during lunar eclipses, for improving determinations of possible climatically significant small variations of the solar radius derived from central solar eclipse timings, has been discussed in previous issues of *O.N.* and on p. 100 of last January's issue of *Sky and Telescope*. The Watts angles of solar eclipse contacts used in this work are listed in *O.N. 2* (14) 189, along with a formula for calculating the distance, from a predicted northern or southern limit, where an occultation contact at a given Watts angle can be seen. Timings should be as accurate as possible; some remarks about visual timing methods are given in my review of the chapter on lunar occultations in Clay Sherrod's book on p. 224.

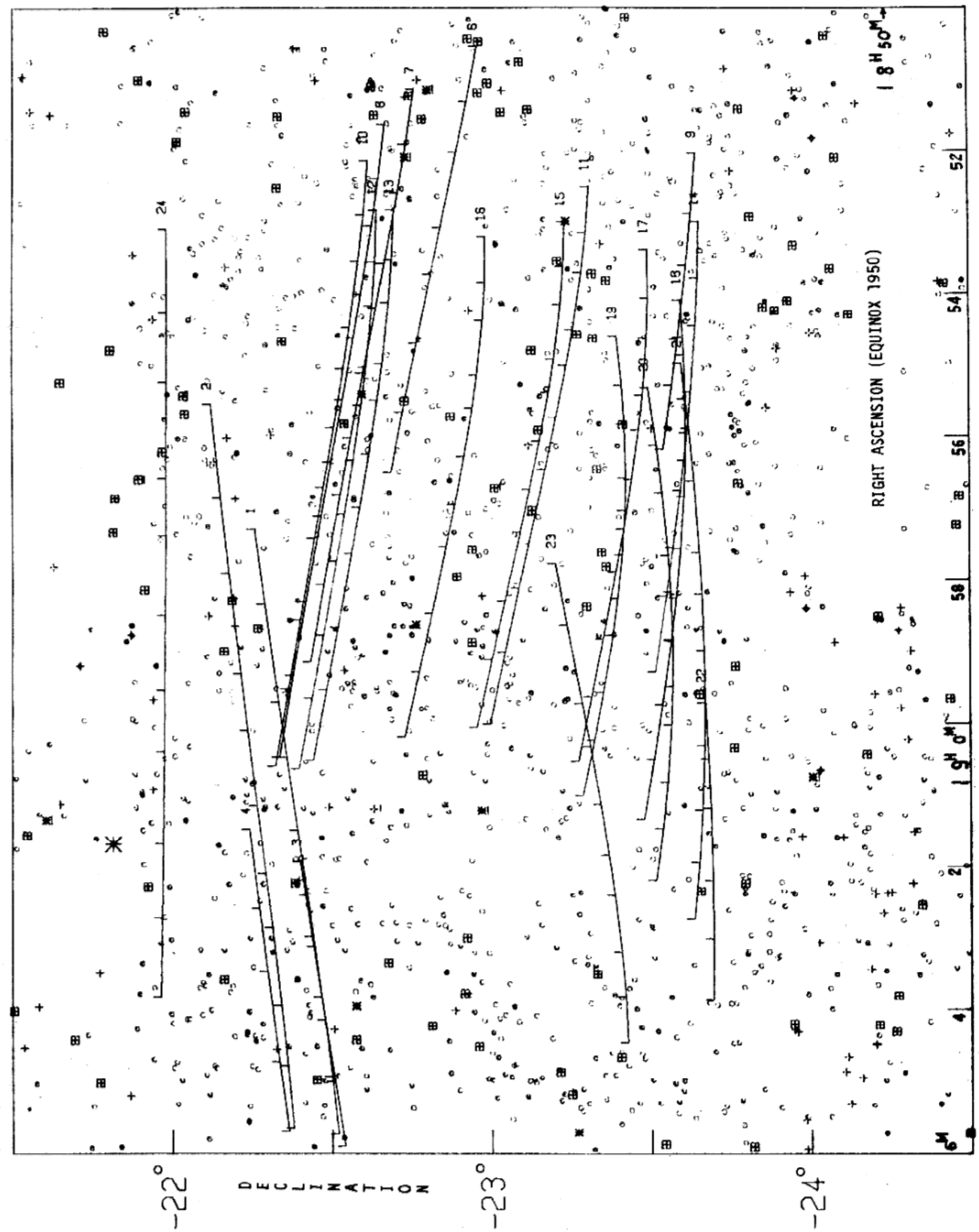
Observations of occultations during last January's total lunar eclipse were described in "IOTA NEWS" in the last issue of *O.N.* Paul Maley's photograph of the Delta Geminorum graze was published in the 1982 April issue of *Sky and Telescope*; the month was not specified on p. 200. Unfortunately, besides the historical observation of the Delta Geminorum occultation at both limits, I have received reports of no other grazing occultations observed during that eclipse. Only a few reports have been received from observers who timed several occultations during the eclipse. I hope that we get a much larger harvest of observations on July 6; a very dark eclipse will help achieve this. Competition from elaborate photographic attempts and public viewing considerably decreased the number of occultations timed during the January eclipse, and I hope that occultation observers will resist these lures on July 6. There will be hundreds of amateurs who will attempt to photograph the eclipse, most of whom are not IOTA members and will not try to time any occultations. Let them take the elaborate photographs; you should use your occultation timing skills where they will have the most useful scientific impact. If you must take some photographs, try to do so with a telescope other than the one you use to observe occultations and/or schedule your exposures to minimize interference with occultations. Remember that only a small fraction of the eclipse photographs which will be received by *Sky and Telescope* and *Astronomy* will be published, while every occultation timing will be used; the success of the overall occultation analysis will be proportional to the number of reported timings.

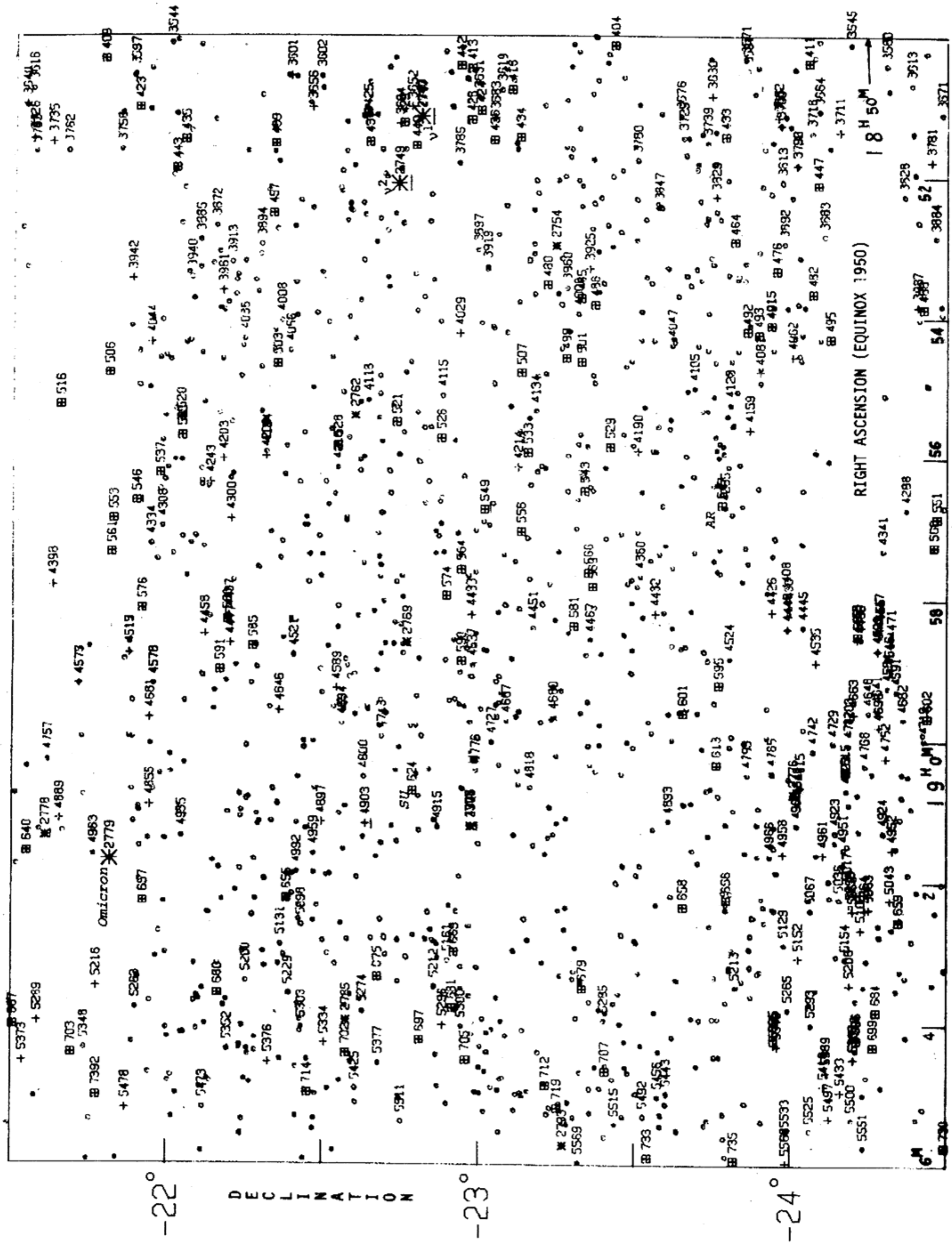
A main concern should be to use the largest aperture telescope available. The larger the aperture, the more occultations you probably will be able to observe. If you have access to a club or college observatory, try to make arrangements to use the largest telescope for timing occultations. Many observatories set up programs for public viewing during eclipses. This is good publicity, but they don't need to use the largest telescope. If there is not a smaller telescope available in another nearby dome, members of the public will be just as impressed with the view of the eclipse seen with a portable 6-cm refractor or 15-cm reflector set up on the front lawn. They don't need to use the large main instrument, which can better be used for research during rare astronomical events such as eclipses.

If your telescope is portable, I recommend observing from the path of the nearest grazing occultation which might be seen in the case of a dark eclipse. The weather should also be an important consideration; if you plan to use a large fixed-site telescope, you might make contingency arrangements to take a portable telescope to an area where clear skies are predicted, if clouds threaten the fixed-site. For those in the USA, Monday, July 5, will be a holiday, so a three-day weekend will be available to drive to an area with clear skies, if necessary. But arrangements should be made to take time off work on July 6, and possibly the 7th, to allow time to travel back (some time off on July 6 might be recommended in any case to recover from a hard night's work). Travel to avoid light pollution is also useful. The overall ecipse phenomenon will be enhanced in an area where the Milky Way shines brilliantly during totality. During the 1975 May eclipse, I paid no attention to a light beside a dwelling about ½ km away as I assembled my telescope during the early partial phases, when the landscape was still brightly illuminated by the moon. But during totality, the light was a little annoying.

If there are several occultation observers with portable telescopes in one metropolitan area, they shouldn't all cluster together in one place at a star party. If there is no graze path in the region to bracket, the observers should be dispersed, at home or other suitable locations, so that the occultation contacts occur at slightly different places along the moon's limb.

The eclipse star field is shown in two charts. The stellar symbols identify the different catalogs used as listed in Table 1. The first chart shows the paths of the center of the moon as seen from 23 stations listed in Table 2. The station number is plotted to the right of the right-side (beginning, low R.A.) end of each track. Vertical tick marks


RIGHT ASCENSION (EQUINOX 1950)
DECLINATION
-22°
-23°
-24°
18H 50M
52
54
56
58
19H 0M
2
4
6M


RIGHT ASCENSION (EQUINOX 1950)
DECLINATION
-22°
-23°
-24°
18^H 50^M
19^H 0^M
Omicron

show the locations of the center of the moon at the 11 times given in Table 3, the times increasing from right to left (with increasing R.A.). Only parts of the track with the moon above the horizon are plotted (Station 5 was Cape, but since the moon will be above the horizon at only one of the times listed in Table 3, its path is not included on the plot). Consequently, some of the early time tick marks are omitted (before moonrise) for Anchorage, Honolulu, and stations in Australia and New Zealand, while some of the later time tick marks are omitted (after moonset) for some of the other stations in the Americas.

Table 1. Key for Star Field Plots

⚹ - Zodiacal Catalog, Mag. 3.9 - 5.5

⁎ - Zodiacal Catalog, Mag. 5.6 - about 8

⊞ - SAO Catalog, Mag. 7.0 - about 9

+ - Astrographic Catalog, Mag. 8.4 - 10.5

• - Astrographic Catalog, Mag. 10.6 - 13

Symbols of double stars are underlined

Table 2. Stations for Topocentric Paths

No.	Location	Longitude	Latitude
1	Auckland	174°.777 E	-36°.908
2	Dunedin	170.500 E	-45.873
3	Brisbane	153.070 E	-27.516
4	Melbourne	145.000 E	-37.750
6	Recife	34.928 W	-8.061
7	Rio de Janeiro	43.187 W	-22.898
8	Porto Alegre	50.125 W	-30.054
9	St. John's	52.753 W	+47.537
10	Buenos Aires	58.435 W	-34.605
11	Caracas	66.928 W	+10.507
12	Santiago	70.799 W	-33.555
13	Cerro Tololo	70.806 W	-30.169
14	Montreal	73.600 W	+45.500
15	Bogota	74.081 W	+4.599
16	Lima	77.050 W	-12.100
17	Miami	80.250 W	+25.750
18	Kansas City	94.497 W	+38.964
19	Mexico City	99.100 W	+19.250
20	Los Angeles	118.302 W	+34.113
21	Vancouver	123.100 W	+49.500
22	Anchorage	149.870 W	+61.210
23	Honolulu	157.850 W	+21.300
24	South Pole		-90.000

Table 3. Plotted Times.

U.T.	Contact	
$5^{h}.000$		
5.547	First Umbral	I
6.000		
6.628	Start Totality	II
7.000		
7.515	Maximum Eclipse	
8.000		
8.402	End Totality	III
9.000		
9.483	Last Umbral	IV
10.000		

A map showing the numbers of all of the stars would be too cluttered (but one is available upon request). The second chart shows the numbers of all the Zodiacal Catalog stars (numbers in the 2000's) and of SAO stars not in the Z.C. (3-digit numbers; add 187000 to them for the SAO number). Also, numbers are given for non-SAO stars of mag. 11.0 and brighter; add 10000 to these 4-digit numbers to obtain the C-catalog number. The numbers are always written to the right of the stars. There are only a few places where the numbers are crowded together so much that they can't be read.

