Occultation Newsletter

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FROM THE PUBLISHER

This is the second issue of 1985. It marks the completion of eleven years of publication of *O.N.*

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

If you wish, you may use your VISA or MasterCard for payments to IOTA; include the account number, the expiration date, and your signature. Card users must pay the full prices, which are shown below, FOLLOWED BY THE DISCOUNT PRICES IN BRACKETS FOR THE USE OF THOSE PAYING BY CASH, CHECK, OR MONEY ORDER. These are corrected prices, which supersede those shown in *O.N. 3* (9), 190.

O.N.'s price is $1.46[1.40]/issue, or $5.73[5.50]/year (4 issues) including first class surface mailing. Back issues through *Vol. 2*, No. 13 still are priced at only $1.04[1.00]/issue; later issues at $1.46[1.40]. Air mail shipment of *O.N.* back issues and subscriptions, if desired, is 47¢[45¢]/issue ($1.88[1.80]/year) extra, outside the U.S.A., Canada, and Mexico. IOTA membership, subscription included, is $11.46[11.00]/year for residents of North America (including Mexico) and $16.67[16.00] for others, to cover costs of overseas air mail. For IOTA members, the following items are available without extra charge; non-members pay $1.04[1.00] for local circumstance (asteroidal occultation) predictions, and $1.56[1.50] per graze limit prediction.

Observers from Europe and the British Isles should join IOTA/ES, sending DM 50.-- to Hans-J. Bode, Bartold-Knaust Str. 8, 3000 Hannover 91, German Federal Republic.

IOTA NEWS

David W. Dunham

The European Section of IOTA has incorporated in the German Federal Republic, and has applied for tax-exempt status there, as the parent IOTA has done in the U.S.A. IOTA/ES will hold a meeting, the fourth European Symposium on Occultation Projects, in Belgium on August 24-25; see p. 244. The parent IOTA will hold its annual meeting in Houston, TX, in November or Early December. Details will be announced in the next issue, which probably will be distributed in October.

Tony Murray, Georgetown, GA, has provided IOTA letterhead and envelopes, as was announced in the last issue. I have not had time to prepare a design for a membership card. If you would be interested in preparing such a design, send it to me at P.O. Box 7488, Silver Spring, MD 20907 for consideration. That would expedite this project; Murray is ready to generate them when we settle on a design.

Pressure of generating the material about the occultations by comets during the rest of the year, in particular, the numerous events involving Comet Giacobini-Zinner in September, as well as pressure of my work needed in preparation for the spacecraft encounter with that comet, has forced delay or postponement of other projects. For the comet occultations, I used existing stellar databases and prediction programs, not having time to generate the merged star catalog mentioned in the last issue. It may or may not be prepared in time for early 1986 predictions. Also delayed has been work on IOTA's occultation manual, although some progress has been accomplished on this since last time. In April, a somewhat rough draft of a very preliminary version was sent to Mark Allman, who is now distributing it to new observers, since it is better than the old set of papers. IOTA members who have not received any of the descriptive papers should write to Allman at the parent IOTA address given in the masthead, asking for the preliminary version. However, since then I have made several corrections and additions amounting to a substantial fraction of the material, including a discussion on determining shifts from graze observations (see p. 247), among other useful things. These will be incorporated into the disk file so that a better preliminary version of the manual can be generated and (we hope) distributed with the next *O.N.* Progress is being made, so you are encouraged to wait rather than to write to Allman and deplete the supply of the unpolished April version.

On October 31st, the U. S. Naval Observatory will no longer support the MVT operating system on their IBM 4341 computer, but will convert all operations to CMS. Since all of my programs are now on MVT, I will be busy during the next months converting the important ones, those needed for the basic 1986 predictions, to CMS. In addition, the CMS version of the OCC program needed to generate profile data does not work, and will need some help from Tom Van Flandern to debug it. I want to try to generate as many of the 1986 graze predictions as possible before October 31, since we have been using the MVT 78A version of OCC for all our graze profiles. Comparisons with observations show it to be more accurate than the 80F or 80G versions, perhaps due to the poor Perth 70 positions for northern bright stars included in their datasets. Unfortunately, the 78A version exists only in load module form under MVT, and can not be run on CMS. The problem is urgent, and its solution is uncertain.

E.S.O.P. IV

The Flemish Astronomical Society has announced that the 4th European Symposium on Occultation Predictions will be held on August 24 and 25 in *Urania*, Public Observatory of Antwerp (Mattheessenstraat 62, B-2540 Hove, Belgium). The symposium is open to everyone. Talks on all aspects of occultations are welcome. The official congress language is English. IOTA/ES and the organizing committee hope that many astronomers, both professionals and amateurs, from all over Europe, will make use of this opportunity to exchange experiences. More specifically, it is hoped that one representative of each country will give a short presentation of the activities in his country. [Ed: This article will be issued too late to comply with registration (May 15th and June 30th) and payment (June 30th) deadlines. Total costs range from BF 2500 to BF 5000, depending on lodging and tour requirements. Further information could be obtained from Jozef Van Camp; Ferdinand Maesstraat 23; B-2571 Waarloos; Belgium (Tel.: 32-15 31 55 77) or Edwin Goffin; Aartselaarstraat 14; B-2710 Hoboken; Belgium.]

Preliminary programme:

Saturday, August 24th
- 8.30 h Symposium opens at the Observatory
- 9.00 h Sessions
- 12.30 h Lunch (<<Kempense tafel>>)
- 13.30 h Guided visit to the Public Observatory
- 14.00 h Sessions
- 18.00 h Bus trip to city of Lier, visit to the <<Zimmertoren>> (world-famous astronomical clock) and the Beguinage
- 20.00 h Dinner in Lier

Sunday, August 25th
- 9.00 h Sessions
- 13.00 h Lunch
- 15.00 h End of symposium

Monday, August 26th
- Optional visit to the Royal Uccle Observatory and to Brussels.

ABOUT ASTBBS

Joan Bixby Dunham

The Astronomy Bulletin Board System (ASTBBS) is a modification of the ABBS sold by the Washington Apple Pie. This bulletin board is intended for amateur and professional astronomers. The emphasis is on providing announcements of astronomical events, observations planned, and the results of observations. Message service is provided, but that is secondary to the announcements. Members of the ASTBBS may use the message service; members with privileges may upload files. Non-members may read messages, bulletins, and announcements, may download files, and leave the SYSOPs a message.

Information is provided on grazing occultation expeditions in the Mid-Atlantic states and from the Washington, DC, area; occultations by asteroids, Comet Halley, Comet Giacobini-Zinner; and meetings of the controlling organizations plus any public events on astronomy. Bulletins will be provided on novas, new comets, satellite barium cloud releases, etc.

The ASTBBS is provided for the National Capital Astronomers (NCA) and IOTA. Membership in both of these organizations is open to anyone, amateur or professional, with an interest in astronomy or in occultation observations. Any member of NCA or IOTA with a terminal and a modem can ask for an ASTBBS membership. Membership for others may be given at the discretion of the SYSOPs.

The ASTBBS is operational whenever the computer is not in use by the SYSOPs. If the phone is busy, the modem is in use. If the phone does not answer within four rings, you can assume that the computer is in use or the system has been turned off.

The equipment used for ASTBBS is an Apple II+ with two disk drives, an internal clock, and a US Robotics Password modem. This equipment is owned by the SYSOPs, and the service is provided free of charge. This equipment has some fairly significant limitations in both size and speed. The primary one of concern to ASTBBS members is that there is not much room to accept uploads, so the privilege to do that will not be distributed freely.

The software for this system is written in Applesoft and in Apple machine language. This is public domain software. We are open to suggestions for improvements, and we would like to know about errors you find.

The SYSOPs are: Joan and David Dunham, PO Box 7488, Silver Spring, MD 20907. The bulletin board telephone number is 301,495-9062. The voice telephone is 585-0989. We also can provide membership information on NCA.

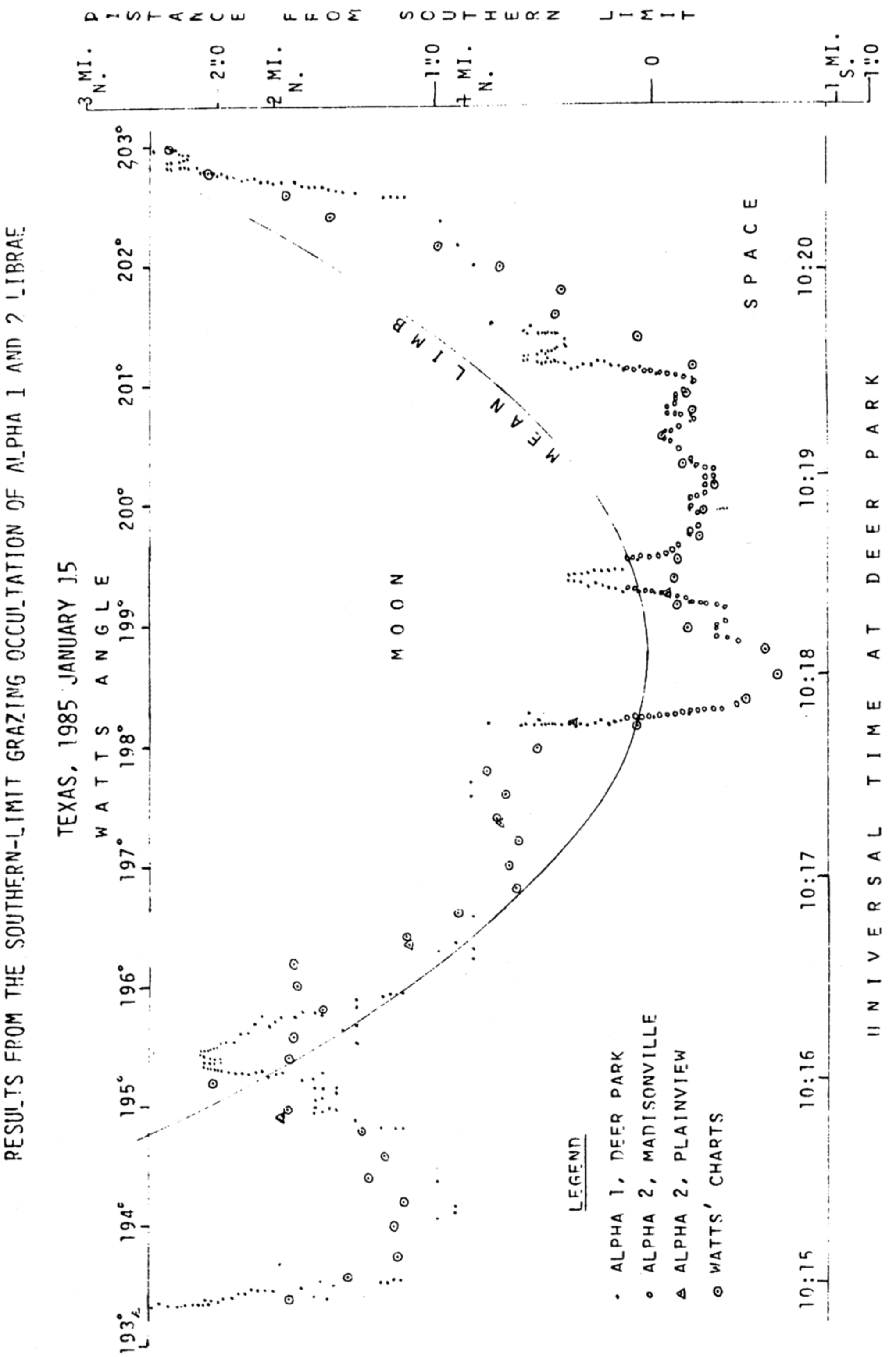
The summer hours are: Tuesday evenings, 7 PM to 11 PM, EDT, attended. Midnight to 7 AM, unattended. It will be available at sporadic and unpredictable times on weekends, when we are not using the computer.

RESULTS FROM THE SOUTHERN-LIMIT GRAZING OCCULTATION OF ALPHA 1 AND 2 LIBRAE OBSERVED IN TEXAS, 1985 JANUARY 15

David W. Dunham

As already noted on pages 225 and 231 of the last issue, the most successful grazing occultation to date involved the 5.3-magnitude star Alpha 1 Librae (= 8 Librae or Z.C. 2117) on Tuesday morning, 1985 January 15. Over 265 contact timings were made by 65 observers organized by Paul Maley at Deer Park, a southeastern suburb of Houston, Texas. A few minutes later, 82 timings of the graze of 2.9-magnitude Alpha 2 Librae (= 9 Librae or Z.C. 2118 or Zubenelgenubi) were made by 14 observers organized by Don Stockbauer at Madisonville, about 75 miles north of Houston. In addition, Rogers Orr and Jim Stevens, from Lubbock, Texas, timed six events during the graze of Alpha 2 at Plainview. I have made a first analysis of these observations to prepare the plot included as Figure 1, showing the most detailed lunar profile ever recorded, covering a span of 10° of position angle (actually, of Watts angle, which is position angle measured relative to the moon's axis of rotation and offset by 0°.2). The total horizontal range shown is 200 miles, while the vertical range is less than 4 miles. Hence, the vertical scale is exaggerated by about 30 times the horizontal scale.

Fig. 1.



The plot used as its basis one by Paul Maley showing the Deer Park observations. For each observer, the path of the star behind the moon is a straight line. The paths are horizontal for the observers at Deer Park, where the Watts angle of central graze was 198°.76 (or position angle 214°.10) and the librations were +3°.35 in longitude and -0°.85 in latitude. At Madisonville, the Watts angle of central graze was 198°.71. Due to the exaggeration in the vertical direction, the paths for the Madisonville observers are inclined by over 1° to those for Deer Park. The librations at Madisonville were exactly the same as for Deer Park in longitude and -0°.82 in latitude, differing by only 0°.03 from Deer Park. Since the Watts angle of central graze was 197°.29 at Plainview, 1°.5 less than for Deer Park, a line connecting the triangles marking the Plainview timings slopes steeply from the upper left to the lower right side of the diagram. All of the observations are rather consistent, except for the first reappearance and second disappearance at Plainview. More analysis is needed to resolve this discrepancy. At Plainview, the libration in longitude was +3°.39 and that in latitude was the same as at Madisonville.

Art Ciampi's observed sequence at Madisonville was virtually identical to Gary Nealis' sequence at the southernmost station 3-1 at Deer Park. This permitted linking of all of the Alpha 1 and 2 Librae observations to an accuracy of 0".02 (about

100 feet) or better in the vertical direction. I then made an average fit of the combined observed contacts with Watts' data points, shifting the latter to obtain the best weighted fit in the vertical direction. Watts' points near steep or poorly observed sections were downweighted relative to points in well-observed relatively flat areas. The resulting observed vertical south shifts from the USNO version 78A prediction was 0".38 for Alpha 1 and 0".11 for Alpha 2. Hence, in direction 214°.1, Alpha 1 is 0".27 from its catalog position relative to Alpha 2. These shifts have been applied in the plot to give the best fit with the circled dots from Watts' charts of the marginal zone of the moon.

For the southern-limit graze of Alpha 2 during the May 4th total lunar eclipse, the predicted profile was very similar to that for January 15th, occurring in the same area. Hence, there again should have been a small south shift, amounting to 0".11 within a few hundredths of an arc second. Details of the southern-limit observations obtained on May 4 have not yet been received to verify such a shift.

GRAZES OBSERVED AT BOTH LIMITS OF THE TOTAL LUNAR ECLIPSE OCCULTATION IN AFRICA

David W. Dunham

The rare occultation of 2.9-mag. Alpha 2 Librae by the totally eclipsed moon on May 4th, and IOTA's plans to observe it, were described briefly on page 232 of the last issue. IOTA members Paul Maley, Gary Nealis, Charles Herold (all also members of the Johnson Spaceflight Center Astronomical Society in Houston) and I travelled to Sudan to observe the northern-limit graze of the star. Due to the revolution less than a month before, we had difficulty in obtaining visas, but finally got them a week before departure. When we arrived in Khartoum on May 2nd, we were dismayed to learn that it rained there for the first time in two years. The early start of the rainy season moderated the daytime temperatures, which had been as high as 129° F.; the highs were about 115° while we were there.

Paul Maley made our initial contacts in Sudan. Dr. Muawia Hamid Shaddad, Physics Department, Khartoum University, made most of the local arrangements, including a minibus of students from his department who helped with the observations. John Schugart and Ted Ray, of Geosource (under contract with Chevron Oil Co.), provided a Transit navigational satellite receiver for determination of accurate geographical coordinates. Others providing important help were Shawgi Abuakar, Dept. of Astronomy and Geography, Khartoum Islamic University, and Richard Eng, Superintendent, Khartoum American School. Babikir Sirelkhatin, the governor of Gezira Province, met us the evening of May 3rd at our site a mile south of Hag Abdullah, on the west bank of the Blue Nile 120 miles southeast of Khartoum and 40 miles south of Wad Medani, where the governor provided us with free hotel rooms. Since the skies were overcast that evening, with intermittent heavy thunderstorms and blowing dust, we decided to split into two groups. Maley, Nealis, and Shaddad left to return to Khartoum, then travelled 45 miles southwest to El Geteina on the White Nile, while the rest of us would try it at Hag Abdullah.

The sky was clear most of the next day, but scattered thunderstorms formed quickly in the late afternoon. Three hours before the eclipse, it rained heavily at Hag Abdullah, but we pressed on with our preparations for the graze. There was little wind, so the clouds left over from the thunderstorm prevented viewing the initial partial phases as we set up 8 stations beside a 4000-foot stretch of paved highway south of Hag Abdullah. Fifteen minutes before the graze, the bulk of the clouds drifted away from the totally eclipsed moon. Small clouds continued to drift in front of the moon, preventing timing of some graze contacts at some of the stations. At my station 500 feet south of the predicted northern limit, small clouds briefly blotted out the moon and the star 3 minutes before and 2 minutes after central graze, but it was very clear during the critical two minutes during which the star disappeared and reappeared five times.

I videorecorded the graze with my black-and-white low level RCA Ultricon camera attached to a 5-inch Schmidt-Cassegrain telescope. My observation site was at the top of a canal levee beside the highway at longitude 33° 35' east, latitude +13° 57'; more accurate coordinates will be determined later from the satellite data and our field measurements. Photoes of some of the video frames may be published in *Sky and Telescope*, probably in their September issue. A preliminary comparison indicates that the prediction of the graze path was very accurate, thanks in part to the observations of the Alpha Librae grazes made in Texas on January 15 (see p. 244).

Unfortunately, timing of the graze at Hag Abdullah was complicated by the fact that we had only three digital watches and two Timekubes, which received Soviet time signals at 10 MHz only intermittently. I had hoped that we could tape record the honks of a car horn simultaneously at all stations, but noise from wind and traffic prevented this. Four large trucks passing through during the graze period provide the best time reference for the tape recordings made at all stations. Analysis is further complicated by difficulty in distinguishing between cloud and lunar occultation events at some stations. By the next issue of *o.N.*, I hope to have had time to sort out these problems so that a final report can be written, the observations analyzed, and the results listed. For any future efforts like this, I will bring along an extra supply of cheap digital watches as well as small tape recorders.

Four stations were set up near El Geteina, but a rapidly approaching thunderstorm forced quick teardown of equipment, and set up again after it passed. As at Hag Abdullah, the moon appeared from behind the clouds about 15 minutes before the graze, and timings were obtained at all four stations. Over 200 timings were made during the southern-limit graze of Alpha 2, as observed from about three dozen stations in five separate expeditions in southern Africa, according to M. D. Overbeek, who led the effort there. When analyzed together, our observations will permit an accurate determination of the moon's polar diameter, which is difficult to measure with direct observations, since the dividing line between the sunlit and dark sides of the moon is always close to the poles. The moon's equatorial diameter was measured with laser altimeters aboard the Apollo spacecraft, but they were in low-inclination orbits and consequently could not measure the polar diameter. The lunar polar diameter is important for calibrating total solar eclipse observations made near the edges of total solar eclipse paths.

GRAZING OCCULTATIONS

Don Stockbauer

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

If you currently are reporting graze observations on the old ILOC forms which don't request the P.A., magnitude, % sunlit, etc., please ask for a supply of new forms from me. This information is needed for the list of grazes in *Occultation Newsletter*.

It is becoming more important to plot your observations and estimate a shift value for your expedition. I shortly will begin a project to put the graze list from all *O.N.'s* into machine-readable form, and the shift is the most important piece of information. I'll be happy to answer questions concerning how to derive this value from your observations.

Be careful of maps with inadequate control standards. In particular, I've noticed our Texas county maps, issued by the Texas Highway Department, may have features misplotted by several tenths of a mile, and they even have a disclaimer to this effect. Such maps are fine for spotting recent changes in an area, but beware of using inaccurate maps for positioning observers. They are useless for scaling coordinates; the accuracy of a 1:24,000-scale USGS topographic map (±40 feet) is needed here, if such maps are available.

I apologize to our overseas friends for being stingy when mailing reporting forms. The problem is overseas postage; just 5 forms cost 88¢ to mail. If you have access to a photocopier, please feel free to duplicate them, even if it takes two sheets per form.

The graze of Z.C. 842 at Atlee, VA, is the main event that prompted David Dunham to write the paragraph about poor time signal reception (see p. 249). The only observers who were able to receive any time signals at all, and then only faintly and intermittently, were in the northern part of the predicted zone and had no occultation. The others were flustered by the lack of time signals at their stations and didn't turn on their tape recorders; if they had, they at least could have obtained sets of relative timings which would have been of some value. It was possible to determine the shift reasonably well from one observer who saw five "fairly short" occultations of the star over a period of approximately 90 seconds. But since no timings were obtained, "0" must be entered in the # Tm column; it is not possible to complete an IOTA/ILOC report for the graze. The moral is that observers should pay attention to the remarks in the "Late Note for Grazing Occultations" (see p. 249); digital watches (or even dial watches with second hands) should be available at each station and can save the day in situations such as were encountered on March 1.