The amplitudes of the light curves of the variable stars AR Sagittarii (SAO 187547) and SU Sagittarii (SAO 187624) are 1.9 and 0.7, respectively, small enough so that the stars are not on the program of the AAVSO, which could therefore not supply me with an estimate of their magnitudes during the eclipse. AR is an RV Tauri variable, a supergiant with a double-wave variation, with alternating primary and secondary maxima. SU is an RR Coronae Borealis semi-regular variable, a giant of late spectral type and almost regular variation. At mag. 8.4, the star C14903 is probably the brigtest non-SAO star shown. It is Aitken's double star 11986, with an 11th-magnitude companion 3".9 away in p.a. 148°.

Detailed USNO extended-coverage C-catalog predictions of occultations during the eclipse are being sent to IOTA members who are in the region of good visibility of the eclipse and who are also in USNO's current active list with an observability code limit less than 5 (there is no use in computing predictions for the higher O-code limits, since they are already adequately covered by the regular USNO XZ-catalog predictions including all SAO stars). The predictions are being sent also to some IOTA members who are not in USNO's list and who have supplied accurate geographical coordinates, and to a few non-IOTA active observers in USNO's list, especially those with photoelectric equipment. Some IOTA members have sent me payments in response to my article in *Sky and Telescope*; since the predictions are a privilege of IOTA membership, these payments are being returned or, in a few cases, applied to the member's credit to extend his membership. Some IOTA members who have not supplied geographical coordinates, or who are in other countries and live near other IOTA members whose predictions they can use, have not been sent predictions. Overseas observers who are being sent the predictions are also being sent a preprint of this article. Since the eclipse may be an unusually dark one, I have increased the observability codes for some of the faint stars by decreasing their magnitudes only for the total occultation predictions during eclipses. Specifically, during this year's remaining eclipses, if the star's catalog magnitude is 10.1 to 10.5, it has been changed to 10.0; 0.5 has been subtracted from the magnitudes of stars fainter than 10.5; and any remaining magnitudes greater than 12.5 have been changed to 12.5.

Predictions of grazes of SAO and ZC stars during the eclipse have been distributed as part of the regular graze prediction coverage. Also I have checked the C-catalog total predictions for active graze observers to see if there are any "graze nearby" messages for possibly observable non-SAO stars, and have computed and distributed detailed predictions for some of these grazes. The magnitude adjustments described above have not been made in the graze predictions. Since the graze prediction computer program was not written with AC stars in mind, the star's AC number has been given in the DM number place, but the sign of the declination zone is always given as + for all AC stars (it should always be -, or "B" to denote an A.C. zone, for grazes during the July 6 eclipse) and the prefix "C.D." should be "A.C." In addition, I have computed total occultation predictions for some for the closest point in the predicted limit. If you need predictions for either grazes, or total occultations for specific stations, which have not already been supplied, call me at area 301, 585-0989 and I will try to compute the requested predictions and get them to you. I plan to travel much of the weekend before the eclipse, if necessary, to get to a location with clear skies. If you plan to do the same, and need predictions for an area far from home, we will establish a message center at Wayne Warren's home in College Park, MD (phone area 301, 474-0814). Call this number telling where you plan to go, and they will tell you when I next plan to call (probably at approximately 8-hour intervals). I will give the phone number of the observer nearest to the place you are headed who has detailed predictions.

Arnold Klemola plans to take a large-field plate covering the eclipse field with the 50-cm twin astrograph at Lick Observatory 2 or 3 weeks before the eclipse. This will be reduced with Perth 70 stars, so that we can provide more accurate positions for either SAO or non-SAO stars for which we have distributed graze predictions. I will try to distribute shifts predicted in this way which exceed 0".3 to observers by telephone, telex, or telegraph. Several months after the eclipse, hopefully by which time we will have received nearly all reports of occultation timings, Klemola will remeasure the plate to improve the positions of all stars, either total or grazing occultations of which were observed. This will help our analysis of the observations to derive corrections to Watts' Lunar limb data.

Before reporting observations, read the article about the extended-coverage predictions on p. 222. Many of the USNO reference numbers given in the chronologically ordered lists are wrong, as described in the article. Observers in New Zealand and Australia should send their eclipse occultation reports to David Herald, P.O. Box 254, Woden, A.C.T. 2606, Australia; others should send them to me at P.O. Box 7488, Silver Spring, MD 20907, USA. If possible, send a copy to the ILOC, and indicate that this has been done on the form. If you time an occultation of a star which is not numbered on the chart, and which is not in your prediction list (either because you don't have one or because the observability code of the occultation was below the limit for your predictions), mark the star (or stars) on the chart and include it (or a copy) with your report. Do the same if you time an occultation of a star which is not on the chart (that is, mark its location); when Klemola remeasures his plate to obtain accurate positions of stars whose occultations have been timed, he will not be restricted to just the A.C. and SAO stars shown on the chart.

For those in the USA and Canada being sent total occultation predictions for the eclipse on July 6, predictions will also be included for the Hyades passage on July 17, the last relatively favorable one for us, including occultations of a few 4th-magnitude stars. Predictions of occultations during this December 30th's eclipse will also be included for these observers, to avoid some work later.

VIDEO RECORD OF SECONDARY OCCULTATION OBTAINED AT MEUDON OBSERVATORY DURING (146) LUCINA APPULSE ON 1982 APRIL 18

David W. Dunham and J. Lecacheux

Observations of possible occultations of BD +17° 2516 = AGK3 N17° 1309 made in France on April 18 were reported on IAU Circular No. 3692. At Meudon, a possible secondary occultation was recorded by J.-E. Arlot, C. Richardson, and W. Thuillot on video tape, using an SIT-vidicon and the 1-m reflector; the full-amplitude extinction, of duration $0^s.6$ second, was centered at $20^h23^m25^s$ UT. An extinction recorded photoelectrically at CERGA's Calern station near Grasse, far south of a path through Meudon (near Paris; see the map on p. 205 of the last *o. N.*), was later discounted as "a spurious effect from the tracking computer." The CERGA observation was inconsistent with a timing of the occultation by Lucina itself made visually by Carlos Schnabel at Barcelona. His reported duration of 6 seconds, starting at $20^h21^m28^s$ UT, is less than half of the expected central duration of 16 seconds, so it was probably a nearly grazing occultation. It is then not unreasonable that R. Casas, observing at Sabadell, Spain, only 14 km north of Schnabel's position on the fundamental plane, saw no occultation.

The relative positions of the star and Lucina were measured on selected video frames obtained around the time of the occultation at Meudon. These measurements showed a distance of closest approach of 0".7 to the south at $20^h20^m.3$ UT, consistent with the Barcelona occultation observation to the former's 0".2 accuracy.

Although neither the primary nor the secondary occultation have been confirmed by observers at other locations, the Meudon record gives strong support to the hypothesis of satellites of minor planets. The observation was made at relatively high altitude and guiding errors can't affect video records, which cover a substantial area of sky, in the same way they hinder photoelectric observations. Although sky conditions were not ideal, Lucina was visible well enough to perform the astrometry described above and to confirm that the observed extinction corresponded to a complete occultation of the star. The duration of the occultation corresponds to a distance of 6 km. The separation in the sky plane between the Barcelona and Meudon objects was about 1610 km or 1".33, in p.a. 60°.

The event had been predicted to be visible from central France by Gordon Taylor, according to astrometric observations he made at the Royal Greenwich Observatory a few days before the occultation. Paul Maley travelled from Houston, TX, to Lyon, and some members of the British Astronomical Association also travelled to central France to observe the occultation. But they, as well as local observers, saw no occultation. R. Boninsegna, Viroinval-Dourbes, Belgium, helped coordinate observations of the event. He reported that observers at La Seyne sur Mer, France, and at Massa, Italy, saw no occultation, but both of them were north of even the path through Sabadell, Spain. Other observers in Italy and in Germany were clouded out, which presumably was also the fate of observers in Spain and Portugal who would have been in the path of Lucina's shadow.

GRAZING OCCULTATIONS

David W. Dunham

The table lists successful, or partly successful, expeditions for grazing occultations which have been received since the list on p. 126 and 127 of issue No. 11 (1981 March) was prepared. The format of the list was published in *O.N.* 2 (3) 27. A "V" is given between the date and star number if a video record of some graze contacts was obtained from at least one of the stations, and a "P" is similarly given if a photoelectric record was obtained.

Reports of observations of grazing occultations should be sent to me at P. O. Box 7488, Silver Spring, Maryland 20907, U.S.A. If possible, a copy of the report also should be sent to the International Lunar Occultation Centre (ILOC), whose address is given on the report forms and also on p. 221, where there is also a discussion of important new instructions for completing occultation report forms which especially affect grazes. The IOTA/ILOC graze report forms are available upon request to either IOTA or me.

In addition to the detailed predictions, most computors now are distributing summary lists of all the grazes for each observer during a quarter, or during a half year. With some versions of the computer prediction program, including the one which I use at USNO, there is an error which sometimes causes bad data, usually in the form of asterisks, to be printed for some grazes in the summary. This happens in the rare cases (always at low altitude when the graze will probably not actually be visible, anyway) when the closest point in the predicted limit is not included in the range of data in the detailed INT4 graze limit predictions. Eventually, we hope to identify and correct the program error.

Observers should check to see if they have an ACLPPP printed profile for each INT4 graze limit prediction, especially for stars of southern declination of about 6th and 7th magnitude. The INT4 predictions are computed with USNO's prediction base 80F, which includes Perth 70 catalog data, while the ACLPPP profiles use prediction base (version) 78A, which does not include the Perth 70 data, and often uses inaccurate Z.C. or G.C. stellar positions. In some cases, the position difference for the star at the present is so large from one

Mo	Dy	Star Number	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap cm	Organizer	St	WA	b
1979														
9	12	0659	6.4	61-	N	Milton, CT	2	10		15	M. D. Overbeek			
1980														
1	13	2284	4.7	20-	-1N	Yunta, Australia	4	4	2	11	David Steicke		6	-75
2	13	2826	4.0	9-	-4N	Murray Bdg,Austrl.	1	1	3	15	David Steicke		11	-49
4	7	161582	7.7	60-	11S	Naracoorte,Austrl.	2	8	2	11	David Steicke	0	191	-5
5	9	146534	8.0	28-	4S	Virginia, Austrl.	7	14	2	11	David Steicke	13N	185	20
7	21	2100	6.6	61+	9N	Delamere, Austrl.	2	1	3	11	David Steicke	1S	10	-72
9	26	0321	4.5	93-	15N	Pt.Augusta,Austrl.	4	6	3	10	David Steicke	2S	353	62
10	13	159842	9.1	15+	-1S	Auckland,N.Zeald.	1	4		20	G. Herdman			
11	1	1481	7.4	33-	7N	Memphis, TN	2	7	1	8	Joe Johnson	2N	350	72
11	15	3206	5.2	52+	S	Bloemfontein, RSA	3	25	1	9	Graeme Walker	0		
1981														
1	9	164770	8.2	11+		Canberra, Austrl.	2	2	2	20	David Herald			
1	28	2141	6.0	44-	9S	Murray Bdg,Austrl.	1	14	1	6	David Steicke	2N	190	-75
2	1	2679	7.4	11-	11S	Baguio,Philip.Is.	2	9		8	Ernesto Calpo			
2	12	0618	7.2	59+	4S	Manila,Philip.Is.	1	4		8	Ernesto Calpo			
2	12	0620	6.3	59+	3N	Murray Bdg,Austrl.	2	0	3	6	David Steicke			
2	12	094019	7.1	63+	3N	St.PereRibes,Spain	2	3	2	20	Carlos Schnabel		1	
2	17	184922	7.2	35-	15S	Gallman, MS	2	8	1	20	Benny Roberts		197	-34
2	26	2291	5.5	66-	12S	West Kankakee, IL	2	10	2	13	John Phelps, Jr.	9S	192	-57
2	28	160995	8.1	33-		Goulburn, Austrl.	1	1	2	20	David Herald			
3	4	3181	5.9	4-	S	Goulburn, Austrl.	3	13	2	10	David Herald		191	
3	14	0995	4.1	61+	2N	Lion's Head, Ont.	2	7	1	20	Doug Cunningham		0	41
3	15	1138	7.1	72+	4N	St. Joseph, Ont.	1	1	2	20	Doug Cunningham		1	27
3	15	1138	7.1	72+	4N	Ingersoll, Ont.	1	2	1	20	Bob Radko		1	27
3	15	1138	7.1	72+	4N	Applegarth, NJ	3	3	2	10	David Dunham		1	27
3	16	1275	5.6	82+	4N	Edgar Springs, MO	1	3	2	9	Joseph Senne	10S	1	11
3	25	2247	5.6	80-	15S	Austin, TX	3	8	1	15	Rick Binzel		193	5[illegible]
3	29	2797	3.0	44-	-7N	Webster, MD	8	55	1	20	David Dunham		9	-18
4	7	0453	7.3	7+	7S	Five Mi. Fork, VA	6	24	1	15	William Stein		182	68
4	10	0930	8.1	35+	-0S	Ottawa, Ontario	2	2	2	20	Brian Burke	10S	180	43
5	10	1310	4.2	41+	4N	Evart, MI	1	11	1	20	Paul Asmus	1N	1	1
5	10	1310	4.2	41+	4N	Spry, PA	1	3	1		Steve McLaughlin			
5	10V	1310	4.2	41+	4N	Conowingo Dam, MD	18	111	1	6	David Dunham	2S	2	1
5	14	1773	5.1	82+	5N	Blenheim, N.Zeald.	1	3	1	20	Brian Loader			
5	25	3113	5.4	65-	2S	Flora, MS	2	6	2	15	Benny Roberts		185	22
5	27	3392	7.1	44-	-1S	Mize, MS	1	3	1	20	Benny Roberts		180	49
6	26	0208	7.0	36-	2N	Georgetown, MS	1	1	2	20	Benny Roberts		357	73
7	17	188551	8.0	68E	86U	Goodman, MS	2	3	1	20	Benny Roberts		191	-2
7	21	3409	7.0	84-	7N	Barcelona, Spain	3	10	2	20	Carlos Schnabel		358	
7	28	095087	8.4	9-	-7S	Cruger, MS	2	2	2	20	Benny Roberts		168	42
7	28	077850	8.4	9-	8N	Greenwood, MS	2	14	1	20	Benny Roberts		347	41
8	8	2265	8.4	61+	11N	Rafaela, Argentina	1	11	2	20	Eduardo Przybyl		13	-64
8	20	0327	4.5	70-	5N	Doonside, Austrl.	8	35	1	11	Roger Giller			

version to the other, that the 78A prediction system fails to predict a graze for a point in the version 80F predicted limit. When that happens, no input cards with limb correction data for the ACLPPP are generated and ACLPPP produces no profile for the event. We use version 78A with ACLPPP since there are empirical corrections built into that program which depend on analyses done with 78A. But in the case where the position difference is so large that the problem described above occurs, 80F gives the better prediction. For these cases, we can compute an ACLPPP profile with version 80F for you, if you request one (specify date, approximate time, whether northern or southen limit, and USNO reference star number) at least a month in advance. ZC 2210, currently being occulted, is one star where the problem described above above occurred.