Corrections to the graze lists in O.N. 3, (11) are listed below:

1. The graze of Z.C. 2118 (Alpha 2 Librae) on 1985 January 15 was observed near Waco, TX, according to a telephone conversation, and was reported in

Mo	Dy	Star Number	Mag	% Snl	CA	Location	# Sta	# Tm	C C	Ap cm	Organizer	St	WA	b
1983														
2	17	109952	7.7	21+	6S	Rodovre, Denmark	1	2	2	20	P. Darnell		177	67
2	21	0654	6.0	55+	3S	Cor. de Tucson,AZ	6	26	2	15	Gerald Rattley	0	176	29
2	21	0668	3.6	55+	-2S	Cor. de Tucson,AZ	6	32	1	15	Gerald Rattley	2S	180	29
12	31	2330	6.3	9-	S	Sitges, Spain	1	4	1	8	Tofac Tobal			
1984														
5	5	1046	6.9	22+		Cordoba, Spain	2	1	2	20	Jesus R. Sanchez			
8	3	2016	6.5	40+	9N	Canberra, N.S.W.	2	20	1	10	David Herald			
10	4	3089	5.3	76+	5S	Merriton,S.Austrl	2	16	1	15	David Steicke	3S	174	58
10	16	1061	6.1	60-	10N	s'Gravendeel,Neth	1	4	2	15	Henk Bulder	3N	348	-41
10	29	2750	2.1	30+	7S	Red Hill,S.Austrl	5	45	1	11	David Steicke	0	176	43
1985														
1	26	0061	7.7	25+	12S	Liverpool,Austrl.	3	18	1	20	J. Ashton		168	42
1	27	109935	7.9	37+	12S	Loenhout, Belgium	4	17	1	13	Henk Bulder	3S	169	38
2	12	2214	6.1	48-	18S	Brookhaven, MS	1	4	1	33	Benny Roberts	0	201	9
3	1	0842	6.3	62+	4N	Atlee, VA	2	0	1	10	David Dunham	3S	4	-32
3	1	077619	7.1	64+	2	Canberra, Austrl.	2	2	3	20	David Herald	3N	3	-47
3	5	1484	3.6			Dortmund, G.F.R.	3	1	2	10	Gunther Neue	5S		
3	16	2984	6.9	20-	13S	Sutherland,Austrl	10	32	1	9	Roger Giller	4N	190	62
3	28	077668	8.1	41+	3N	Tisvildeleje,Denmk.	1	0	3	30	N. P. Wieth-Knudsen			-37
3	30	1089	6.8	55+	5N	West Haven, CT	3	10	1	10	Philip Dombrowski		4	-50
3	31	1206	5.9	64+	5N	East Haven, CT	1	6	1	25	Philip Dombrowski		6	-59
4	2	1484	3.6	85+	8N	Pleasanton, TX	2	10	1	20	Don Stockbauer	3N	13	-61
4	12	188677	7.8	48-	4S	Portland, CT	1	0			Philip Dombrowski		185	71
4	27	1270	6.1	46+	13N	Liria, Spain	3	16	1	9	Jaime Busquets			
4	28	1290	6.8	48+	10N	Daleville, PA	5	24	1	10	David Dunham	6N	9	-63
5	1	1659	6.8	81+	11N	Hockley, TX	1	2	1	20	Donald L. Oliver	0	16	-56
5	4	2118	2.9	0E	83U	El Geteina, Sudan	4	10	1	3	Paul Maley		21	-2
5	25	080171	8.4	24+	14N	Canton, MS	3	21	1	25	Benny Roberts	3N	11	-62
5	26	1390	7.8	34+	10N	Chilesburg, VA	6	23	1	13	David Dunham	1N	9	-61
5	27	099033	9.1	45+	16N	Tomball, TX	1	5	1	20	Donald L. Oliver	4N	15	-62
5	28	099474	8.4	57+	14N	Jackson, MS	1	3	2	33	Benny Roberts		15	-55
6	11	128661	7.0	40-	5N	Whitehall, TX	1	0	1	15	Don Stockbauer	>6S	353	56
6	11	128661	7.0	40-	11N	Clifton, VA	1	2	1	20	Stan Cowelti	7S	347	56
6	11	128661	7.0	40-	11N	Bethesda, MD	1	2	1	20	John Wetmore	7S	347	56
6	25	119051	8.6	42+	13N	Boling, TX	4	16	1	20	Don Stockbauer	7N	14	-46
6	25	119074	8.3	43+	8N	Lane City, TX	4	21	2	20	Don Stockbauer	6N	8	-44
6	28	2053	4.6	75+	17N	Stedman, NC	2	5	1	13	Bob Melvin		18	-5

the last issue. However, for various reasons, it appears that no useful timings will be reported from that effort.

2. The "Ap cm" for Z.C. 2118 on 1985 January 15 at Madisonville, TX, should be 6, not 3.

3. On page 226, there is a graze listed of Z.C. 668 on 1983 February 21, at Cor. de Tucson, AZ. This entry is a mixture of two separate grazes observed that night by Gerald Rattley, and the correct separate entries appear in this issue's list.

Thanks for the reports received, and please keep them coming in.

RECORDING OCCULTATION OBSERVATIONS

Dietmar Büttner

Systematic and careful recording is an important condition of the observer's success. Detailed and complete records are necessary and useful in reporting the observations to the ILOC, the IOTA, or any other interested authority. Also, they aid in tracking down any errors in the observation or reduction process. Any information on the observation which is not recorded is lost forever.

The ILOC's instructions for completing the report forms (e.g., 'Guide to Lunar Occultation Observations') are very helpful and should be considered strictly. Do not deviate from the requested data format on the form, as this would delay processing your observations. For one's own purposes, however, one should write down more information than the few items on the ILOC forms.

What should be documented? The original draft must describe the used instruments and methods as well as all steps of the way to the observing result. For example: Do not write down any time in UT immediately if your watch gives local standard time (but report the time in UT to the ILOC). Clearly, the transformation is simple, but in the stress of actual observing conditions, mistakes may occur. The same is appropriate for the personal equation. Do not apply it to the time read from the stop watch before writing it down, but write the uncorrected reading and the personal equation separately. Subtract the personal equation later. Any deserved comment on poor quality of the time signal received should be recorded, as, especially in the case of the often-disturbed short-wave transmitters, a bad receipt may be the cause of errors in relating the measurement to the time signal. Write down any unusual features of the actual situation at the telescope which have or may have any influence on the result (e.g., if the ocular lenses are clouded by respiration moisture or hoarfrost; also interruptions due to clouds or interference by a passing car). The observer's actual disposition and his posture at the telescope influence the ability to concentrate on the occultation event, and therefore should be mentioned briefly.

Use the correct units of quantities: h, min, and s denote hour, minute, and second of time, whereas °, ', and " denote degree, minute, and second of angle. Abbreviations such as m for minute and sek or sec for second are incorrect. Also, do not use ' or " in case of a time, because they should only be used for angles.

Which methods are suitable in completing the original record? A check list is very useful and convenient for writing down the requested data in a standard order, so as not to forget any of the items of an occultation observation. As the completion of original records should consume only a little time, the use of abbreviations and code words is legitimate, as long as the notes remain clear. Summarize all used abbreviations lucidly in a list. Permanent constant information (e.g., station coordinates, timing equipment) do not need to be included in each record in full detail. Document them once in the record book and refer to them in the record only briefly. The record should be completed, insofar as possible, immediately after the occultation observation, while still at the telescope. Do not defer this until the next morning, as you may forget some details by then. An effective method is recording with the help of an assistant. This permits a continuous observation without interruptions for writing down anything or readapting to darkness. Generally, this method may be replaced by the tape recorder method, but not in cases where any watch reading, etc., is necessary. The tape recorder method will not be considered in more detail here, as this has been done already in connection with grazing and planetary occultations.

For use at the telescope, a small permanently bound notebook is practical, as it may be handled easily, you have no 'flying pages', and the observations are stored in chronological order. A pencil is the ideal writing tool, because it remains operational under all conditions, even with moisture and frost.

In order to know what you have reported to ILOC or IOTA, make a copy of your report. This aids in checking for any errors in the transmission of your results.

Karl-Marx-Stadt, DDR

[Ed: The following articles, "Pluto-Charon Occultations Begin," "Late Note for Grazing Occultations," "Galilean Satellite Mutual Phenomena," "Asteroid Results from Speckle Interferometry," and "Correction" are reprinted from the "Last-Minute Addenda" page appended to *o.N. 3*, (11). That page now should be removed and discarded.

PLUTO-CHARON OCCULTATIONS BEGIN

David W. Dunham

R. Binzel, University of Texas; E. Tedesco, Jet Propulsion Laboratory; and D. Tholen, University of Hawaii, report detection of partial occultation of Charon (1978 P1) by Pluto, on Feb. 20.585, and partial transits of Charon across Pluto, on Jan. 16.467 and Feb. 17.385, according to I.A.U. Circular 4040. Tholen suggests that the difference in magnitude drop (0.04 for the transits, and 0.02 for the occultation) might be due to a higher albedo for Pluto on the western limb. The symmetry of event times relative to the synodic period defines a nearly circular orbit. The synodic period of 6.38726 days can be used to predict future events, which will decrease during March and April as Pluto's retrograde motion carries it away from the eclipse zone. Deeper events will occur next year. Potential observers are invited to contact IOTA member Rick Binzel; Department of Astronomy; University of Texas; Austin, TX 78712 for more information.

LATE NOTE FOR GRAZING OCCULTATIONS

David W. Dunham

Observers are reminded that graze reports should be completed with pencil, not ink. Send ILOC the original if you make copies of the report.

Be prepared for poor time signal reception when solar activity disrupts the ionosphere. Fifty feet of wire attached to the antenna and suspended above ground enhances reception. Back-up use of a selected AM radio station with one time-calibrated master tape will provide a time base. Also, use of digital watches, preferably with seconds dosplay and/or beeping alarm to record on the tape, can save the situation. The watch can be compared with time signals after the event, and one watch on the expedition should be compared before it. Some graze data have been lost due to too much reliance on the convenient Timekube; don't let it happen to you.

GALILEAN SATELLITE MUTUAL PHENOMENA

David W. Dunham

Predictions of the upcoming series of mutual phenomena of the Galilean satellites are given by K. Aksnes and F. Franklin in *Sky and Telescope 69* (2), 116-118. Observations of these will be valuable for planning for the Galileo spacecraft mission. Photoelectric observers are encouraged to record as many of these events visible from their observatories as they can.

ASTEROID RESULTS FROM SPECKLE INTERFEROMETRY

David W. Dunham and Richard Nolthenius

Jack Drummond and K. Hege, University of Arizona, published an abstract, "Speckle Interferometry Results for 12 Victoria and 4 Vesta," in *Bulletin of the American Astronomical Society 16* (4), 922, in which they state: "Recent detailed modelling of our speckle interferometry observations of Herculina and Pallas have provided such stringent upper limits to the size and brightness of any possible satellites that we consider them moon-less, although both Pallas and Herculina show strong albedo markings." They also report that "4 Vesta is the most obviously spotted asteroid." In the corresponding presentation which they gave at the American Astronomical Society meeting in January in Tucson, AZ, they said that they did not have all of the stated results, primarily due to computer problems. In later discussions, Drummond set upper limits for a possible satellite of Herculina at 50 km out to a distance of 1500 km, and 11 km for a satellite of Pallas to 2000 km. The 50-km limit for Herculina is just above the 45-km diameter of the largest possible satellite inferred from the 1978 June occultation, so it can not be ruled out on the basis of the speckle data. To date, there is no good occultation evidence for a satellite of Pallas. The large possible satellite claimed for Pallas was based solely on the speckle data and appears to be ruled out by the more complete recent analysis. In other results, ellipticities have not yet been determined from the speckle data for (433) Eros, (511) Davida, and (532) Herculina. The next projects include more analysis of the data on Pallas and (12) Victoria, the latter being a good candidate for having a satellite, based on previous speckle work.

CORRECTION

In *O.N. 3* (11), 233, it was incorrectly stated that the reduction profiles on pages 233 through 235 had been prepared by the ILOC. They were provided by Toshio Hirose of the Lunar Occultation Observation Group in Japan.

LUNAR ECLIPSE NEWS

David W. Dunham

Extended-coverage USNO total occultation predictions were generated for all four total lunar eclipses during 1985 and 1986, and were sent along with some descriptive information, including charts of the eclipse star fields, to all Eastern Hemisphere observers who are IOTA members, IOTA/ES members whose positions I could determine at least approximately, and those on USNO's active list. These were sent out only about two weeks before the May 4th eclipse, with considerable help from Richard Taibi and Pat Trueblood. Unfortunately, some did not receive them before May 4th, but at least they have the data in time for the other eclipses. Bad weather and low altitude prevented observation from most of Europe. An account of the first really successful simultaneous north-south graze observations made during the May 4th eclipse is given on p. 246. If you want extended-coverage predictions for October's eclipse, and the 1986 eclipses, send me station coordinates and telescope aperture to my address given in IOTA NEWS on p. 243. None of the four eclipses are visible favorably enough from the Western Hemisphere (altitude too low) to warrant distribution of extended-coverage predictions to observers there; the standard USNO predictions will be sufficient.

The predictions for the 1985 May and 1986 April eclipses were computed using Astrographic Catalog data for these southern zones provided on floppy disk by David Herald in Australia. It took some effort on 4 computers to transfer the data to tape in a format which could be read with USNO's computer. Herald asked in return for a subset of Watts' limb corrections on floppy disk for his analysis of the eclipse occultation observations. I have written a program to generate this to a standard computer tape, but unfortunately, we no longer have access to the same computers to reverse the process used with Herald's data in March. We hope to overcome this problem sometime in the next couple of months, probably with help from Terry Losonsky, a local observer with a Commodore 64 computer similar to Herald's machine.

OBSERVATIONS OF ASTEROIDAL APPULSES AND OCCULTATIONS

Jim Stamm

(4) Vesta and SAO 94222, 1984 Jan 7: A miss at Cape Town, South Africa, was reported by Danie Overbeek.

(375) Ursula and anonymous star, Jan 20: A miss at East Rand, South Africa, was reported by Overbeek.

(194) Prokne and 12.2-mag. star, Jan 30: (*O.N.* 3 (9), 186). A possible dimming at Potchefstroom, South Africa, occurred at approximately 22:25 UT, as reported by Danie Overbeek. This would confirm the north shift previously reported, but the time was about 10 minutes earlier than predicted.

(566) Stereoskopia and AGK3 +24° 0996, Feb 27: Carles Schnabel observed no occultation from Barcelona, Spain, from 18:30 to 19:00.

(114) Kassandra and SAO 159989, Mar 23: (*O.N.* 3 (9) 186). Jose Aguiar monitored from 03:45 to 04:05 at Guia, Grand Canary Island without detecting an event.

(9) Metis and anonymous star, Apr. 2: H. S. Mahra, observing with the 104-cm telescope at Uttar Pradesh State Observatory, Manora Peak, Naini Tal, India, did not see any occultation.

(128) Nemesis and SAO 139402, May 2: (*O.N.* 3 (11) 225) Danie Overbeek reports that misses were observed at East Rand, Pretoria, and Sedgefield, South Africa.

(326) Tamara and SAO 226130, May 15: (*O.N.* 3, (9) 186). Danie Overbeek reports that misses were observed from Bloemfontein, East Rand, Johannesburg, and Potchefstroom, South Africa.

(47) Aglaja and SAO 146574, Jun 2: Six locations in South Africa reported misses to Danie Overbeek. They were Cape Town, Durban, East Rand, Grahamstown, Johannesburg, and Potchefstroom.

(602) Marianna and SAO 227909, Jun 2: (*O.N.* 3 (9) 187). Overbeek reports misses at the 6 locations mentioned above (Aglaja), plus at Kimberley and Port Elizabeth.

(13) Egeria and SAO 80995, Jun 8: A miss was reported from Durban and Port Elizabeth, South Africa, by Danie Overbeek.

(624) Hektor and 11.3-mag. star, Jun 29: Overbeek reports that misses were observed from Durban, East Rand, Pietermaritzburg, and Sedgefield, South Africa.

(211) Isolda and SAO 164173, Jul 16: South African misses were reported by Overbeek from Durban, East Rand, Johannesburg, Kimberley, Nigel, and Sasolburg.

(209) Dido and SAO 188498, Sep 4: (*O.N.* 3 (11) 226). A miss at Sasolburg, South Africa was reported by Danie Overbeek.

(47) Aglaja and SAO 146599, Sep 16: (*O.N.* 3 (11) 226). Vicente Borras saw no occultation at Benicarlo, Spain from 02:00 to 02:35, and Joan Bullon at Valencia, Spain saw none from 02:05 to 02:35.

(159) Aemilia and SAO 128970, Oct 14: Brian Loader watched the asteroid skim past the star at Blenheim, New Zealand, seeing no occultation.

(201) Penelope and SAO 163019, Oct 17: No occultation was seen by H. S. Mahra at Uttar Pradesh State Observatory, Naini Tal, India.

(712) Boliviana and SAO 108591, Oct 24: (*O.N.* 3 (11) 228). Joan Bullon observed from 20:35 to 21:30 at Valencia, Spain, but detected no events.

(48) Doris and 11.5-mag. star, Nov 2: Harold Marx, observing from the Swabian Observatory in Stuttgart, West Germany, saw no occultation from 20:35 to 20:45.

(238) Hypatia and AGK3 +6° 0528, Nov 12: (*O.N.* 3 (11) 228). French observers A. Rabin, F. Vaissiere, and F. Leborgne, observing from 00:05 to 00:25 at Toulouse saw no occultation, nor did A. Figer at Paris from 00:03:30 to 00:25:10.

(1) Ceres and BD +8° 471, Nov 13: (*O.N.* 3, (11) 228). The Florida Institute of Technology organized an expedition for this event, with help from the Massachusetts Institute of Technology. Four of the five photoelectric stations obtained data. A 56^{s}8 disappearance was recorded at Melbourne, FL, and one of 30^{s}7 was recorded at Providenciales, in the Caicos Islands. Fig. 1 shows the FIT/MIT-obtained profile of Ceres. The circular outline represents a diameter of approximately 950 km. A detailed account of the expedition has been submitted to *Sky and Telescope*. The observation by Ireland, Mooney, and Leibow was incorrectly published in the last issue of *O.N.* They did not record a 1-sec. drop in light level. Their disappearance actually occurred within the 1-second interval beginning at 4:42:05 and ending at 4:42:06. The reappearance was not recorded, but it appears that they obtained a chord of at least 62 seconds.

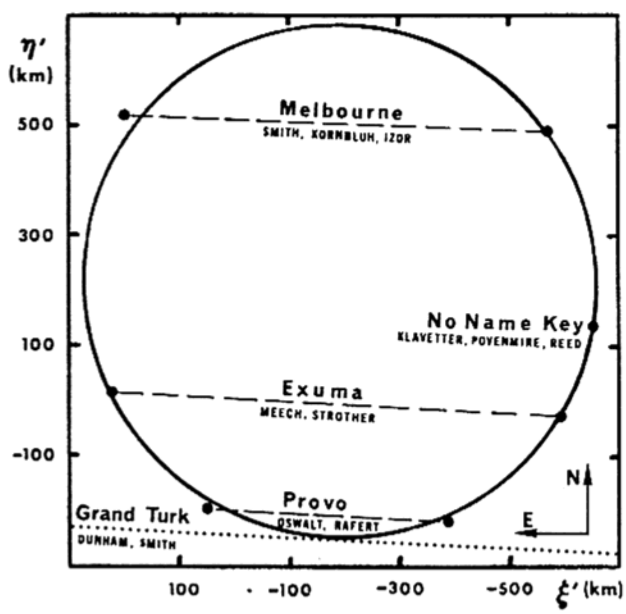


Fig. 1. Outline of Ceres from Chords Obtained by the Florida Institute of Technology Expedition

(747) Winchester and SAO 114569, Nov 28: (*O.N.* 3, (11) 229). R. Scott Ireland observed from 6:03 to 6:30 at Southern Cross Observatory in south Florida, and recorded a 'no event'. Ray Desmarais and Robert Riefer also got a 'no event' from south Florida. They monitored from 6:00 to 6:20. The 27.3-sec. chord obtained by Antonio Mendez and Christos Galdys was from Tocuyito, Venezuela. Negative observations were made by A. Perroni and R. F. Martins at Campinas, Brazil, R. Rodriguez at Maracay, Venezuela, and S. Delgado and M. T. Hostos at Naguanagua, Venezuela. These misses indicate that the chord obtained was a northern one.

(82) Alkmene and SAO 118747, Dec 16: L. Maksymowicz at Chapet, France monitored the star from 02:41:35 to 02:58:02 under good skies, but saw no occultation.

(184) Dejopeja and AGK3 +24° 0505, Dec 16: A visual observation of a video image at the Pic du Midi Observatory (France) revealed no occultation from 22:32 to 22:48.

(161) Athor and SAO 59154, Dec 17: (*O.N. 3* (11) 229). J. Lecacheux at Bagneres, France, monitored the star from 00:47:40 to 01:00, and reports that the asteroid seemed to pass about 1 arc second north of the star.

(154) Bertha and AGK3 +46° 740, Dec 18: Joaquim Fort observed from 01:40 to 02:00 at Maia de Montcal, Spain, without seeing an occultation.

(747) Winchester and BD +4° 1312, Dec 25-26: (*O.N. 3* (11) 229). P. Barufetti monitored at Massa, Italy, from 23:52:10 to 24:12, and determined that Winchester passed southwest of the star. Three French observers also reported misses: P. Poitevin at Puimichel (23:56 - 24:05); R. Heidman at St. Maurice, noting that the asteroid seemed to pass south of the star (23:50 - 24:20); and R. Mailler at Pontailler, who determined that least distance was about 0".5 southwest at 23:58 (23:30 - 24:10).

P/Halley and anonymous star, Dec 27: No occultation was seen by H. S. Mahra at Uttar Pradesh State Observatory, Naini Tal, India.

(111) Ate and SAO 78743, Dec 30: (*O.N. 3* (11) 230). Five southern African locations reported misses, according to Danie Overbeek: Bulawayo, East Rand, Henley on Klip, Johannesburg, and Pretoria.

(747) Winchester and 10.6-mag. star, 1984 Dec 30: Danie Overbeek has forwarded negative reports from Cape Town, East Rand, Henley On Klip, Johannesburg, Pretoria, Sasolburg, and Sutherland, South Africa.

(97) Klotho and SAO 130198, 1985 Jan 10: (*O.N. 3* (11) 230). Joan Bullon began observations at 19:14, and with a 1-min. break at 19:23 and a 3-min. break at 19:30 because of clouds, saw no event at Valencia, Spain.

(747) Winchester and SAO 95375, Jan 22: (*O.N. 3* (11) 230. Benny Roberts observed at Jackson, MS, from 7:30 until 8:00 without detecting any events.

(179) Klytaemnestra and SAO 109864, Jan 24: Wolfgang Palzer managed to observe from 17:12 to only 17:14 before clouds interfered, seeing no occultation at Wiesbaden (West Germany) Observatory.

(1111) Reinmuthia and SAO 159738, Feb 4: W. Palzer had clear skies at Mainz-Kastel, West Germany, but saw no event from 04:00 to 04:15.

(535) Montague and SAO 93598, Feb 10: (*O.N. 3*, (11) 230). No events were detected at Jackson, MS, by Benny Roberts. He monitored the star from 3:00 until 3:30. R. Riefer and Ray Desmarais observed no event from 3:19 to 3:32 at Mahogany Hammock, FL.

(579) Sidonia and SAO 78450, Feb 16: (*O.N. 3*, (11) 230). Benny Roberts reports another negative observation at Jackson, MS. He monitored the star from 5:15 until 5:40. Roberts has reported a good many observations to IOTA, and he doesn't get discouraged by the majority being negative. He feels, "... that if you don't look you sure won't see anything."

(7) Iris and SAO 94467, Feb 16: A miss at East Rand, South Africa, was reported by Danie Overbeek. W. Palzer and Dietmar Staps at Wiesbaden Observatory also reported a miss from 21:00 to 21:21. A dozen Spanish observers were able to monitor the star under mostly poor conditions: Fernando Freire, Ramiro Moar, and Faustino Gomez at La Coruñha saw no event from 20:50 to 21:45; Josep Marti and Manuel March observed from 21:00 to 21:45 (They recorded some blinks (?) at 21:11:40.8 and 21:19:39.4 under "bad" skies); Joaquim Illa at Mataro recorded a 'no event' from 21:00 to 21:35, as did Fernando Comeron at Orrius (21:05 - 21:11 and 21:15 - 21:30); Pedro Pisa saw no occultation from 20:54 to 21:45 at Santa Marina de Piedra Muelle; Manuel Cortes at Lleida monitored from 21:05 to 21:25 without seeing an event; Edvardo Cifuentes observed from 20:55 to 21:30, and saw the asteroid pass to the south of the star at Renteria; Ricard Casas saw no occultation from 21:00 to 21:30 at Sabadell; Jordi Miralda monitored at Terrassa from 21:00 to 21:30 without seeing an event.