For Watts angles near the lunar north pole and latitude librations greater than +3°.0 (in the deep Cassini region), the ACLPPP adds 0″.6 to the incorrectly low Watts heights for those regions. Observations of the graze of ZC 1138 on 1981 March 15, when the librations were +5°.5 in long. and +2°.67 in lat., show that a correction at least this large also needs to be added to limb corrections in the Watts angle range from 0° to 2°.6 for latitude librations from about +0°.5 to +3°.0. The actual limb seems to be near the mean limb, as other grazes have shown for deeper parts of the northern Cassini region. Keep this in mind if you have ACLPPP profiles for grazes in these regions (they are occurring now); if the graze occurs in the affected area, set up farther north than the Watts data indicate. This has been corrected, in the form of observed data for the ZC 1138 graze, for many (but not all) of the ACLPPP profiles for 1982 July and later.

Mo	Dy	Star Number	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap cm	Organizer	St	WA	b
9	5	159579	8.2	39+	4N	Clifton B.,Austrl.	1	1	2	12	Martin George		5	-62
9	5	159579	8.2	39+	4N	EaglehawkN,Austrl.	1	6	1	12	Mrs. Hilary Wilson		5	-62
9	6	2361	4.8	45+	-0S	Ft. Lauderdale, FL	2	4		15	Harold Povenmire			.
9	6	2399	5.0	48+		Woonona, Australia	7	21	2	11	Roger Giller			
9	8	2614	6.2	64+	3N	Summit Brdg., DE	2	7	2	9	David Dunham			
9	9	2779	3.9	74+	1N	Potsdam, MN	1	2	1	20	James Fox	2N	2	-10
9	20	0796	6.8	56-	12N	Nunez, LA	1	1	1	20	Don Stockbauer	S	348	47
9	20	0796	6.8	56-	12N	Arcola, LA	1	0	1	15	Benny Roberts	S	347	47
9	20	0796	6.8	56-	13N	Stormont, VA	6	38	1	13	William Stein			
10	5	2633	4.0	42+	4S	Keith, Australia	2	15	2	11	David Steicke	0	178	-33
10	6	187096	8.2	47+	1N	Ceresville, MD	1	1	2	25	David Dunham	2N	5	-14
10	16	0648	3.9	86-	17N	Panique, Phil. Is.	1	6	1	8	Ernesto Calpo	0	347	54
10	18	0894	4.6	72-	-8S	Zürich, Switzerld.	4	3	3	7	Robert Germann		171	
10	19	1086	6.5	59-	13N	Los Banos, CA	9	47	1	20	James Van Nuland	3N	346	17
10	20	079899	7.7	48-	12N	Highland Spgs, VA	4	18	1	10	David Dunham	3N	347	3
11	2	2717	7.4	25+	-1N	Kaituna Vly,N.Zld.	1	4		20	Brian Loader			
11	4	189041	8.9	41+	4S	Beverly Hills, CA	1	1	2	15	Richard Nolthenius		178	12
11	15	1047	5.2	83-	12N	Greenfield, CA	3	6	3	9	Gerald Rattley	6N	348	18
12	3	3210	7.0	36+	6S	Auckland, N.Zeald.	6	54		20	G. Herdman and P. Kilbey			
12	3	3225	7.1	37+	9S	San Fernando, P.I.	1	2	1	8	Rodrigo Nieva	0	173	38
12	4	165149	8.3	43+	8S	New Byram, MS	1	4	1	33	Benny Roberts		175	48
12	31V	164948	7.0	18+	9S	Wicomico, VA	2	7	2	20	David Dunham			
12	31	3358	7.2	25+	S	Gravenzande,Nethr.	3	10	2	15	Henk Bulder			
1982														
1	2	3529	6.8	38+	4S	Mapleville, MD	7	30	2	20	David Dunham		179	65
1	2	3529	6.8	38+	4S	Maryland Line, MD	1	6	2	10	Richard Taibi		179	65
1	2	147032	8.1	38+	10S	Triunfo Pass, CA	1	3	2	15	Richard Nolthenius		173	66
1	9	1110	3.5	0E	U	Dagupan, Phil. Is.	2	14	1	6	Paul Maley			
1	9	1110	3.5	0E	U	Rosales, Phil. Is.	1	11	1	8	Ernesto Calpo			
1	9	1110	3.5	0E	U	Ayres Rock,Austrl.	1	1	1	15	David Herald			
1	21	2498	4.5	12-	13S	Gardner, FL	1	1	3	20	D. Dunham and C. Hunter			
1	21P	2498	4.5	12-	13S	Gainesville, FL	8	74	1	10	Campbell and Schneider			
1	29	146857	8.8	14+	9S	Eastland, PA	1	6	3	15	Craig Patterson	5N	178	63
2	18	186356	8.3	24-	12S	Aldinga, Australia	1	4	1	25	Vello Tabur		196	-28
3	2	0689	7.8	48+	8S	Halen, Belgium	6	44	1	12	Roger Laureys			
3	2V	0726	6.8	51+	8S	S. Wilmington, NC	5	52	1	10	David Dunham			
3	16	2401	5.6	62-	15S	Kearney, MO	2	8	1	15	Robert Sandy		196	35
3	16	2446	7.2	58-	18S	Pangasinan, Phl.I.	1	3	2	8	Rodrigo Nieva	0	199	-34
3	17	2529	6.6	52-	0S	Hooker, OK	1	4	1	20	Larry Hoeme		181	
3	21	3078	4.9	17-	12S	Knoxville, MO	3	20	1	15	Robert Sandy	0	191	33
3	21V	3078	4.9	17-	12S	Villa Ridge, MO	6	40	1	6	Joseph Senne	0	191	33
3	31	0847	3.0	37+	1N	West Hartford, CT	1	0	1	15	Jamie Meyers			
3	31	0847	3.0	37+	1N	Glastonbury, CT	1	4	1	15	Philip Dombrowski	0	0	31
3	31	0847	3.0	37+	1N	S. Kingstown, RI	4	36	1	5	John Cardillo			
3	31	077497	8.4	38+	2N	Beverly Hills, CA	1	1	1	15	Richard Nolthenius		1	29
3	31	078460	7.5	47+	1N	Dresden, D.D.R.	1	4	2	6	Peter Lipski		2	20

ILOC NEWS

David W. Dunham

In March, the International Lunar Occultation Centre issued a "Guide to Lunar Occultation Observations," which is a more detailed description of instructions for completing their report forms than previously has been available. An example of a completed report is included at the end, including both visual and photoelectric total occultation observations, and one visual grazing occultation observation. Copies of the Guide can be obtained from the ILOC/ Astronomical Division/ Hydrographic Department/ Tsukiji-5, Chuo-ku/ Tokyo, 104 Japan.

The new Guide includes virtually all of the new interpretations described in previous issues of *O. N.*, especially my article about using the forms in *O.N. 2* (12) 159. Two exceptions are the descriptions for using columns 56 and 57, about which the new Guide only says will be completed by ILOC personnel based on notes given by the observer in the comments section. Column 56 apparently is used for gradual phenomena, as described in *O.N. 2* (12) 159. In general, it should not be used by photoelectric observers, who should report the time for the occultation when the stellar intensity is at the 25% level, which corresponds to geometric contact with the lunar limb. If visual observers report the times of gradual phenomena, the reported values will have more meaning if they also include an estimate of the limiting (or threshold) magnitude under the conditions at the time of the occultation. The new Guide includes a new code for column 36-37 (Method of Timing and Recording): V for television (video).

Some important new instructions about recording repetitive data are given on p. 3 of the new Guide. Especially on graze reports, observers often use arrows and ditto marks. The ILOC is now very specific about this; don't do it. The Guide states: "Enter specified, and only specified, letters etc. clearly in each column. For example, do not use any mark to show that the same letters are to be entered as in the corresponding columns of an above line. Such letters or marks will interfere with the work of completing the form for processing by a computer at ILOC. As a rule, fill all the columns, as far as known, for each observation. You should fill a column even if the letter for it is the same as the one in the corresponding columns of an above line. As for columns 1-2, 24-34 and 36-41, however, it is only necessary to fill them once in the first line if they are the same for all observations on the form. In this case, no mark should be written in these columns of the second and below lines." Since arrows have been used liberally on virtually all of the graze reports transcribed by IOTA volunteers, I will ask ILOC if it would slow up their work very much if we sent these reports to them as is. If so, the reports should be rewritten to conform to the above specifications, and volunteers will be needed to do this. It would probably be better for us to do the work than further delay the ILOC's important work, considering their large burden.

Some observers have asked me about receiving residuals for their observations from the ILOC. The Lunar Section of the British Astronomical Association has also been concerned and wrote to the ILOC asking about the situation. The reply from Dr. Yamazaki, Director of the Astronomical Division of the Hydrographic Department, is reprinted below from the B.A.A. Lunar Section *Circular 17* (3) 24, 1982 March:

"Thank you very much for your letter dated January 4. I greatly appreciate the many valuable observations of lunar occultations made by the observers belonging to your Association and reported to us periodically.

"To my regret, it is quite true that we are badly behind with our schedule of processing the observations of lunar occultations accepted at our office, mainly due to the various difficulties peculiar to the transition phase of the international centre. I would like to explain our present status in a little detail.

"Although we had had long experience of reducing the observations of lunar occultations made by Japanese observers, when we took over the service of International Centre for lunar occultations from HMNAO, we found it necessary to reconstruct the reduction system in order to make it match the demands of the International Centre. We had to take into account the system which had been followed by HMNAO as well as to ask the opinion of the U.S. Nautical Almanac Office (USNO) concerning station codes, star catalogues etc. As you know, USNAO provides many observers with local predictions of lunar occultations. It might be easier for us to make a completely independent new system.

"To add to this, from the beginning of last year when the centre was taken over we received a large number of observation reports, including unreduced reports forwarded to us in a bundle by HMNAO. These reports were written on forms of two kinds and used two different code systems. We are now preparing the files for our computer which include all the observations accepted so far, and data concerning station coordinates, telescopes and observers which are written in a uniform format. This will be completed by April and as soon as the files are prepared we will begin the reductions. We intend to obtain the first results by July if everything goes well. Once the system begins to operate I am sure that we can compute the residuals and return them to observers periodically. I am worried myself about keen observers who are anxious to know their residuals very soon, but since our situation is just as stated above, I sincerely hope that they will be patient and wait a little longer, and will continue to make their observations which will certainly add much to the progress of astronomy."

REQUEST FOR DESCRIPTIONS OF HIGH-SPEED PHOTOELECTRIC EQUIPMENT

Russell M. Genet

The *IAPPP Communications*, the quarterly journal of the International Amateur-Professional Photoelectric Photometry (IAPPP) association, has published a number of descriptions of low-speed photoelectric equipment such as is used for variable star photometry. There is considerable interest among many IAPPP and IOTA members in photoelectric photometers capable of measuring high-speed occultation events. I would like to invite and encourage papers on such equipments for publication in the *IAPPP Communications*. Papers should be sent directly to Coeditor Robert C. Wolpert; Belmont Observatory; 144 Neptune Ave.; North Babylon, NY 11704.

SOUTHERN ASTROGRAPHIC CATALOG DATA ADDED TO USNO C-CATALOG FOR EXTENDED-COVERAGE TOTAL OCCULTATION PREDICTIONS

David W. Dunham

IOTA's Southern Astrographic Catalog (SAC) project was organized by David Herald in 1977 to provide a machine-readable data base of stars to magnitude 11.5, giving a density of stars generally over 15 times denser than the SAO (the densest source then available in machine-readable form), for the rich Milky Way Zodiacal regions between right ascensions 17 and 19 hours. The intention was to use this for detailed occultation predictions. The project was described in *O.N. 1* (11) 113 and *O.N. 1* (13) 137. The calculation of the plate constants and the equinox 1950 coordinates of all the stars (including those to the plate limit, near mag. 13, for a few plates of special interest, such as the ones in the -23° zone covering the July 6th lunar eclipse field) were completed in 1979. The plate constants, errors found in the course of the work, and a discussion of the accuracy of the resulting coordinates, have been published by Herald in an article, "The Hyderabad (S) and Cordoba Zones of the Astrographic Catalogue: A Preliminary Investigation," in *Bulletin d'Information du Centre de Donnes Stellaires No. 22* (March 1982).

All of the -17° zone plates were computed first; the data were keypunched at USNO and included in the J-Catalog for the extended-coverage USNO total occultation predictions for the latter part of that year. The large volume of material which Herald and other workers on the project sent me during the next two years was more difficult to manage since it arrived at different times in slightly different formats, some containing special errors which had to be fixed with tailored computer programs. Other pressing work prevented my controlling the situation in time to prepare a successor to the J-Catalog when the moon's orbit moved south of the -17° zone of the region in 1980. The data are still being keypunched, with the job now about 3/4 complete. During the last month, I wrote a series of computer programs to process the data, converting it into a uniform format and checking for errors (being sure that the star numbers increased properly, that their coordinates really represented a position on the plate in question, etc.), sorting it all by right ascension, eliminating duplicates, and merging it with the USNO K and X Catalogs. When several stars were found to have been skipped on one plate, I wrote a computer program to use the plate constants provided by Herald to compute the equinox 1950 coordinates from the x and y measures given in the A.C. book. This work, including the correcting of numerous keypunch and some computational errors found with the computer checks, took more time than I expected, considerably delaying the distribution of predictions for the July eclipse. It was clear that there was not time to process all the data on hand, so only those data which had been keypunched in the zones currently (and in the near future) being traversed by the moon, were processed. This included 8261 stars, which were simply added to the C-Catalog described in *O.N. 2* (14) 188, since their R.A.'s were all higher than those of the northern stars in the original version of that catalog. I've discovered one error since using the catalog for computing predictions; the star C13680, listed as a non-SAO star with a mag. of 5.7, should be deleted since it = ZC 2747 (SAO 187426 = C13678 = Nu^1 Sagittarii). C13680's AC position was so poor that my program matching logic failed; I plan to remove it before computing 1983 predictions. ZC 2747 will be occulted in eastern South America during the July 6th eclipse, but in the penumbra before totality. ZC 2747 is double (ADS 11794), with an 11th-mag. companion 2".5 away in p.a. 97°.

The augmented C-Catalog has been used to compute extended-coverage USNO total occultation predictions for many active IOTA occultation observers for the second half of 1982. For most IOTA members for whom I have accurate geographic coordinates, I have computed predictions at least for the lunar eclipses on July 6 and December 30; see the last part of the eclipse article on p. 219. If you don't have extended-coverage predictions, or want them for another station or for the entire 2nd half of the year (not just during the eclipses), I will try to provide them upon request. It is simpler to do this if you are on USNO's active mailing list for the regular XZ USNO predictions; especially if you are (or want to be) timing lunar total occultations regularly, you should have these predictions. If not, you may want to send accurate coordinates (including height above sea level) and telescope aperture to: Marie Lukac, Nautical Almanac Office, U. S. Naval Observatory, Washington, DC 20390.

The USNO predictions are always computed and listed in order of increasing star number (= increasing R.A.). But the high density of the C and J Catalogs means that the lists are not in chronological order. For convenience, daily chronologically-ordered summary lists have been provided at the end of the extended-coverage predictions. Unfortunately, there is a computer program error which we have not yet tracked down and corrected, which causes incorrect catalog codes (usually, J instead of C, or vice versa) to be printed in the USNO REF NO column of the chronological summaries. The correct catalog codes and numbers are given at the beginning in the main (R.A. order) list, which should especially be consulted before completing the observation report form. Also, check the DM number column, which gives other catalog numbers. When available, ZC (ILOC form catalog code R), SAO, X, or K numbers should be used on the report forms, rather than J or C numbers. Most of the N (AGK3) stars given in the J-Catalog have X numbers, obtainable from the regular USNO predictions; the J-Catalog was formed before X. SAO numbers are preferred over the old Z numbers given for some J-Catalog stars. The A.C. numbers (prefixed A or B under the DM number column) should not be used on the ILOC report forms. Note also that in the main list of the extended-coverage predictions, the Z.C. number is sometimes (but not always) given as a 4-digit number preceded with no (blank) catalog code in the USNO REF NO column. In this case, it is also given in the chronological summary list in the USNO REF NO column, but with an incorrect prefix, either J or C, like the other stars in the list for the day in question. If the star is in the Z.C., this is always indicated in the DM REF NO column.

As noted on p. 218, detailed graze predictions can be computed for the C-Catalog stars not in the XZ, although the predictions might not be very accurate unless the positions are improved with modern astrographic data. Since time was short for acting on requests for the July 6 eclipse, I have computed and distributed graze predictions of some C-Catalog stars for active graze observers on my own initiative. Detailed predictions of grazes for C-Catalog stars not in the XZ or ZC which occur after July 6, including during the total lunar eclipse of December 30, can be obtained only upon request to me. Arnold Klemola exposed and measured a plate at Lick Observatory which covers the December 30 eclipse field, and created a catalog of stars down to about 11th magnitude for a larger project to aid analysis of astrometric observations made by the Voyager spacecraft for their encounters with Jupiter and Saturn. These data will be used to improve graze predictions of C-Catalog stars for that eclipse. If predictions are requested for grazes of some stars not in the Lick Voyager Catalog, I may ask Klemola to remeasure the plate in question to provide good positions.

The A.C. plates used for the augmented C-Catalog include all those in the -21° zone from R.A. 17h 00m to 19h 00m; in the -23° zone from 17h 32m to 48m and 18h 20m to 19h 00m; and in the -25° zone from 18h 20m to 19h 00m. These plate centers are on equinox 1900. The A.C. data have been merged with K and XZ data in the equinox 1950 R.A.-Dec. rectangles specified in Table 1. The specified boundaries completely enclose the A.C. coverage, which extends generally to within 5', but sometimes as far as 10', of the boundaries.

Table 1. 1950 Boundaries for the SAC-extension of the C-Catalog.

Right Ascension		Declination	
16h58m to	17h29m	-22°20' to	-19°40'
17 29	17 57	-24 20	-19 40
17 57	18 17	-22 20	-19 40
18 17	19 08	-26 15	-19 40

For the extended-coverage predictions for 1983, I plan to create another small catalog of SAC data, including at least more of the -23° and -25° zones which will have been keypunched by later this year. This will be needed in order to cover the star field for the Western-Hemisphere partial lunar eclipse on 1983 June 25. The main uncertainty in the positions of the AC stars is caused by the lack of knowledge of their proper motions combined with the fact that the SAC plates were all exposed before 1930.

We are indebted to the following, who participated in the SAC project: M. Ashley, D. Herald, G. Kellock, B. Soulsby, J. Elso, and N. Butterworth, in Australia; and K. Strait and D. Stockbauer in the USA. I thank Tom Van Flandern and the Nautical Almanac Office for having the data keypunched at USNO; and Robert Clyde and Ben Hudgens, who carefully proofread the keypunched data.

REVIEW OF "A COMPLETE MANUAL OF AMATEUR ASTRONOMY" BY CLAY SHERROD WITH THOMAS KOED

David W. Dunham

This book was printed by Prentice-Hall, Inc., in 1981. I am reviewing here only their Chapter 7, "Lunar Occultations."

There is a considerable amount of useful information about observing occultations, not available anywhere else in as concise a form, in this chapter. Examples of the detailed USNO total occultation predictions, a map showing a graze layout, and a predicted and observed graze profile have been published in a book for the first time, as far as I know. However, it is out of date in places, an inevitable consequence of the rapid developments which have occurred in the occultation field in recent years (to its credit, the correct addresses are given for IOTA and the ILOC). Some of the methods described, especially for making accurate timings, are not the best available and can lead to poor results, if caution is not excercised. It is recommended that this chapter be augmented by reading Tom Van Flandern's "Precision Timing of Occultations" (avaiable from Marie Lukac at USNO; see p. 223) and/or Gordon Taylor's NAO Technical Note on observing occultations (available from Taylor at H.M. Nautical Almanac Office, Royal Greenwich Observatory, Herstmonceux Castle, Hailsham, Sussex BN27 1RP, England), and perhaps also USNO's explanation of their total occultation predictions. Some comments about specific statements in the chapter are given below in the order in which they appear there.

For short-wave radios, Sherrod stresses the importance of having tunable bandwidths to cover all frequencies. But this has a disadvantage, since it takes time, which you might not have when behind schedule going to a graze, for example, to tune in WWV or another time station. The design of some of the fixed-frequency time-signal receivers (such as the Timekube available from Radio Shack) was improved a few years ago. I have rarely had trouble with them, and their ease of use and good-quality reception make them very practical for field use. A problem with them is dead batteries from accidentally being turned on while enroute; this can be solved by leaving the battery out, and putting it in 5 to 10 minutes before the observation (and remembering to remove it again afterwards).

If you write to the address for USNO given on p. 123, your request probably will reach the right people after a little delay. But it would be bett to write to the Nautical Almanac Office than to th non-existent "Occultation Timing Division." The less-detailed occultation predictions are no longer available from *Sky and Telescope* and are no longer free; see my "Occultation Highlights" article in January issue of *Sky and Telescope* for information about obtaining less-detailed predictions (now from either the RASC in Canada or from Walter Morgan).

In the description of the USNO predictions, the discussion about the second option in the heading is incorrect; a zero value is normal and does not indicate inactivity. This applies to the 4th code, which if it is zero, means that no predictions will be computed or mailed. The 4th code is set to zero if an observer fails to complete and return the coupon sent out with each year's predictions.

The value in the AC (accuracy of predicted time) column is not affected by the "conditions of observability." "Smithsonian Star Catalog" numbers are never given in the USNO REF NO column. The value code (V) is not just inversely proportional to the observability, but is increased at times when fewer timings are made, such as reappearances duri the waning phases and events when the moon is a thin crescent and above the horizon in a dark sky for only a short time. Occultations of faint stars on the sunlit limb are not given high value codes, an are not included in the predictions because they c not be accurately timed. The calculations for the Observability and Value codes are done independently of each other.

Under MAX MAG, for variable stars, it is the mag. at maximum light, actually the lowest, not highest, predicted magnitude of the star. Under SN AL, when the value is -12°, it is nautical twilight, not astronomical twilight, which occurs at -18°. But the sky is dark enough at nautical twilight that there is almost never any significant effect on occultation observability. In the VA description, "eastward" should be replaced with "counter-clockwise." The description of contact angle is not precise; it is measured from the direction of the moon's apparent motion. Under DM REF NO, the Cordoba Durchmusterung is used rather than the B.D. for stars south of -22°; it is sometimes used for other catalogs, especially for extended-coverage predictions; see p. 223.

In the section on accurate timing, WWV is not the only possible source for time signals; they are also available, for example, on CHU and JJY. Achieving an accuracy of 0.03 second is overly optimistic for a visual observer.

In the stopwatch method, Sherrod recommends stopping the stopwatch at the WWV minute tone. But before this is done, you should listen to the seconds beats and note the tenths-of-a-second while the stopwatch hand is still moving, as described by Gordon Taylor in his Technical Note. Use this determination of the tenths with the whole number of seconds read from the watch after stopping it at the minute tone. In this way, you don't have to worry about your reaction to the minute tone, which can vary considerably due to unconscious anticipation. For awhile, when I first began timing occultations, I assumed that this was not important so that the reaction to the time signal and to the occultation would cancel each other. But the audial and visual reactions are different; due to the rhythm of the former, there is an unconscious tendancy to anticipate. This was driven home to me during one occultation where I stopped the watch just before the minute tone, while I had every intention of reacting to it. By examining the moving stopwatch hand to determine the tenths of a second soon after the event, the uncertainty of a reaction to the time signal is eliminated. Note that this can't be done with electronic stopwatches, so that mechanical ones with sweep second hands are preferred. Then you only have to determine your personal equation, or reaction time to the occultation, discussed below.

In the discussion about tape recorders, a manually operated device ("cricket," buzzer, or tone generator) is usually more accurate than voice, although the latter can be sufficiently accurate, especially for grazes, where the timing accuracy required is not as stringent. When reducing a time from a tape, I first simply count the seconds beats to obtain the time to the nearest second, perhaps making an estimate to a half or third of a second as well. Then I play the tape again (usually, a few times), starting a stopwatch in rhythm with the seconds beats about 10 seconds before the event, check to be sure the beats occur when the second hand passes the integer second marks on the watch face, then note the tenths of a second when the audible signal for the event occurs, while the hand is still moving, somewhat analogous to determining the stopwatch tenths of a second described above. It is also possible to estimate the tenths analogous to the eye-and-ear method, only in this case, it might be an ear-and-ear method, without using a stopwatch at all. When doing this, I find it helps to move a finger up and down in time with the seconds beats, so that it is always at the bottom of its swing at the seconds beats. Then I imagine (or sometimes even draw) a scale from one to five, and move the finger uniformly so that it is at the top of its swing half a second after each second beat. Usually, it is better to use a stopwatch, but I find the latter method to be useful if the stopwatch and tape playback rate don't match, often the case when the tape recording was made during cold weather or with the batteries a little low.

No matter how much practice you have, your personal equation, or reaction time to an occultation, can never be as small as 0.1 second. Under "laboratory" conditions, reactions a little over 0.2 second have been achieved, but telescopic viewing is not an ideal "laboratory" situation. In hundreds of comparisons with photoelectric timings made simultaneously with visual timings with telescopes in the same observatory domes in Japan, a personal equation of less than 0.30 second was never achieved. 0.3 second can be used if the star was easy to see and you think your reaction was as fast as possible; larger values should be estimated and used otherwise. None of the methods for testing personal equation described by Sherrod will work very well, if at all. Through practice and experience in timing events and listening to time signals, one can soon develop a sense of time to estimate occultation reaction times. The best way to test reaction times, short of comparison with a photoelectric timing, is to use a device with an electronic timer and artificial star, like the ones a few astronomical societies have built. But you can test your reaction time using a stopwatch of either the mechanical or electronic type. For a mechanical watch, cover the face with opaque tape, leaving a small rectangular window near the edge. Start the watch and stop it as soon as you see the hand appear in the window. Your reaction is the distance the hand has moved from the edge of the window. With an electronic stopwatch, start it running and cover the display except for the tens of seconds. As soon as the 0 turns to 1 (that is, ten seconds), press the stop button. Subtract ten from the elapsed time for your reaction time.