(372) Palma and SAO 118291, Feb 18: Thomas Langhans conducted a photoelectric observation from 11:48 to 12:08, without recording an occultation, at San Bruno, CA. No events were detected by Australian observers P. Kearney (11:59 - 12:12) and D. Lowe (11:45 - 12:15) at Bundaberg, nor by New Zealand observers J. Priestley and Graham Blow at Wellington (12:02 - 12:09), and Brian Loader at Blenheim (11:59 - 12:13). Although the asteroid was predicted to pass to the north for Kearney, he reported that it appeared to pass to the south, while Priestley and Blow suspected that the pass was to the north.

(564) Dudu and SAO 76544, Feb 18: D. Staps and W. Palzer monitored the star from 19:05 to 19:25 at Wiesbaden Observatory, but detected no event.

(51) Nemausa and 10.6-mag. star, Feb 19: W. Palzer observed from 00:36 to 01:00 at Wiesbaden Observatory without seeing an occultation, but he did determine that Nemausa passed south of the star at about 00:50. Rainer Riemann monitored from 00:44 to 01:07 at Mainz-Lerchenberg, West Germany, seeing no event.

(454) Mathesis and SAO 99560, Mar 3: A group of amateurs at the Southern Cross Observatory, in south Florida, all recorded a miss. Luis Gonzales and Mike Mooney monitored from 3:51 to 4:00 with a 5" refractor. Tip D'Auria used an 8" SCT from 3:51 to 4:01, but Bobby Riefer and Patty D'Auria, using a 14" SCT, saw the asteroid shortly before 3:50. They soon concluded that the asteroid was moving away from the star. Bob Grant, at a nearby location, observed from 3:49 to 4:07 without observing any event. At another nearby station, Scott Ireland and Skip Jarrett monitored from 3:45 to 3:56, with negative results. They both saw the asteroid approach the star as they were setting up their 8" scopes, and at 3:48:30, Jarrett said he thought the asteroid was on the other side of the star. Ireland confirmed this at 3:50. Both Mooney and Ireland independently noted that they felt the asteroid was "10 minutes early."

(51) Nemausa and SAO 96887, Mar 4: Lick Observatory astrometry indicated a shift of about 0".6 west, putting the path across the central U.S.A. in broad daylight. A large storm prevented monitoring of the appulse after sunset in the northeastern U.S.A.

(375) Ursula and SAO 157187, Mar 5: A miss was reported at Potchefstroom, South Africa, according to Danie Overbeek.

(82) Alkmene and SAO 118747, Mar 11: I monitored the star at London, KY, from 1:46 to 2:02:08, with breaks at 1:46:54 (46^s), 1:49:45 (30^s), 1:52:30 (71^s), and at 1:55:20 (forced by a 109-second cloud). The only possible event was a 1^s extinction at 1:58:57 that I felt was a 'blind spot' extinction. However, I was unable to duplicate the disappearance during the next 3 minutes. My guess is that the asteroid passed south of the star. Mike Mooney and Luis Gonzalez alternated observing from 1:51 to 2:02 at Southern Cross Observatory in south Florida without seeing an occultation.

(454) Mathesis and AGK3 +13° 1117, Mar 12: D. Staps and W. Palzer monitored the star at Wiesbaden Observatory. Haze hampered them somewhat, but no occultation was visible from 20:56 to 21:20.

(198) Ampella and SAO 77087, Mar 12: D. Staps and W. Palzer observed from 21:36 to 21:45 at Wiesbaden Observatory without seeing an occultation. Harro Lorenz also recorded a 'no event' at Berlin, D.D.R.

(1227) Geranium and SAO 41121, Mar 14: R. Scott Ireland and Luis Gonzalez monitored the star from 00:30:43 to 01:00:06, and report a qualified 'no event' due to the very hazy conditions at Southern Cross Observatory in south Florida.

(51) Nemausa and 12-mag. star, Mar 14: S. Hutcheon at Sheldon, Australia, monitored from 13:00 to 13:20, and felt that the asteroid passed north of the star at 13:16. Peter Anderson at Brisbane, Australia, watched Nemausa pass 0".5 northwest of the star while monitoring from 13:00 to 13:35.

(42) Isis and BD +18° 2490, Mar 28: I monitored the star from 8:27 to 8:37 at London, KY. Although I saw no event, it was so windy that a one-magnitude drop (predicted drop was 2.0) easily could have escaped my detection. Carl Schweers, at Ardmore, OK, began monitoring the star at 8:30. At 8:33:02.9 he recorded a disappearance, and about 2 seconds later a cloud covered the star. Eleven seconds after the disappearance, the cloud passed by, and the star was visible. Schweers does not feel that a cloud caused the disappearance, because a nearby star was visible for the 2 seconds before everything was covered up. Schweers was at 0".30 south, although astrometric plates taken a week before indicated a zero shift with considerable uncertainty.

(129) Antigone and DM +20°2390, Apr 11: David Dunham distributed a special bulletin detailing this event, since certain factors made this an especially interesting occultation. Lowell Observatory provided astrometry updates before the event. Paul Thayer and David Levine, using two telescopes set up 5 feet apart, obtained a 66.3-second chord from High Plains, CO. The disappearance occurred at 03:36:48.6. Paul Maley recorded a disappearance at 03:36:52.9 and a reappearance at 03:37:44.6 from Parker, CO. Harold Reitsema recorded a miss at Boulder, CO. Three portable photoelectric telescopes from Lowell Observatory recorded chords (from Pueblo, CO, to 40 miles east of Pueblo). Since the actual path was almost 0.4 diameters east of its finally predicted path, all of the observers were west of the true path center. Dunham planned to observe near the eastern edge of the path, since no other observers were going to be there. Extensive clouds covered the path, and he drove 25 miles beyond the eastern edge (between Agate and Limon, CO) before he finally got out of the clouds. Not wanting to record a miss, he drove to the southwest, where it appeared that the dissipating cloud cover would give him a possibility, about 2 km inside the eastern path edge. By the time he got set up, the event had occurred. Dunham points out that if he had stayed near Agate, he would have gotten a very valuable eastern chord, since the final path shift was so far east. He warns the rest of us always to allow plenty of time to set up, and to pay less attention to location, as astrometry likely will be somewhat in error, anyway.

(1113) Katja and SAO 57948, Apr 12: From LaVerne, CA, Greg Lyzenga monitored the star from 04:32 to 05:01. His only 'event' was a "probably spurious" dimming at 04:33:36.5.

(275) Sapientia and SAO 139564, Apr 15: Lowell astrometry showed the path to shift 0".68 south, placing it over populous parts of Ontario, New York, and southern New England. The weather forecast was for clouds everywhere east of Lake Superior, so David Dunham headed for Duluth, MN, where his brother, Douglas, lives. They notified a number of local observers, who were to spread out north and south of town. Since no one stayed in Duluth, David decided to observe from Doug's balcony in town. Cirrus prevented finding any stars other than Spica, and in desperation, Dunham measured R.A. and Dec. offsets from Spica using the *O.N.* finder chart, and adjusted the scope from the offsets. He only guessed at polar alignment when setting up, but found the target star. Since he was near the predicted southern limit, he was surprised to see a 3.5-sec. extinction, beginning at 02:18:21.0. This indicated that he was only a few km from the limit. No one else in the area was able to make an observation, but Philip Nicholson at Cornell University in Ithaca, NY, photoelectrically recorded a 9.5-sec occultation through a lucky break in the cloud cover. This shows that Dunham actually was near the northern limit!

(51) Nemausa and 11.9-mag. star, Apr 16: Since this event was the most favorable one predicted for Australasia in 1985, a concerted effort was made to obtain a positive result. Alan and Pam Gilmore at Mt. John University Observatory (New Zealand) agreed to obtain plates over the nights preceding the event so that Warwick Kissling (Applied Maths Division, D.S.I.R.) could compute any path shift. Six plates taken on the 14th and 15th led to a path shift of about 0".3 to the north, and Graham Blow telephoned a large number of observers on the North Island and on the east coast of Australia. A subsequent revision of the path shift placed it at 0".4 north of nominal, and off the coast of New Zealand, but close to Siding Spring Observatory. Besides the poor final predicted path region, bad weather covered the whole area, and no positive reports were received. Eight New Zealand observers did monitor the star: H. Wil-

liams from 09:50 to 10:10; R. Austin (09:30 - 10:05) guessed the asteroid passed to the south with closest approach at 9:59; J. O'Kane (09:50 - 10:00), A. Dodson (09:48 - 10:04), and G. Blow and J. Priestley (09:57:30 - 10:06) at Wellington; B. Loader who began at 09:45 and saw a probably spurious event at 09:58:26, while clouds covered his field from 09:58:32 to 09:59:08, and finished at 10:01; S. Ryan and L. Hussey (09:47 - 09:58) at Christchurch; A. Gilmore (09:50 - 10:04) at Mt. John; C. Smith at Woodridge, Australia, detected a probable atmospheric event at 09:52:02.7; P. Anderson at Brisbane, Australia, monitored from 09:49 to 10:10. He determined that the closest approach was at 09:57:30, with the asteroid passing marginally south. In addition, he notes a probable ½-sec. atmospheric fade at 09:57:57.4. Blow reports that the effort was nevertheless a success. Anderson's observation helped to confirm the reliability of the Mt. John astrometry, and it will be used in the future.

(57) Mnemosyne and SAO 137722, Apr 19: P. Anderson determined that the planet passed just west of the star at Brisbane, Australia. He monitored from 14:00 to 14:33.

(12) Victoria and SAO 183095, Apr 21: Overbeek reported a miss at Johannesburg, South Africa, but adds a preliminary report of 2 probable occultation observations at Bloemfontein at 1".2 south. This is in agreement with astrometry obtained at Bordeaux, France (at rather low altitude), which indicated a shift of 1".0 ±0".2 south.

(51) Nemausa and unnamed star, Apr 23: Tony Freeman had excellent skies at Berkeley, CA, but observed no events from 4:23 (when the asteroid was lost in the glare of the star) to 4:30 (when he recovered the asteroid). Lick Observatory astrometry on April 16 indicated a 1½" north shift, putting the path off the earth's surface.

(372) Palma and BD +02° 2250, 1985 Apr 28: Greg Lyzenga, observing from Mt. Baldy, CA, observed no occultation from 4:40 to 5:10.

(746) Marlu and SAO 138569, May 1: No occultation was observed by Pere Soler and Tofol Tobal from 23:00 to 23:50 at Vilanova i La Geltru.

(1771) Makover and SAO 81369, May 2: Pere Soler and Joan Garcia recorded a negative observation at Vilanova i La Geltru, Spain, from 20:18 to 20:48.

(625) Xenia and SAO 99935, May 8: Mike Kretlow and W. Palzer began observation at Wiesbaden Observatory at 22:50. At 23:01, a 2- or 3-magnitude dimming of the star occurred, but it was probably "...due to a haze cloud," which was visible on the horizon when monitoring began. Observation ended at 23:10 without a definite occultation.

(578) Happelia and SAO 98974, May 20: Horst-Rainer Schneider, M. Kretlow, and W. Palzer at Wiesbaden Observatory monitored from 21:50 until 22:12 when haze clouds moved into the area. No occultation was seen. R. Riemann at Mainz-Lerchenberg observed from 21:55 to 22:12. He may have seen a 2-second event at 22:12, but no description was reported. Alfons Gabel (also at M-L) could only observe from 22:02 until 22:08 because of haze. He saw no event.

Uranus and SAO 184819, Jun 25: J. Lecacheux supplied 8 meridian observations of the planet and/or star from Bordeaux Observatory (France) taken from April 24 to June 12. With additional data supplied by Arnold Klemola from Lick Observatory, Wayne Warren was able to send astrometry update results to the European Southern Observatory at Cerro La Silla, and Santiago, Chile, as well as the Meudon Observatory. At La Silla, closest approach was predicted to be 3".69 ±0".2, indicating a probable occultation by the Epsilon Ring. The only report received so far was from Ferruccio Ginelli, who made a visual observation, and estimated that the planet's center passed from 3".6 to 3".9 from the star, at between 22:01 and 22:03.5. He did not observe any occultation.