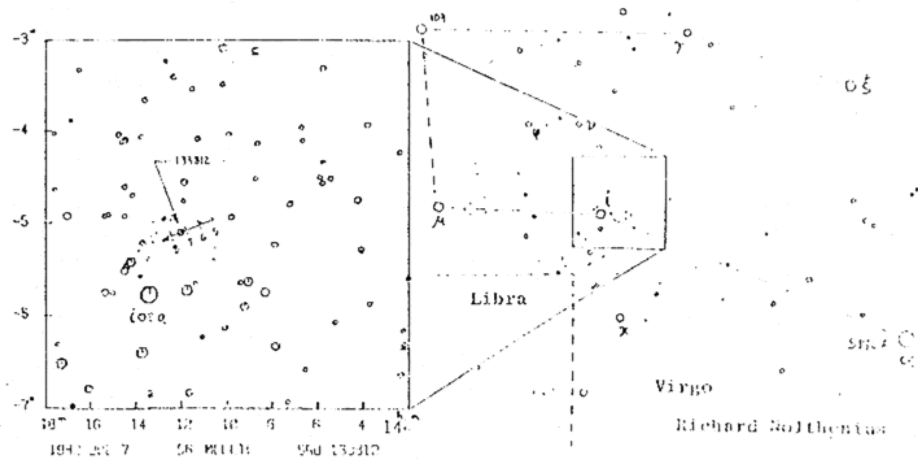
Sherrod's sentence spanning pages 131 and 132 is wrong; the reported time of an event should be the uncorrected (or "raw") time reading (for example, hour and minute announced by WWV, minus the stopwatch time determined by the methods described above) less your personal equation (reaction time). The estimated accuracy should not also be subtracted! In Sherrod's description, he is confusing accuracy with reaction time. If you think you timed an event 0.2 sec too early, as he says, that should be included in the reaction time estimate. Sherrod states correctly at one point, "Do not subtract your accuracy estimate, which serves only as an indicator of how much your reported time could deviate." Essentially, the timing accuracy is the uncertainty of the estimate of your reaction time. As a rule of thumb, I usually assign an accuracy which is half the estimated reaction time. Another consideration is the certainty of the event which was timed. The star may be near the threshold of visibility, so that the event you timed may have been an atmospheric seeing variation rather than an occultation by the moon. You may have timed it well, with small personal equation and accuracy, but there may be some doubt about its reality, which you can indicate with the certainty code on the report form. Of course, if you have considerable doubt about an event, it shouldn't be reported.

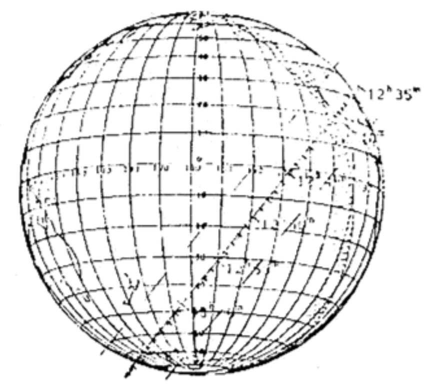
In the section on grazes, it is very important to determinate accurate geographic coordinates of sites where successful observations were made. Standard

0.1-mile (or 0.1-km) automobile odometers are not accurate enough for measuring distances to stations along a road. Observers should be located close enough to landmarks shown on the map, within a few hundred feet, so that the distance can be measured from the landmark along the road, and perpendicular to it, with a tape measure or by pacing, to an accuracy of 5 meters or better. Observers can be located far from landmarks if a bicycle wheel with revolution counter is used, or an automobile with a precision odometer with units of 0.01 mile or km (so interpolation to thousandths is possible) is used. Sometimes, road markers or telephone poles spaced at equal intervals along the road can be used.

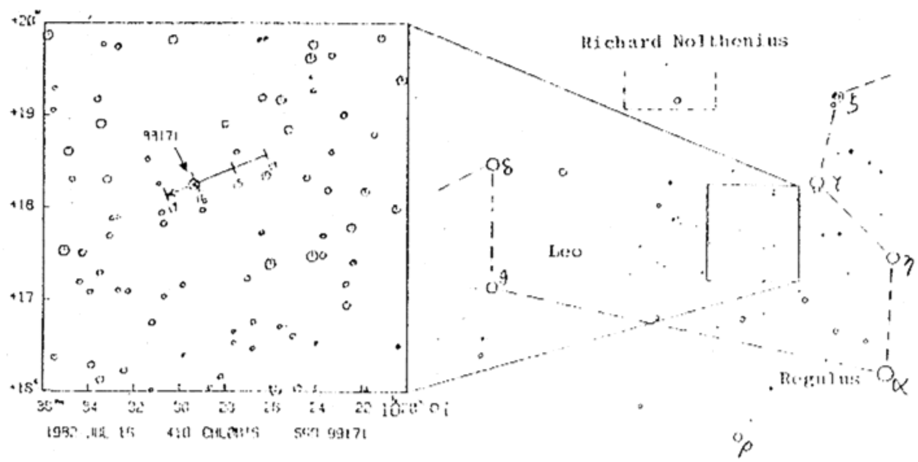
PLANETARY OCCULTATION PREDICTIONS FOR 1982

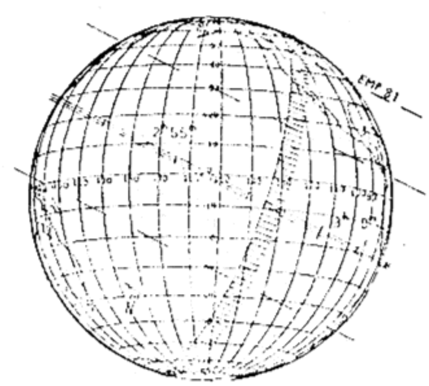
This is a continuation of the earlier articles bearing on this subject (see *O.N.* 2 (13) 178, *O.N.* 2 (14) 191, and *O.N.* 2 (15) 198 and 204). The remainder of this issue is devoted to world maps, regional maps, and finder charts for use in connection with those events previously listed.



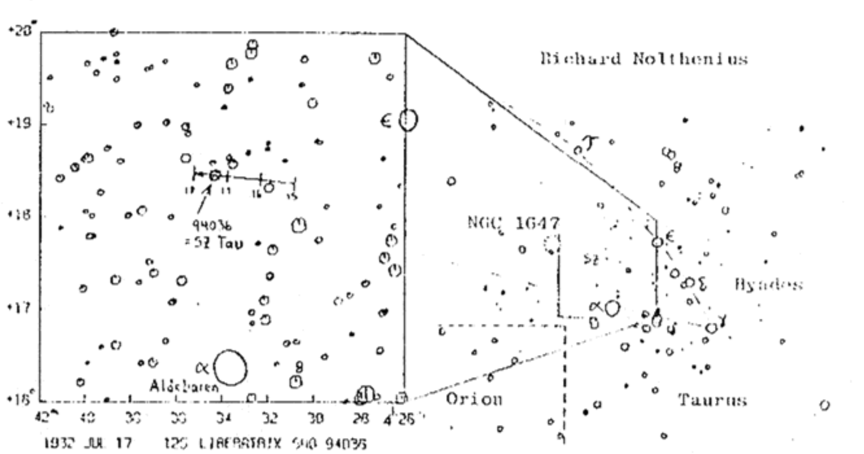


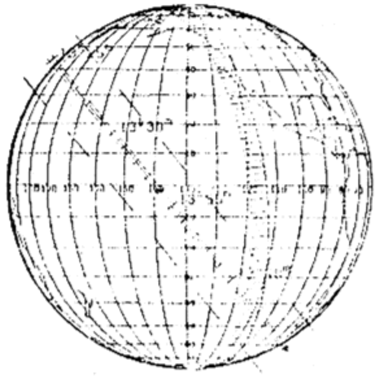
SAO 146853 by Lilaea 1982 Aug 10





SAO 139729 by Chicago 1982 Aug 11

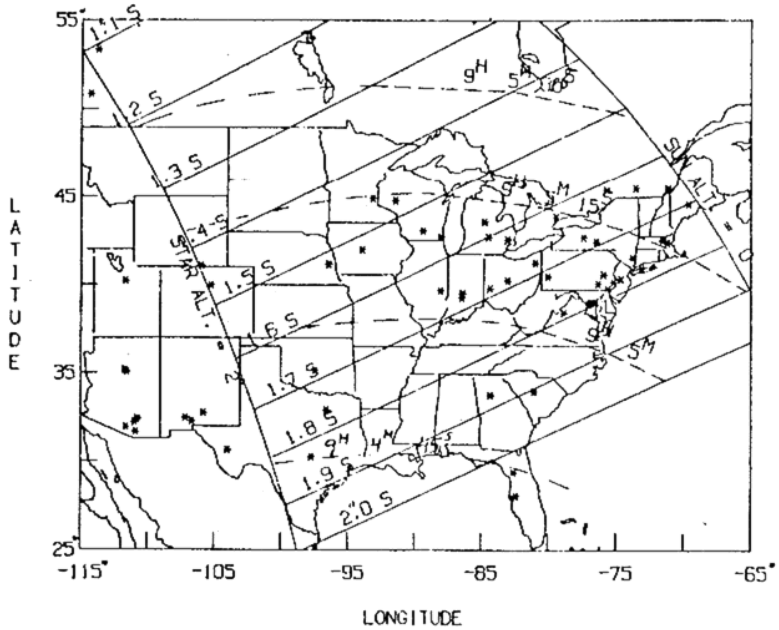




-00° 526 by Prokne 1982 Sep 5

1982 7 17 (125) LIBERATRIX SAO 94036

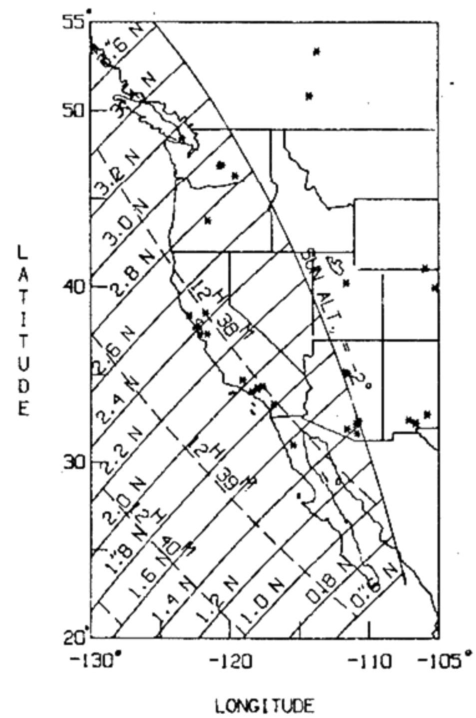
DIAMETER 66 KM = 0."03



EPHEMERIS SOURCE = HERGET

1982 8 10 (213) LILAEA SAO 146853

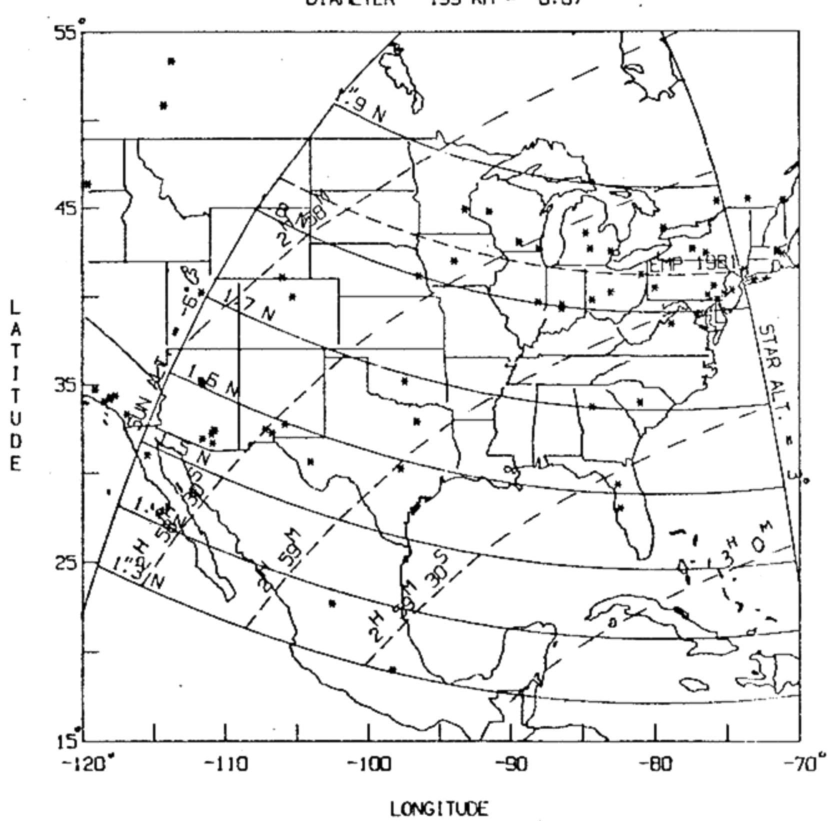
DIAMETER 105 KM = 0."09



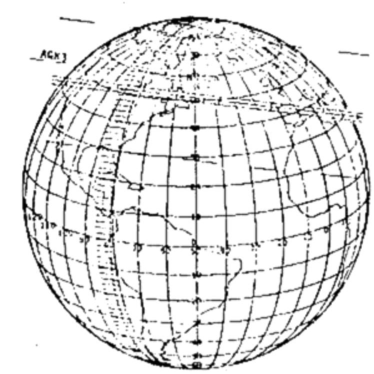
EPHEMERIS SOURCE = EMP 1981

1982 8 11 (334) CHICAGO SAO 139729

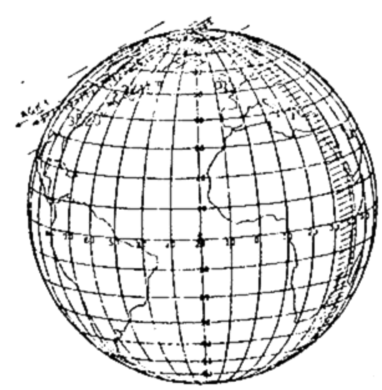
DIAMETER 199 KM = 0."07



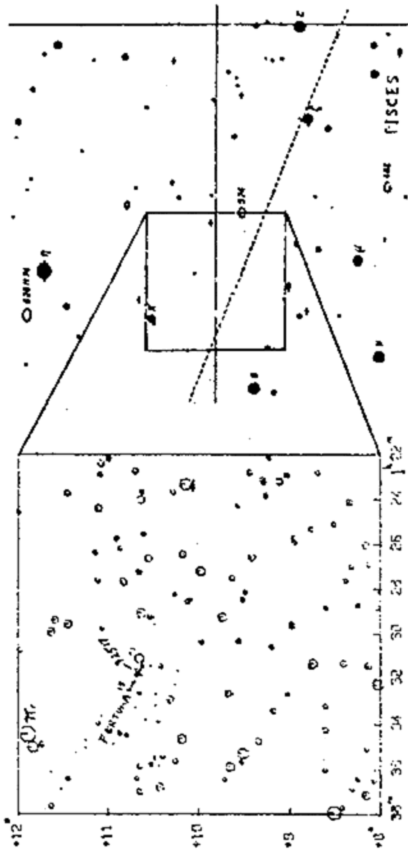
EPHEMERIS SOURCE = HERGET

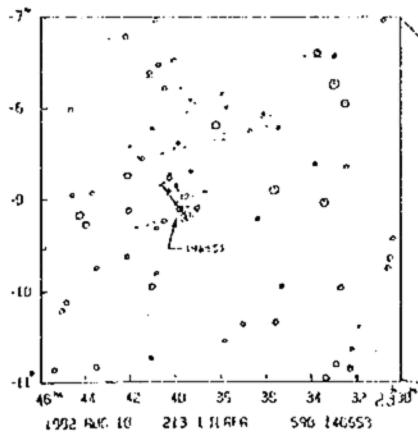


SAO 96932 by Europa 1982 Sep 15

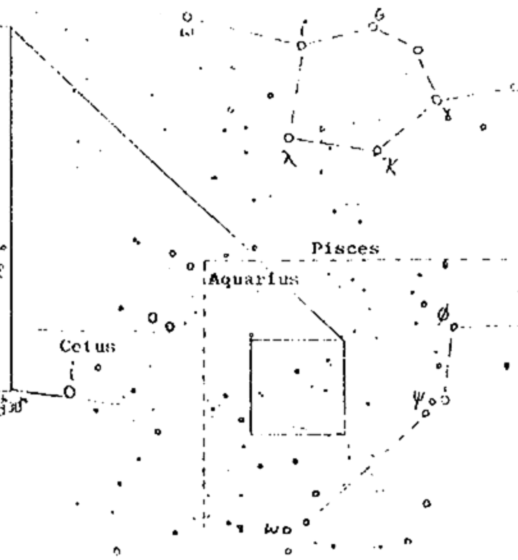


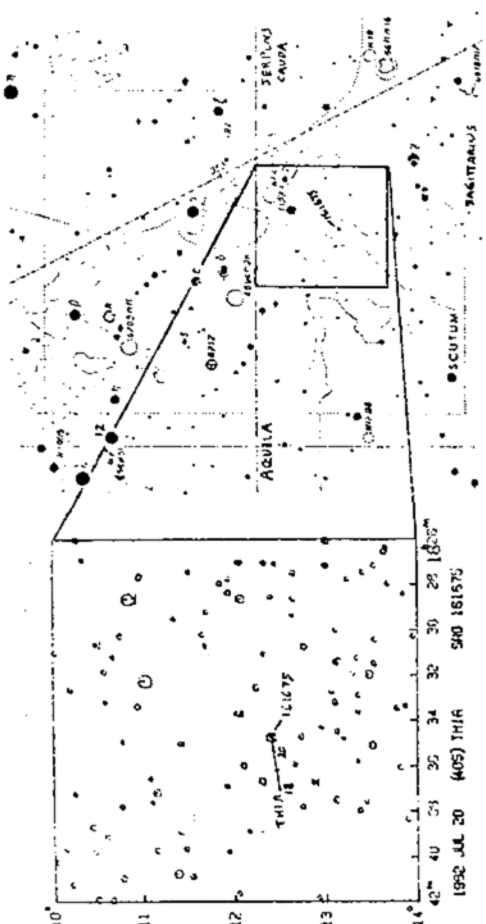
SAO 92517 by Fortuna 1982 Sep 17





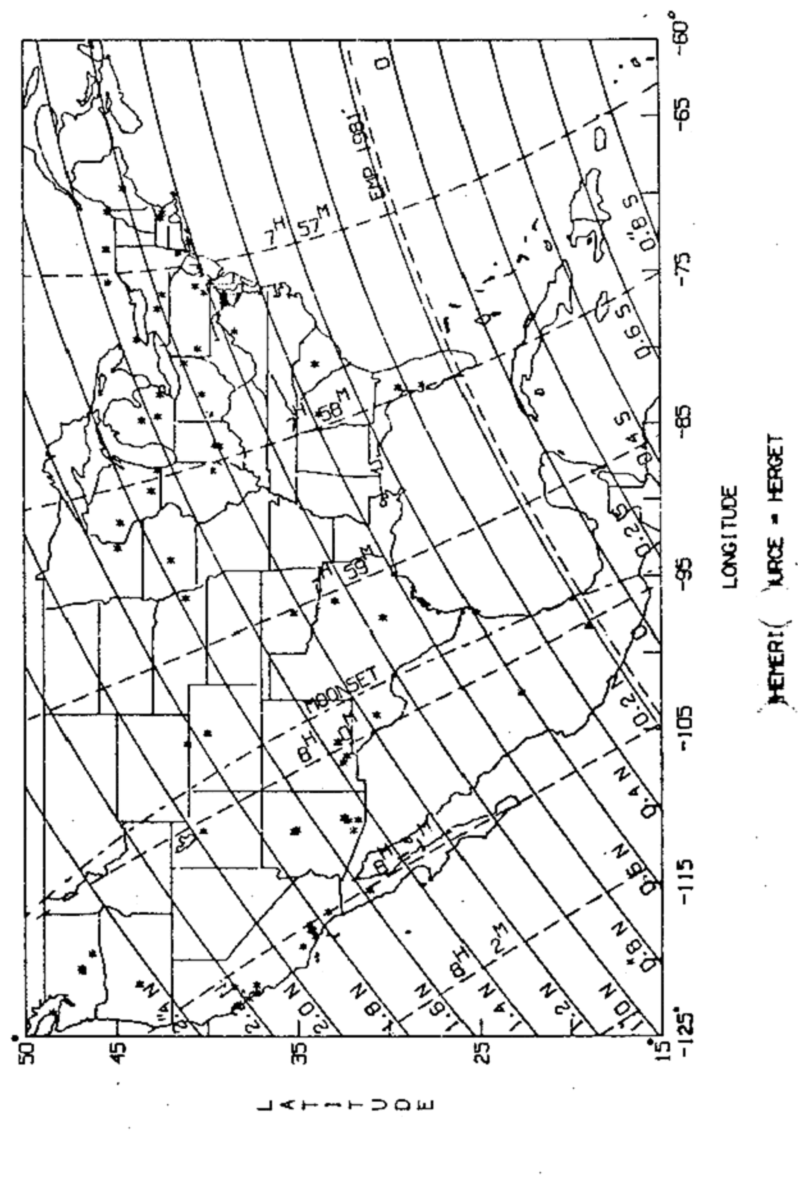
Richard Nolthenius

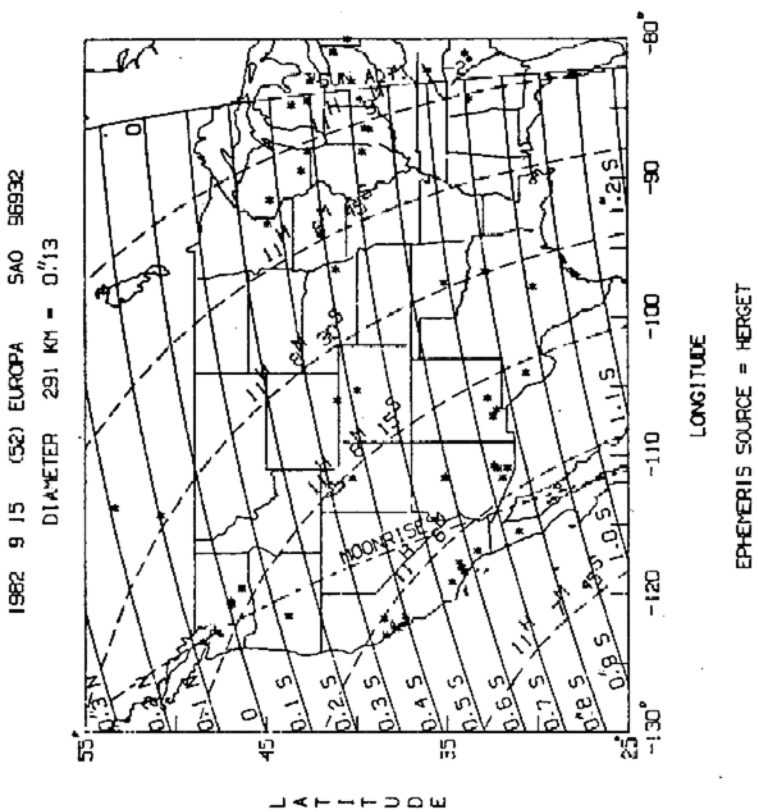


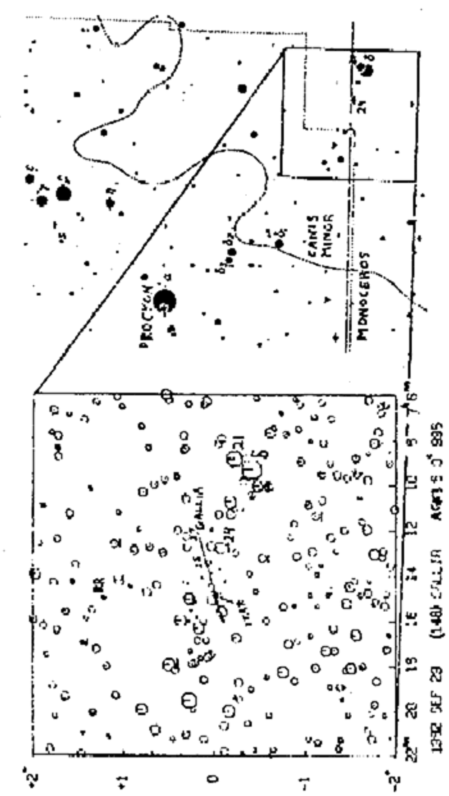


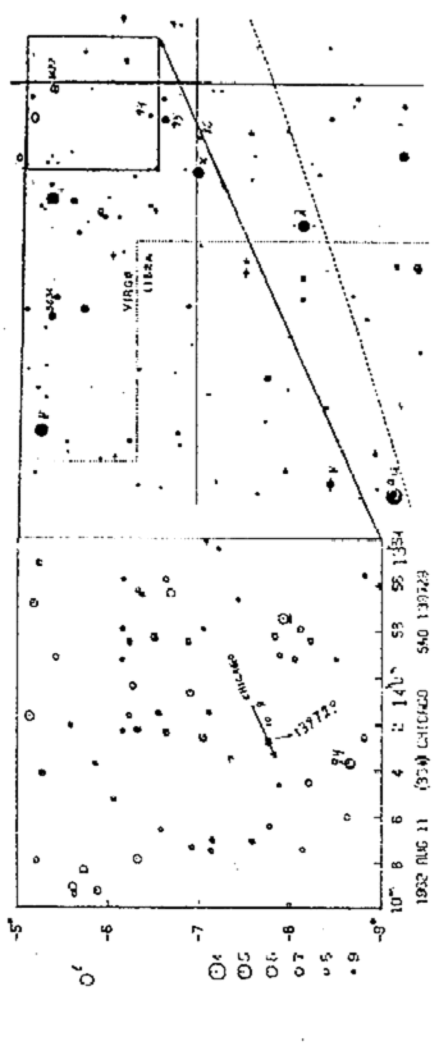
1982 8 29 (57) MNEMOSYNE SAO 127592