Data from several of the above events could have been enhanced greatly by the addition of just one or two more observations. For instance, Carl Schweers (28 Mar 1985) is searching actively for another observation so that he might confirm or refute his 'event'. Although a few amateurs like Greg Lyzenga in California, Peter Manly's observers in Arizona, and Mike Mooney's group in Florida make it a practice to observe as many events as possible, we need more efforts to observe appulses, vis a vis the European, South African, and Australasian groups.

OCCULTATIONS BY COMETS DURING THE REST OF 1985

David W. Dunham

Predictions of occultations of stars by Comet Giacobini-Zinner (G-Z) and by Halley's Comet during the remainder of 1985 are given in two tables below, which use the same format as those for asteroids given with the article in *o.N. 3* (10), 208, and described in *o.N. 3* (1), 9. The occultations of SAO, AGK3, and Klemola (KLH) stars were found by Ted Bowell and Larry Wasserman at Lowell Observatory, and distributed by Lowell or via the International Halley Watch (IHW) at Jet Propulsion Laboratory. I found most of the events, those involving Astrographic Catalog (A.C.) stars. Since A.C. data are available in computer-readable form only between declinations +4° and +31° along G-Z's steep path, A.C. events involving G-Z occur only during September. There are many events due to the rich Milky Way star fields traversed by G-Z. Letters are given for many of the non-SAO A.C. stars in the 'SAO No.' columns of the tables, and are used for identification on the finder charts and regional maps. Halley's Comet stays in the A.C.-covered zone nearly until the end of 1985, but passes over sparser star fields. During 1986, both comets will stay entirely south of the computer-based A.C. coverage, so I expect to add few, if any, 1986 events over those already found at Lowell. I used the latest orbital elements supplied by Donald Yeomans, IHW astrometry discipline specialist. Also included are four of the better occultations found by Goffin and given in the Supplement to *o.N. 3* (10).

Diameters of 50 km and 100 km have been used for G-Z and Halley, respectively, in the table. The nuclei are much smaller; these are simply wild guesses of twice the distance from the nucleus where an observable drop in the star's light might occur. Similarly, the magnitudes are not nuclear magnitudes (which are formally 2 to 4 magnitudes fainter), but may represent the total brightness in the near-nuclear

(Text continues on page 255)

Table 1, Part A

1985 DATE	UNIVERSAL TIME	COMET OR ASTEROID NAME	m_v	Δ,AU	STAR SAO No	m_v	Sp	R.A.(1950)	Dec.	OCCULTATION Δm	Dur	df	P	Possible Area	El SUN	MOON El	%Snl	N Up	Ephem. Source
Aug 7	5h32m	Irene	10.6	1.91	191052	9.1	A5	22h16m.3	-23°10'	1.7	12s	21	18	Ont., MN, NE, KS, NM, AZ, B.Calif.	162°	60°	64-	all	HERGET77
Aug 20	13 48	P/Giac-Zin	13.5	0.50	24333	10.6	K2	3 56.1	50 45	2.9	2	6	15	n.e. China, Siberian Pacific	80	126	22+	none	YEOIHW19
Aug 20	13 49	P/Giac-Zin	13.5	0.50	24333	9.4	K2	3 56.1	50 45	4.1	2	6	15	Mongolia, Lake Baikal area	80	126	22+	none	YEOIHW19
Aug 20	20 20	P/Giac-Zin	13.5	0.50	24353	8.0	A0	3 58.1	50 30	5.4	2	6	15	Balkans, western U.S.S.R.	80	129	24+	none	YEOIHW19
Aug 22	7 52	Ganymed	10.8	0.77	38952	9.0	G0	3 30.8	43 35	2.0	2	11	28	n.w. Mexico, s.e. U.S.A.	88	153	40+	none	EMP 1985
Sep 4	7 35	P/Giac-Zin	13.3	0.47	58030	6.1	K0	5 23.6	33 13	7.2	2	6	14	northwest U.S.A. southern Canada	79	47	78-	all	YEOIHW19
Sep 6	3 28	P/Giac-Zin	13.3	0.47	A	10.7		5 31.9	30 42	2.7	2	6	14	western and southern Africa	79	26	63-	all	YEOIHW19
Sep 6	5 48	P/Giac-Zin	13.3	0.47	B	11.8		5 32.3	30 33	1.8	2	6	14	southeastern Canada	79	25	62-	all	YEOIHW19
Sep 6	8 38	P/Giac-Zin	13.3	0.47	C	11.8		5 32.8	30 24	1.8	2	6	14	Peru, Chile, Argentina	79	24	61-	all	YEOIHW19
Sep 7	5 34	P/Giac-Zin	13.3	0.47		11.6		5 36.6	29 10	1.9	2	6	14	northern Canada, Greenland	79	14	53-	all	YEOIHW19
Sep 8	22 09	P/Giac-Zin	13.3	0.47	D	12.1		5 43.6	26 47	1.5	2	6	14	western U.S.S.R.	79	5	36-	all	YEOIHW19
Sep 9	3 40	P/Giac-Zin	13.3	0.47	E	12.5		5 44.5	26 28	1.2	2	6	14	western and southern Africa	79	8	34-	all	YEOIHW19
Sep 10	1 20	P/Giac-Zin	13.3	0.47		12.1		5 48.1	25 12	1.5	2	6	14	southern Africa	80	19	26-	all	YEOIHW19
Sep 10	2 55	P/Giac-Zin	13.3	0.47		11.1		5 48.3	25 06	2.4	2	6	14	Greenland, Scandinavia	80	19	25-	all	YEOIHW19
Sep 10	8 43	P/Giac-Zin	13.3	0.47		12.0		5 49.3	24 46	1.6	2	6	14	Alaska, northern Canada	80	22	23-	all	YEOIHW19
Sep 11	9 10	P/Giac-Zin	13.3	0.47	F	10.7		5 53.2	23 19	2.7	2	6	14	southwest Canada, northeast U.S.A.	80	35	15-	all	YEOIHW19
Sep 11	13 00	P/Giac-Zin	13.3	0.47	G	10.2		5 53.8	23 06	3.2	2	6	14	south Pacific Ocean	80	37	14-	none	YEOIHW19
Sep 11	18 22	P/Giac-Zin	13.3	0.47		13.0		5 54.6	22 47	0.9	2	6	14	southern China	80	40	12-	e120°E	YEOIHW19
Sep 11	19 30	P/Giac-Zin	13.3	0.47		13.0		5 54.8	22 43	0.9	2	6	14	northern China, Japan	80	41	12-	all	YEOIHW19
Sep 12	19 16	P/Giac-Zin	13.3	0.47	H	11.3		5 58.4	21 20	2.2	2	6	14	southern China	80	53	6-	all	YEOIHW19
Sep 12	19 36	P/Halley	17.9	2.62		10.7		6 12.2	19 33	9.2	25	79	38	Indonesia, Philippines	77	51	5-	none	YEOIHW24
Sep 12	23 39	P/Giac-Zin	13.3	0.47	I	11.9		5 59.0	21 04	1.7	2	6	14	w. and s. central U.S.S.R.	80	56	5-	e 50 E	YEOIHW19
Sep 13	2 04	P/Giac-Zin	13.3	0.47	J	11.8		5 59.4	20 56	1.8	2	6	14	Iberia, northern Africa, Arabia	80	57	4-	e 30 E	YEOIHW19
Sep 13	7 17	P/Giac-Zin	13.3	0.47	K	11.6		6 00.2	20 38	1.9	2	6	14	central Canada, Newfoundland	80	60	3-	e 60 W	YEOIHW19
Sep 13	7 20	P/Giac-Zin	13.3	0.47	L	10.2		6 00.2	20 38	3.2	2	6	14	southeastern U.S.A.	80	60	3-	none	YEOIHW19
Sep 14	13 00	P/Giac-Zin	13.3	0.48		10.4		6 04.5	18 54	3.0	2	6	14	Hawaii?s	80	77	0-	none	YEOIHW19
Sep 17	0 57	P/Giac-Zin	13.4	0.48		13.8		6 12.6	15 28	0.6	2	6	14	Scandinavia, western U.S.S.R.	81	111	7+	none	YEOIHW19
Sep 17	15 49	P/Giac-Zin	13.4	0.49		12.1		6 14.6	14 39	1.6	2	6	14	New Zealand?s	81	120	11+	none	YEOIHW19
Sep 17	21 57	P/Giac-Zin	13.4	0.49		11.5		6 15.4	14 18	2.1	2	6	14	southern Asia	81	123	13+	none	YEOIHW19
Sep 18	2 08	P/Giac-Zin	13.4	0.49	95515	8.9	K2	6 15.9	14 04	4.5	2	6	14	western and southern Africa	81	125	15+	none	YEOIHW19
Sep 18	4 35	P/Giac-Zin	13.4	0.49		9.8		6 16.2	13 55	3.6	2	6	14	Greenland	81	127	16+	none	YEOIHW19
Sep 19	22 22	P/Giac-Zin	13.4	0.49		12.1		6 21.4	11 36	1.6	2	6	14	Kazakhstan, Tibet	81	148	33+	none	YEOIHW19
Sep 20	1 41	P/Giac-Zin	13.4	0.49	M	12.1		6 21.8	11 26	1.6	2	6	14	s. Scandinavia, s.w. U.S.S.R.	81	150	34+	none	YEOIHW19
Sep 20	2 39	P/Giac-Zin	13.4	0.49	N	9.9		6 21.9	11 22	3.5	2	6	14	northern Scandinavia	81	150	35+	none	YEOIHW19
Sep 20	6 14	P/Giac-Zin	13.4	0.49	P	12.1		6 22.4	11 11	1.6	2	6	14	New England	81	152	37+	none	YEOIHW19
Sep 20	17 26	P/Giac-Zin	13.4	0.50	R	9.7		6 23.7	10 34	3.7	2	6	14	Manchuria, southeastern Siberia	81	156	42+	none	YEOIHW19
Sep 21	1 06	P/Giac-Zin	13.4	0.50	S	10.6		6 24.6	10 09	2.9	2	6	14	Denmark, Poland, s.w. USSR, Iran	82	158	45+	none	YEOIHW19
Sep 23	0 31	P/Giac-Zin	13.4	0.50		10.4		6 30.0	7 38	3.1	2	6	15	northern Africa, Yemen	82	157	67+	none	YEOIHW19
Sep 23	11 44	P/Giac-Zin	13.5	0.51		11.2		6 31.2	7 03	2.4	2	7	15	eastern Australia?n (low)	82	153	72+	all	YEOIHW19
Sep 24	18 07	P/Giac-Zin	13.5	0.51	T	9.7		6 34.4	5 29	3.8	2	7	15	Indonesia, Australia	83	140	83+	all	YEOIHW19
Sep 25	2 34	P/Giac-Zin	13.5	0.51	U	10.7		6 35.3	5 03	2.9	2	7	15	U.K., France, Italy, Greece, Egypt	83	136	85+	none	YEOIHW19
Sep 25	9 37	P/Giac-Zin	13.5	0.52	V	11.6		6 36.0	4 42	2.1	2	7	15	western Mexico, Peru, Chile	83	133	87+	w 100W	YEOIHW19
Sep 30	0 17	P/Giac-Zin	13.6	0.54		10.0	K0	6 46.6	-0 39	3.6	2	7	16	Poland, s.w. U.S.S.R., Iran, India	84	85	99-	all	YEOIHW19
Oct 5	17 25	P/Giac-Zin	13.7	0.57	134030	8.9	A0	6 57.8	-6 39	4.8	3	8	16	Japan? ; New Zealand	86	39	64-	all	YEOIHW19
Oct 19	6 23	P/Halley	16.2	1.46		11.6		5 55.2	20 53	4.6	6	14	21	northern South America	116	171	33+	none	YEOIHW24
Oct 20	14 17	P/Halley	16.1•1.41			12.8		5 52.9	20 58	3.4	5	13	21	Aleutians, s.e. Siberia; Japan?s	118	154	47+	none	YEOIHW24
Oct 21	10 29	P/Halley	16.1	1.39		12.0		5 51.3	21 01	4.1	5	12	20	Mexico? Hawaii?n	119	142	56+	w150 W	YEOIHW24
Oct 21	12 58	P/Halley	16.1	1.38		10.4		5 51.1	21 02	5.7	5	12	20	New Zealand	120	141	57+	all	YEOIHW24
Oct 23	20 50	P/Halley	15.9	1.31		14.1		5 46.3	21 11	2.0	5	11	19	n.e. China, s. U.S.S.R., Balkans	123	110	79+	w 70 E	YEOIHW24
Oct 26	14 25	P/Giac-Zin	14.1	0.70	173652	9.1	B8	7 22.1	-23 16	5.0	4	12	20	western Pacific, Tasman Sea	94	101	96+	all	YEOIHW19
Oct 29	20 18	P/Halley	15.4	1.13		12.1		5 29.9	21 38	3.4	4	8	16	U.S.S.R., central Europe	133	35	99-	all	YEOIHW24

region which might affect the observability of occultation-candidate stars.

The most outstanding event, involving a naked-eye star over 3 magnitudes brighter than any other occulted by a comet in either 1985 or 1986 in North America, is the occultation of SAO 58030 by G-Z on September 4. The event takes on added importance, since it occurs just one week before the International Cometary Explorer (ICE) spacecraft [see *O.N.* *3* (6), 117] will pass through G-Z's ion tail. A few good observations of the occultation would yield G-Z's dust production rate, which when combined with ICE's *in situ* measurements will give unprecedented

Table 2, Part A

1985 DATE	No.	COMET OR ASTEROID Name	km-diam.-"	RSOI	Type	MOTION °/Day	PA	STAR SAO No	DM No.	D	STELLAR DIAMETER m"	m	Time	df	S	COMPARISON DATA AGK3 No	Shift	Time	APPARENT R.A.	Dec.
Aug 7	14	Irene	155 0.11	719	S	0.221	238°	191052	-23°17367						S				$22^h18^m.3$	-22°59'
Aug 20		P/Giac-Zin	50 0.14	48		1.484	129	24333	+50 871	B					A				3 58.7	50 51
Aug 20		P/Giac-Zin	50 0.14	48		1.484	129	24333	+50 871	A					AS	N50° 415	0".83	$-0^m.3$	3 58.7	50 51
Aug 20		P/Giac-Zin	50 0.14	48		1.490	129	24353	+50 882		0.10	35	2	0.3	AS	N50 417	0.83	-0.1	4 00.7	50 36
Aug 22	1036	Ganymed	40 0.07	40	S	0.696	114	38952	+43 758		0.16	88	5	0.5	AS	N43 384	-0.25	0.2	3 33.2	43 42
Sep 4		P/Giac-Zin	50 0.15	47		1.685	145	58030	+33 1045		1.27	432	18	3.2	AG	N33 520	-1.09	-0.2	5 25.9	33 15
Sep 6		P/Giac-Zin	50 0.15	47		1.685	146	A							C				5 34.1	30 43
Sep 6		P/Giac-Zin	50 0.15	47		1.685	146	B							C				5 34.6	30 35
Sep 6		P/Giac-Zin	50 0.15	47		1.685	146	C							C				5 35.1	30 25
Sep 7		P/Giac-Zin	50 0.15	47		1.682	146								C				5 38.8	29 11
Sep 8		P/Giac-Zin	50 0.15	47		1.673	147	D							C				5 45.8	26 48
Sep 9		P/Giac-Zin	50 0.15	47		1.671	147	E							C				5 46.7	26 29
Sep 10		P/Giac-Zin	50 0.15	47		1.663	148								C				5 50.3	25 13
Sep 10		P/Giac-Zin	50 0.15	47		1.663	148								C				5 50.5	25 07
Sep 10		P/Giac-Zin	50 0.15	47		1.660	148								C				5 51.5	24 46
Sep 11		P/Giac-Zin	50 0.15	47		1.649	149	F							C				5 55.3	23 20
Sep 11		P/Giac-Zin	50 0.15	47		1.647	149	G							C				5 55.9	23 07
Sep 11		P/Giac-Zin	50 0.15	47		1.645	149								C				5 56.7	22 48
Sep 11		P/Giac-Zin	50 0.15	47		1.644	149								C				5 56.9	22 44
Sep 12		P/Giac-Zin	50 0.15	47		1.631	149	H							C				6 00.5	21 20
Sep 12		P/Halley	100 0.05	332		0.051	68								C				6 14.2	19 33
Sep 12		P/Giac-Zin	50 0.15	47		1.628	149	I							C				6 01.2	21 05
Sep 13		P/Giac-Zin	50 0.15	47		1.627	149	J							C				6 01.5	20 56
Sep 13		P/Giac-Zin	50 0.15	47		1.623	149	K							C				6 02.3	20 38
Sep 13		P/Giac-Zin	50 0.15	47		1.623	149	L							C				6 02.3	20 38
Sep 14		P/Giac-Zin	50 0.14	47		1.603	150								C				6 06.5	18 54
Sep 17		P/Giac-Zin	50 0.14	47		1.557	151								C				6 14.7	15 28
Sep 17		P/Giac-Zin	50 0.14	48		1.544	151								C				6 16.6	14 38
Sep 17		P/Giac-Zin	50 0.14	48		1.539	151								C				6 17.4	14 17
Sep 18		P/Giac-Zin	50 0.14	48		1.535	151	95515	+14 1239		0.34	121	5	0.9	A	N14 630	1.51	0.2	6 17.9	14 03
Sep 18		P/Giac-Zin	50 0.14	48		1.533	151								C				6 18.2	13 54
Sep 19		P/Giac-Zin	50 0.14	48		1.493	152								C				6 23.4	11 36
Sep 20		P/Giac-Zin	50 0.14	48		1.490	152	M							C				6 23.8	11 25
Sep 20		P/Giac-Zin	50 0.14	48		1.489	152	N							C				6 23.9	11 21
Sep 20		P/Giac-Zin	50 0.14	48		1.486	152	P							C				6 24.3	11 10
Sep 20		P/Giac-Zin	50 0.14	48		1.475	152	R							C				6 25.6	10 33
Sep 21		P/Giac-Zin	50 0.14	48		1.467	152	S							C				6 26.5	10 08
Sep 23		P/Giac-Zin	50 0.14	48		1.418	152								C				6 31.9	7 37
Sep 23		P/Giac-Zin	50 0.14	48		1.406	153								C				6 33.1	7 02
Sep 24		P/Giac-Zin	50 0.13	49		1.373	153	T							C				6 36.3	5 28
Sep 25		P/Giac-Zin	50 0.13	49		1.364	153	U							C				6 37.2	5 02
Sep 25		P/Giac-Zin	50 0.13	49		1.356	153	V							C				6 37.9	4 40
Sep 30		P/Giac-Zin	50 0.13	49		1.234	154								A	S00 866			6 48.5	-0 42
Oct 5		P/Giac-Zin	50 0.12	51		1.084	156	134030	-06 1869		0.06	25	1	0.2	S				6 59.6	-6 42
Oct 19		P/Halley	100 0.09	270		0.390	279								C				5 57.3	20 53
Oct 20		P/Halley	100 0.10	268		0.426	279								C				5 55.0	20 58
Oct 21		P/Halley	100 0.10	266		0.450	279								C				5 53.5	21 02
Oct 21		P/Halley	100 0.10	266		0.453	279								C				5 53.3	21 02
Oct 23		P/Halley	100 0.11	262		0.527	278		KLH 7705						H				5 48.5	21 12
Oct 26		P/Giac-Zin	50 0.10	57		0.637	168	173652	-23 5402						S				7 23.6	-23 19
Oct 29		P/Halley	100 0.12	251		0.772	276								C				5 32.1	21 40

Table 1, Part B

1985 DATE	UNIVERSAL TIME	COMET OR ASTEROID NAME	m_v	Δ,AU	STAR SAO No	m_v	Sp	R.A.(1950)	Dec.	OCCULTATION Δm	Dur	df	P	Possible Area	El SUN	MOON El	%Snl	Up	Ephem. Source
Oct 30	0^h06^m	P/Halley	15.4	1.13		11.6		$5^h29^m.4$	21°39'	3.8	4^s	8	16	nw India, Mideast, Mediterranean	133°	33°	99-	all	YEOIHW24
Nov 4	3 58	P/Halley	15.0	0.99		12.1		5 09.0	22 01	2.9	3	6	14	Brazil, Peru	143	34	67-	e 75°W	YEOIHW24
Nov 6	6 36	P/Halley	14.8	0.93		11.3		4 58.5	22 08	3.5	3	5	14	southeast Canada, northwest USA	147	63	45-	e110 W	YEOIHW24
Nov 7	19 20	P/Halley	14.6	0.89		11.0		4 49.9	22 12	3.6	3	5	13	China, India, Arabia, Sudan	151	85	29-	e 90 E	YEOIHW24
Nov 10	3 56	P/Halley	14.4	0.84		11.6		4 35.1	22 14	2.8	3	5	12	Scandinavia, Greenland, Canada	157	122	9-	e 0	YEOIHW24
Nov 12	23 17	P/Halley	14.1	0.78	76535	9.0	A3	4 14.6	22 08	5.1	2	4	11	Sri Lanka, Yemen, n.Africa, Brazil	164	169	0+	none	YEOIHW24
Nov 14	19 34	P/Halley	13.9	0.74		11.6		3 59.4	21 57	2.4	2	4	11	China, Mideast, northwest Africa	170	159	7+	none	YEOIHW24
Nov 15	10 40	P/Halley	13.8	0.73		11.2		3 53.8	21 52	2.7	2	4	11	Mexico; Hawaii?s	171	149	12+	none	YEOIHW24
Nov 15	19 47	P/Halley	13.8	0.72		10.9		3 50.4	21 48	2.9	2	4	10	n. U.S.S.R., Scandinavia, U.K.	172	142	15+	none	YEOIHW24
Nov 16	22 16	P/Halley	13.6	0.70		10.4		3 40.1	21 36	3.3	2	3	10	Maldives?; cen. Africa, e. Brazil	176	124	25+	w 0	YEOIHW24
Nov 19	14 22	P/Halley	13.5	0.67		8.2	A0	3 13.1	20 51	5.3	2	3	10	Samoa, New Guinea, Timor	174	82	52+	w150 E	YEOIHW24
Nov 19	15 48	P/Halley	13.5	0.67		10.7		3 12.5	20 50	2.9	2	3	10	Japan, China, India, Ethiopia	174	81	53+	w115 E	YEOIHW24
Nov 21	15 07	P/Halley	13.5	0.64		10.5		2 51.1	20 02	3.0	2	3	9	Arctic, northwest U.S.S.R.	167	52	72+	w130 E	YEOIHW24
Nov 22	5 13	P/Halley	13.5	0.64		11.3		2 44.5	19 45	2.3	2	3	9	southern Canada	165	43	77+	all	YEOIHW24
Nov 22	8 29	P/Halley	13.5	0.64		10.9		2 43.0	19 41	2.7	2	3	9	northern Canada, Alaska, Japan	164	41	78+	w 95 W	YEOIHW24
Nov 25	17 10	P/Halley	13.5	0.62		11.1		2 04.4	17 42	2.5	2	3	9	Malaysia, Tanzania, Zimbabwe	152	9	97+	all	YEOIHW24
Nov 26	9 52	P/Halley	13.6	0.62		10.5		1 56.3	17 13	3.1	2	3	9	Tahiti, Fiji, southeast Australia	149	19	99+	all	YEOIHW24
Nov 27	1 15	Antikleia	15.3	2.90	190559	5.3	K0	21 39.2	-23 29	10.0	1	13	143	Oregon, Washington, Alberta	75	100	100+	all	EMP 1984
Dec 2	2 02	P/Halley	13.8	0.64		9.3	G5	0 54.2	12 46	4.5	2	3	9	n.w. Africa, Canary Is., Mexico	128	102	82-	e 80 W	YEOIHW24
Dec 7	6 46	P/Halley	14.1	0.69		11.6		0 06.8	8 36	2.6	2	4	10	western U.S.A.	110	170	29-	none	YEOIHW24
Dec 9	4 45	P/Halley	14.2	0.72		11.5		23 52.1	7 12	2.8	2	4	10	northern Canada, southeast Alaska	104	144	12-	none	YEOIHW24
Dec 9	20 10	P/Halley	14.2	0.73	128409	8.6	G0	23 47.6	6 46	5.7	2	4	11	central Africa	103	133	7-	none	YEOIHW24
Dec 11	16 25	P/Halley	14.3	0.76		10.5		23 35.2	5 33	3.8	3	4	11	India, Arabia, Sudan	97	103	0-	none	YEOIHW24
Dec 14	10 30	P/Giac-Zin	15.0	0.99	197296	10.1	F0	6 50.3	-38 02	5.0	6	23	29	New Zealand; Queensland?s	116	114	8+	w160 E	YEOIHW19
Dec 14	10 53	Bower	15.4	2.20	118847	6.7	A2	11 23.1	3 35	8.7	2	19	82	California, Mexico	92	125	8+	none	EMP 1984

data about any comet. If rapidly transmitted observations show that the dust production is much greater than expected (current uncertainties are at least an order of magnitude), we may retarget ICE to a point a safer distance from the nucleus. A final midcourse correction maneuver is scheduled for September 8th, and I am involved in its planning.