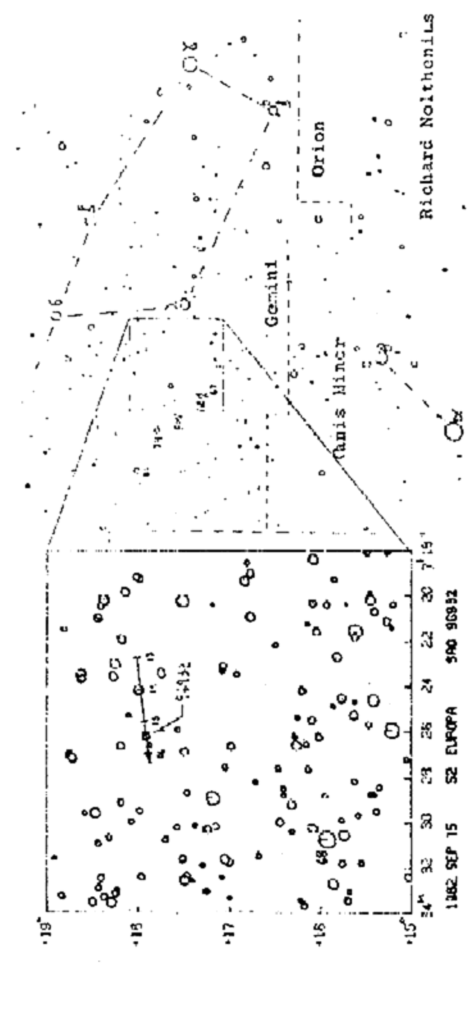
DIAMETER 115 KM = 0".08





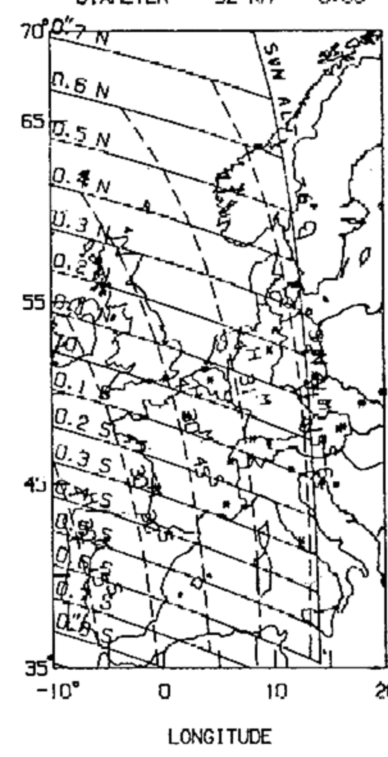






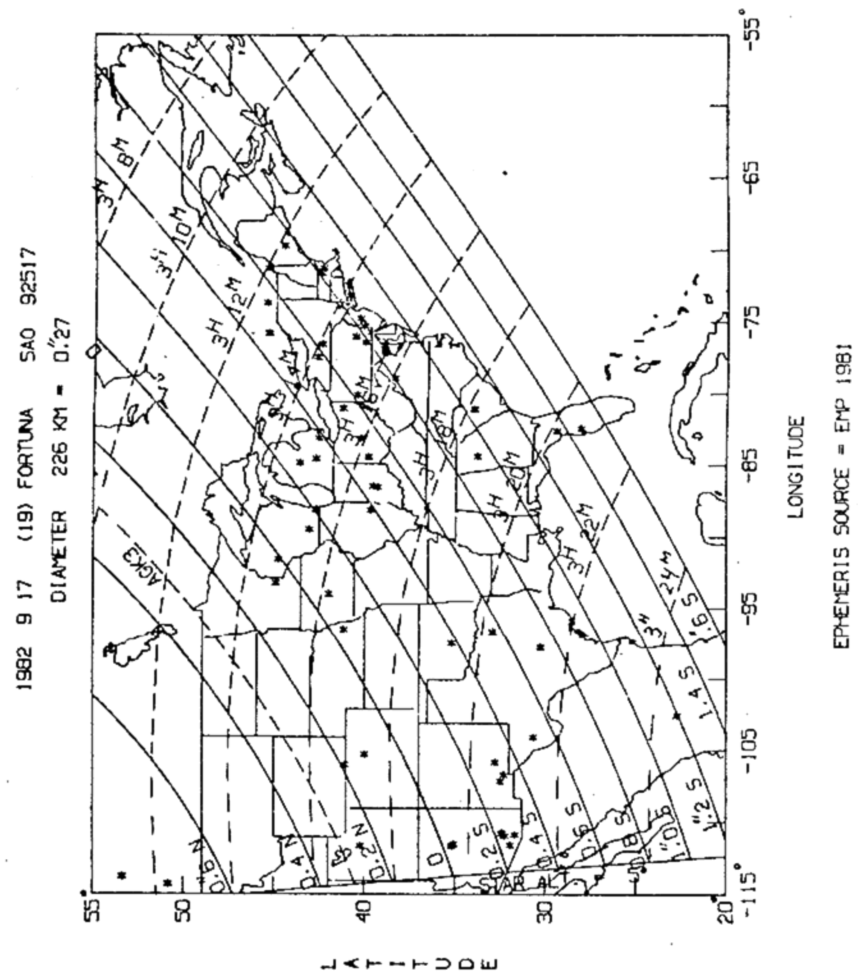
1982 9 29 (148) GALLIA AGK3 50°996

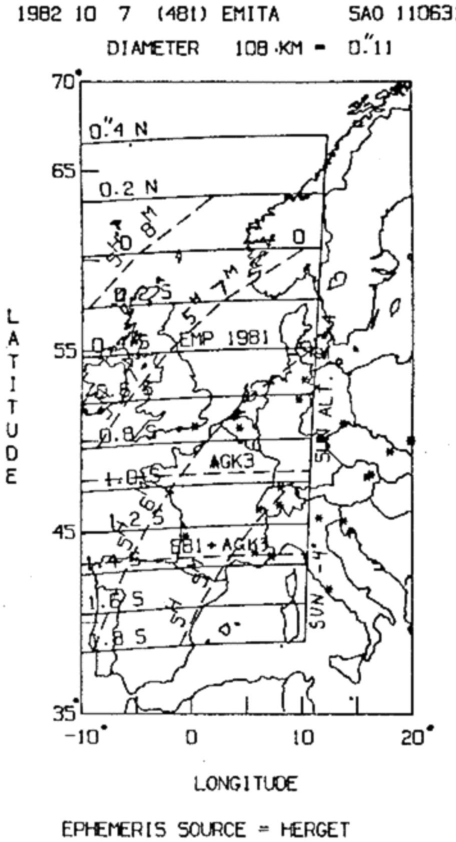
DIAMETER 92 KM - 0."05

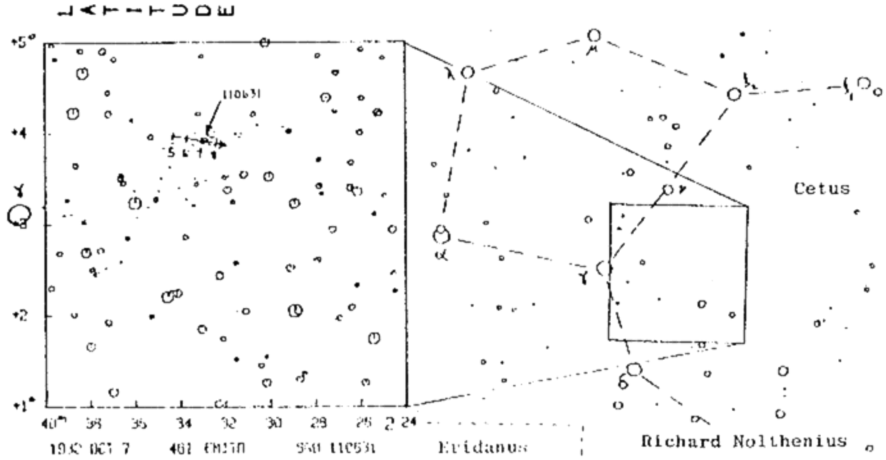


LONGITUDE

EPHEMERIS SOURCE = EMP 1981







Received June 22:

ADDITIONAL NOTES FOR THE JULY 6 LUNAR ECLIPSE

David W. Dunham

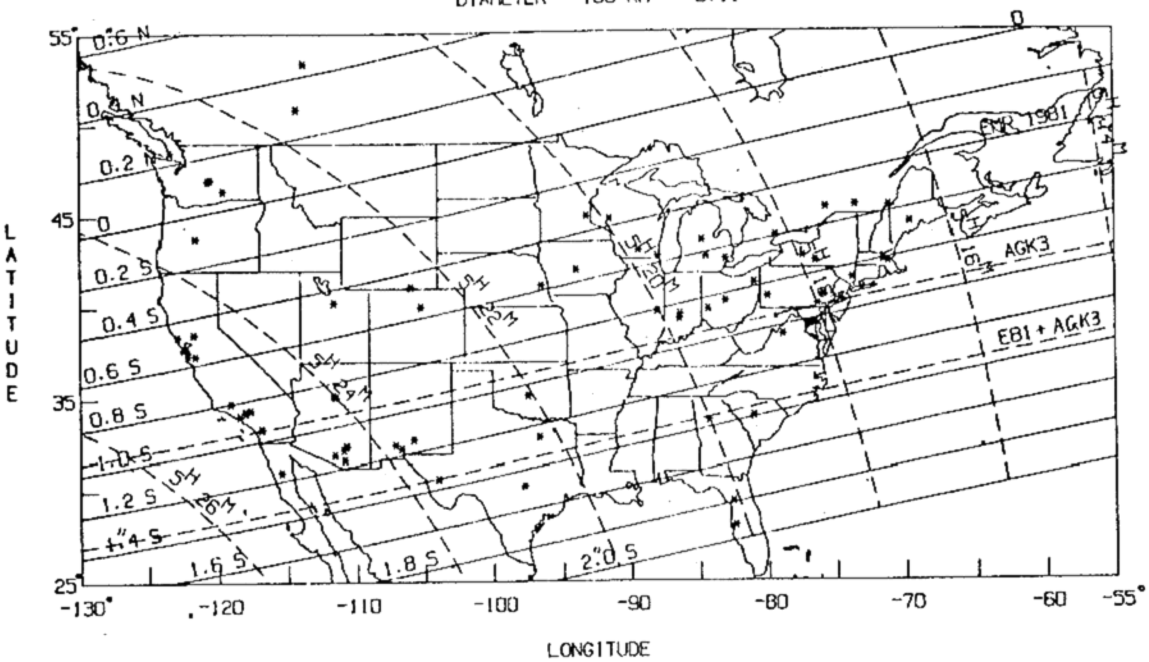
The apparent angular radius of the moon during the eclipse is 14'.74 if the moon is on the horizon and 14'.96 if it is in the zenith. The angular radius, r, is given by the formula r = 14'.74 + 0'.22 sin (moon alt.).

The southern limit of AR Sagittarii's occultation passes south of San Antonio and Houston, TX; northwest of New Orleans, LA; and south of Columbia, SC.

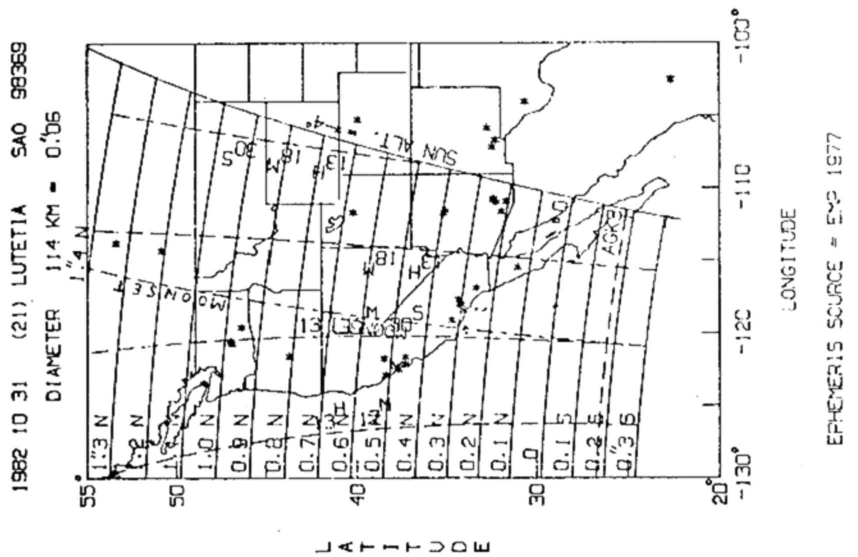
C14658 and C14660, both 12th magnitude, are probably the same star measured from separate A.C. plates. On July 6th, the southern limit of their (or rather, its) occultation crosses California north of Los Angeles.

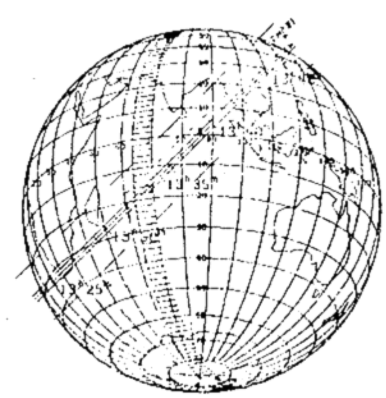
1982 10 7 (481) EMITA SAO 110631

DIAMETER 108 KM = 0."11

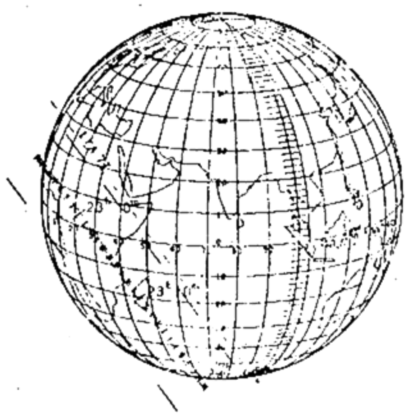


EPHEMERIS SOURCE = HERGET

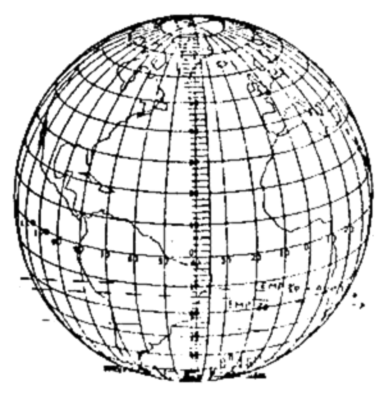




SAO 188202 by Bamberga 1982 Sep 21



+15° 564 by Io 1982 Sep 21

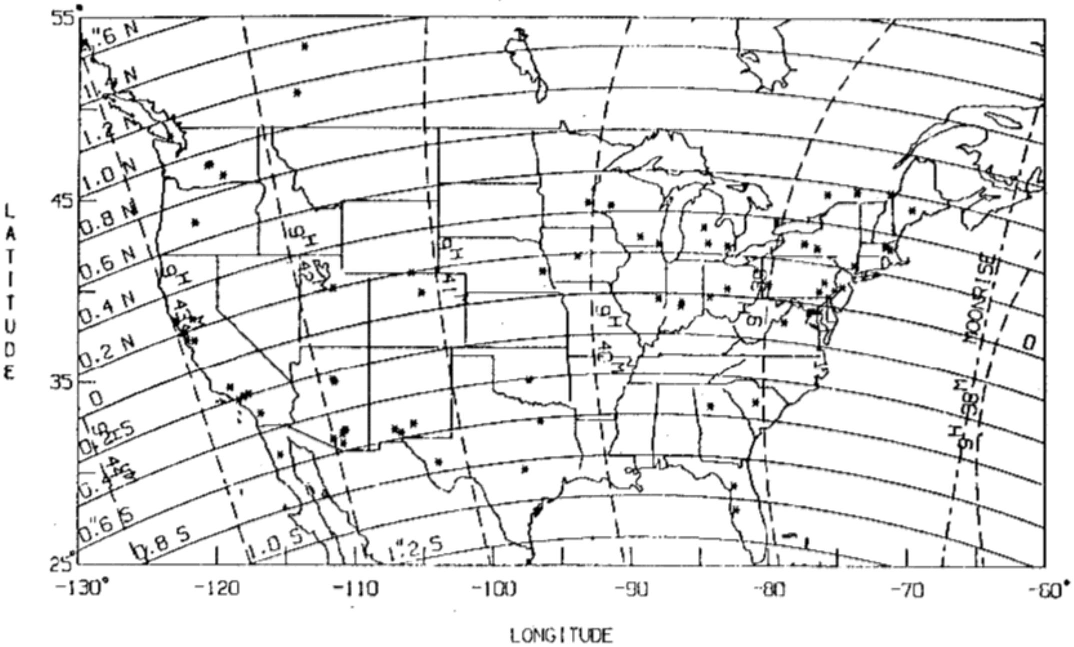


SAO 94833 by Parthenope '82 Sep 24

SAO 114680 by Comacina 1982 Sep 28

1982 11 14 (690) WRATISLAVIA BD +24° 522

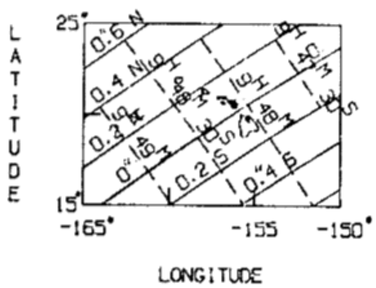
DIAMETER 175 KM = 0."14



EPHEMERIS SOURCE = EMP 1981

1982 11 14 (690) WRATISLAVIA BD +24° 522

DIAMETER 175 KM = 0."14

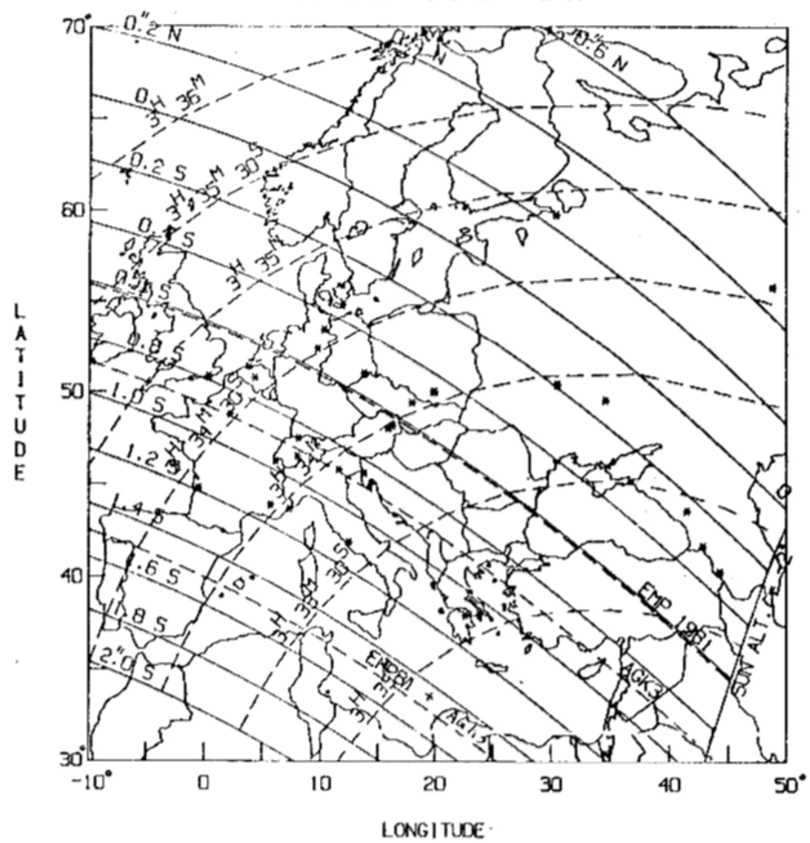


EPHEMERIS SOURCE = EMP 1981

S 0 996 by Gallia 1982 Sep 29

1982 11 22 (93) MINERVA SAO 76017A

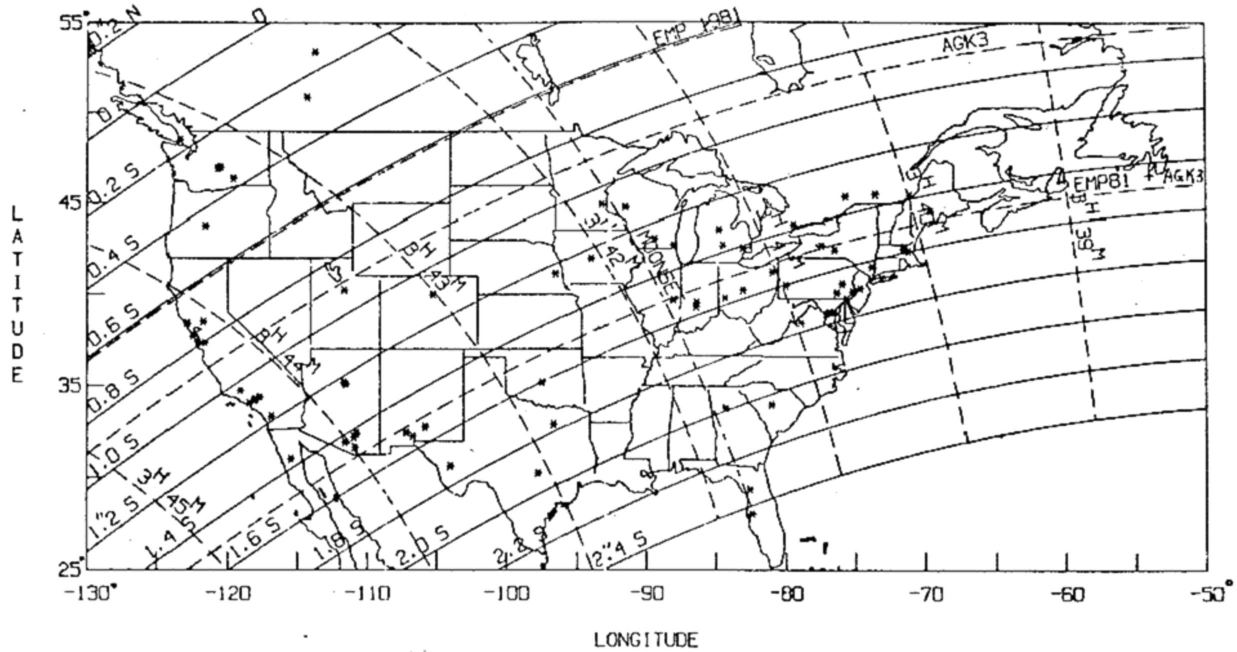
DIAMETER 170 KM = 0."11



EPHEMERIS SOURCE = HERGET

1982 11 22 (93) MINERVA SAO 76017A

DIAMETER 170 KM = 0."11



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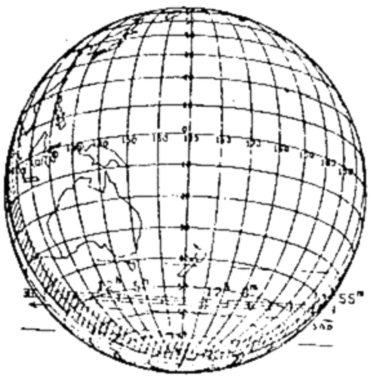
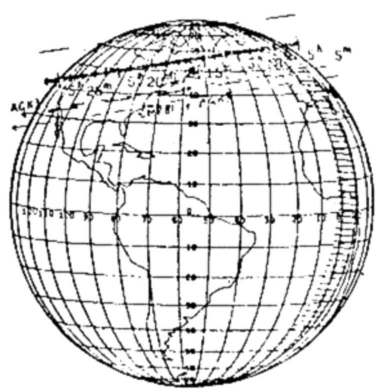
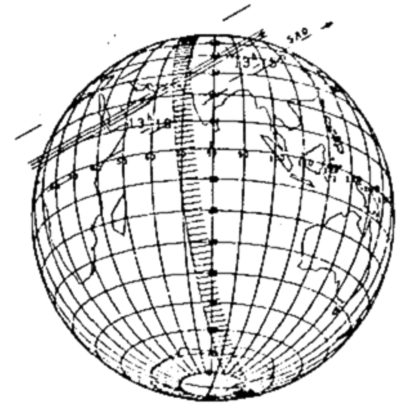


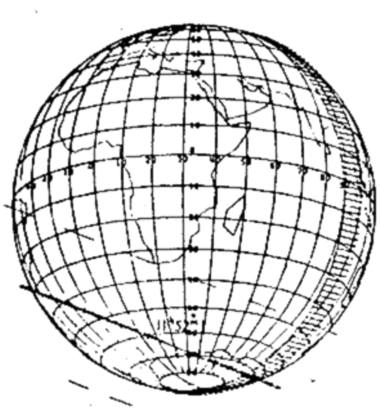
SAO 147137 by Egeria 1982 Oct 4



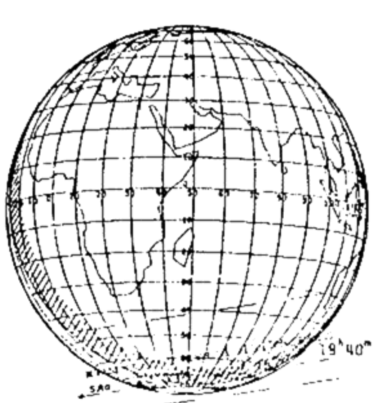
SAO 110631 by Emita 1982 Oct 7



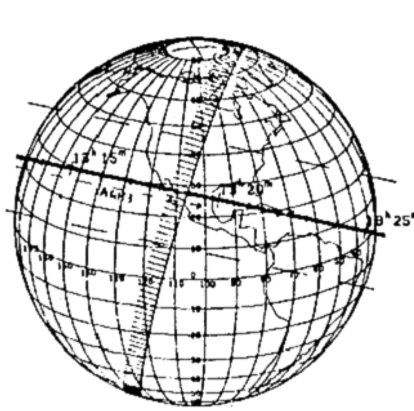
SAO 188537 by Bamberga 1982 Oct 8



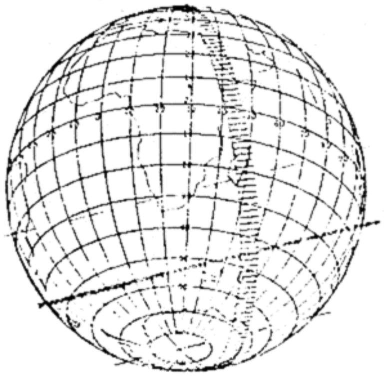
SAO 159277 by Bruchsalia 82 Oct 11



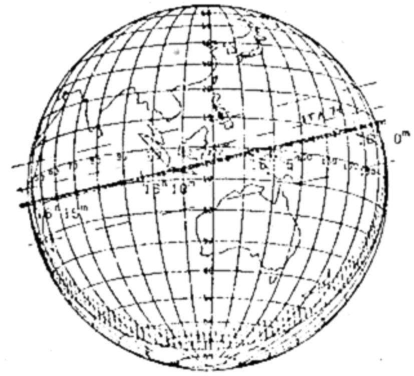
SAO 129289 by Undina 1982 Oct 27



SAO 98369 by Lutetia 1982 Oct 31



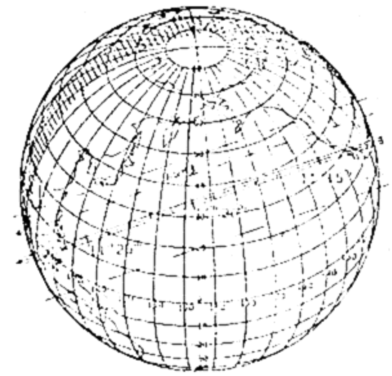
SAO 188343 by Laurentia '82 Oct 31



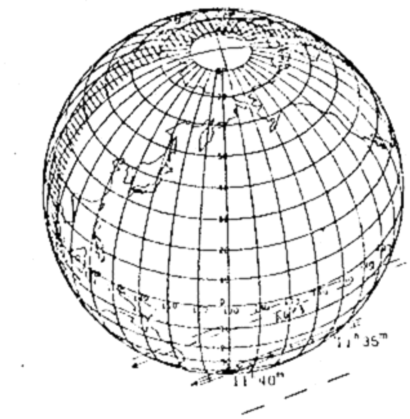
SAO 148612 by Aquitania 1982 Nov 2

+24° 522 by Wratislavia '82 Nov 14

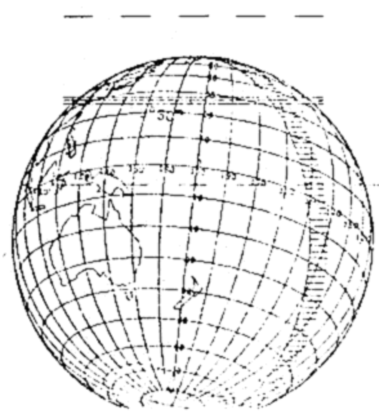
SAO 98482 by Lutetia 1982 Nov 15



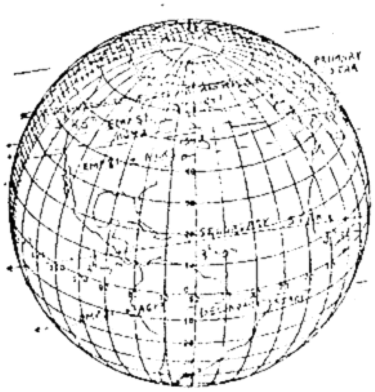
SAO 55791 by Ursula 1982 Nov 15



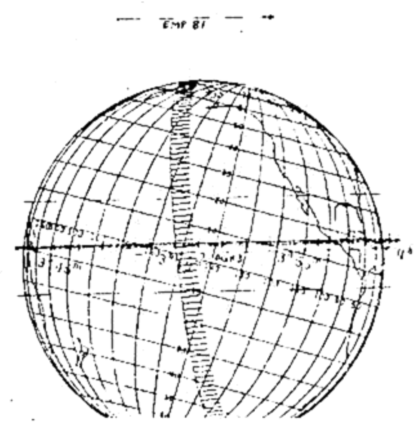
SAO 55766 by Ursula 1982 Nov 17



SAO 187719 by Themis 1982 Nov 18



SAO 76017 by Minerva 1982 Nov 22



SAO 146191 by Emma 1982 Nov 24

SAO 138236 by Germania 1982 Dec 1

SAO 139019 by Hygiea 1982 Dec 6

SAO 93544 by Irene 1982 Dec 13