The September 4th occultation path crosses the northwestern U.S.A. and southern Canada, as shown on the map on page 258. The recent determinations of G-Z's orbit have stabilized, so I expect that the current prediction uncertainty is about ±2". This accuracy corresponds to a smaller-than-usual linear error due to G-Z's distance of less than half an astronomical unit. During the week before the occultation, G-Z will be near perihelion and much fuzzier than an asteroid; also, the motion is very fast. Hence, I believe that the last-minute astrometry which we hope to obtain for the event will be accurate to ±0".5 (total range 340 km) or better. If ten portable photoelectric telescopes were spaced across this path, their cross-track resolution would be 38 km, probably sufficient so that at least two of them would record a 5% or more drop of the star's light. Seventy visual observers could achieve 5-km accuracy in locating the path center, which would be valuable for comparison with dust models if only one photoelectric recording is obtained. Visual observers should do their best to estimate the duration and depth of any dimming seen. *Sky and Telescope* will be publishing a finder chart showing the magnitudes of nearby stars to help estimate the visual depth of any occultation which might be seen. Richard Nolthenius' observation of a dimming of a star by Comet IRAS-Araki-Alcock in 1983 indicated a scale of about 20 km for the size of visually observable dimmings. That comet was perhaps twice as large as G-Z.

Those living in the northwestern U.S.A., or planning to travel there to observe this unique event, should contact the regional coordinator, Richard Linkletter, 1108 Lafayette Ave. N., Bremerton, WA 98310, phone 216,479-1191, so that mobile observers can be targeted to fill gaps in the coverage by fixed-site observers. The coordinator for Alberta and Saskatchewan is Andrew Lowe, 4944 Dalton Dr. N.W., Apt. 705, Calgary, Alberta T3A 2E6, phone 403,286-0854. Possible coordinators for more easterly locations are Richard Bochonko in Winnipeg, David Brown in Montreal, Roy Bishop in Nova Scotia, and Randolph Joyce in St. John's, Newfoundland. I will try to provide overall coordination at P.O. Box 7488, Silver Spring, MD 20907, phone 301,585-0989, where last-minute updates will also be available. Anyone observing any dimming possibly due to G-Z should telephone me or the regional coordinator promptly, since decisions will need to be made quickly for the ICE targeting. Those with a clear view who don't see an occultation also should report their data quickly.

Observers also are encouraged to monitor the other occultations which might occur in their areas, preferably from three or more sites separated across-track by 10 to 20 km. With luck, some additional valuable information about G-Z's dust production might be obtained, but dimmings of these fainter stars will have to be more pronounced (that is, observers need to be closer to the nucleus occultation path) in order to detectable. Two good events involving tenth-magnitude stars predicted to be visible from populous parts of North America occur just after 9 hours U.T. of September 11 (could be especially valuable since it occurs less than two hours before the ICE encounter) and on September 13.

Table 2, Part B

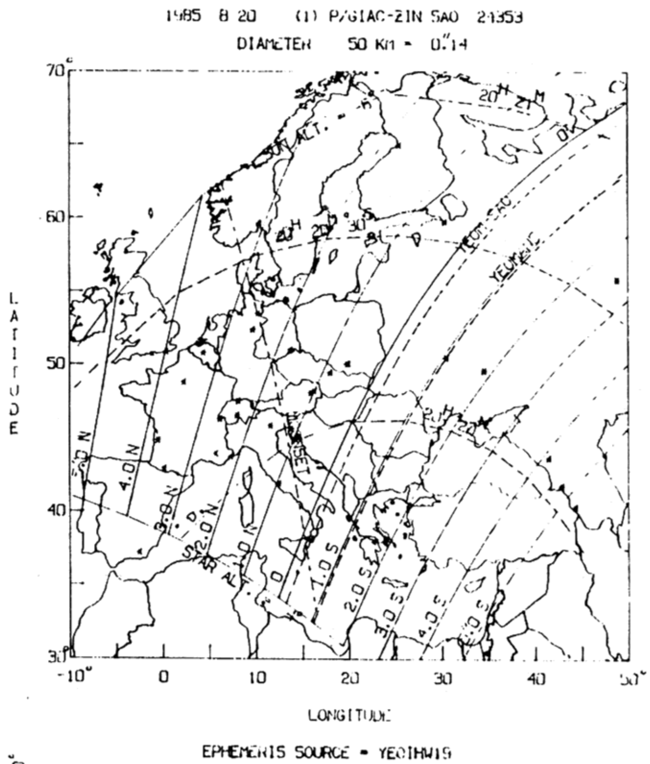
1985		COMET OR ASTEROID					MOTION		STAR		STELLAR DIAMETER						COMPARISON DATA			APPARENT	
DATE	No.	Name	km-diam.	"	RSOI	Type	°/Day	PA	SAO No	DM No.	D	m"	m	Time	df	S	AGK3 No	Shift	Time	R.A.	Dec.
Oct 30		P/Halley	100	0.12	251		0.780	276°								C				$5^h31^m.6$	21°41'
Nov 4		P/Halley	100	0.14	242		1.079	273								C				5 11.1	22 04
Nov 6		P/Halley	100	0.15	238		1.230	272								C				5 00.6	22 11
Nov 7		P/Halley	100	0.15	235		1.352	271								C				4 52.1	22 16
Nov 10		P/Halley	100	0.16	231		1.557	270								C				4 37.3	22 18
Nov 12		P/Halley	100	0.18	225		1.828	268	76535	+21° 616						XA	N22° 405	0.24	0.0	4 16.8	22 14
Nov 14		P/Halley	100	0.19	222		2.017	266								C				4 01.5	22 03
Nov 15		P/Halley	100	0.19	221		2.082	266								C				3 55.9	21 58
Nov 15		P/Halley	100	0.19	220		2.121	265								C				3 52.5	21 55
Nov 16		P/Halley	100	0.20	218		2.234	264								C				3 42.2	21 43
Nov 19		P/Halley	100	0.21	213		2.492	262		+20 531						XA	N20 295			3 15.2	20 59
Nov 19		P/Halley	100	0.21	213		2.498	262								C				3 14.6	20 58
Nov 21		P/Halley	100	0.21	209		2.656	260								C				2 53.1	20 11
Nov 22		P/Halley	100	0.22	208		2.696	259								C				2 46.5	19 54
Nov 22		P/Halley	100	0.22	208		2.704	259								C				2 45.0	19 50
Nov 25		P/Halley	100	0.22	201		2.833	256		KLH 1511						H				2 06.3	17 52
Nov 26		P/Halley	100	0.22	200		2.838	256								C				1 58.3	17 24
Nov 27	651	Antikleia	29	0.01	58	S	0.290	59	190559	-2317057	A	1.82	3830	151	11.4	PG	-2317057	-0.00	1.0	21 41.2	-23 20
Dec 2		P/Halley	100	0.22	189		2.604	252		+12 114						XA	N12 105			0 56.1	12 57
Dec 7		P/Halley	100	0.20	179		2.128	249								C				0 08.7	8 48
Dec 9		P/Halley	100	0.19	175		1.940	249								C				23 54.0	7 24
Dec 9		P/Halley	100	0.19	174		1.879	249	128409	+06 5207		0.18	95	2	0.6	AS	N06 3236	-0.11	-0.0	23 49.4	6 58
Dec 11		P/Halley	100	0.18	170		1.708	248								C				23 37.0	5 45
Dec 14		P/Giac-Zin	50	0.07	76		0.286	273	197296	-37 3133						S				6 51.5	-38 05
Dec 14	1639	Bower	39	0.02	76	C	0.235	124	118847	+04 2461	V	0.17	267	17	0.9	ZG	N03 1493	-0.08	1.4	11 24.9	3 23

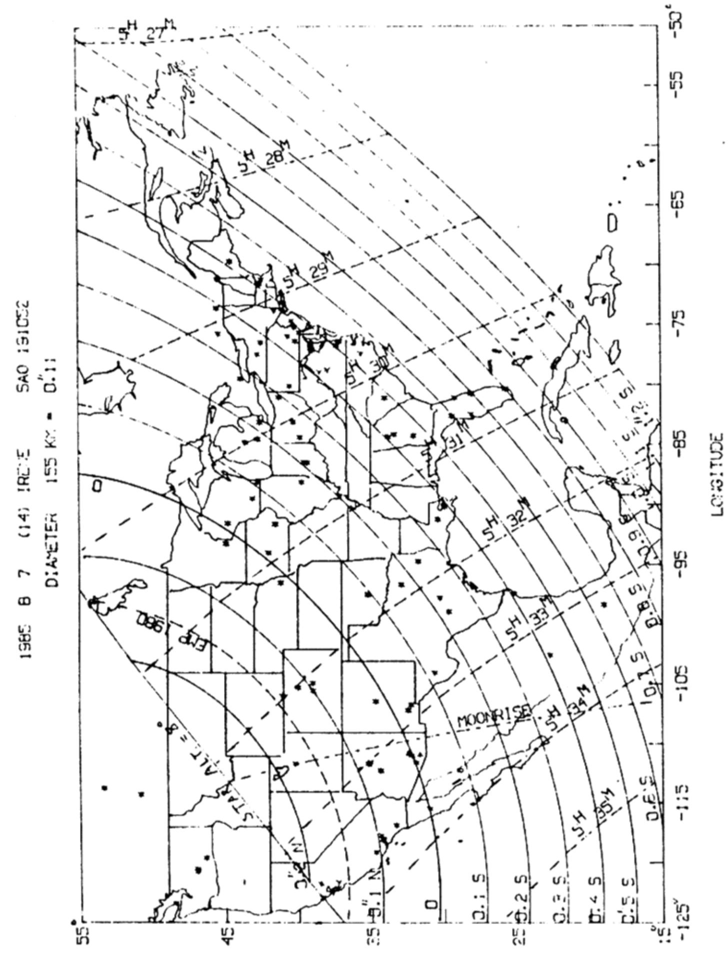
The predictions for the occultations of A.C. stars are somewhat more uncertain than the others due to the errors of those star positions. I hope that these errors will be reduced for some of the events by measurement of existing Lick Observatory plates. Also, there is an error due to the fact that my prediction program uses different (less accurate) methods for computing the location of the earth than Don Yeomans uses for his orbit determinations. We made some accurate comparisons, and found that the maximum difference amounts to 1".2 in early August, in the sense that Yeomans' ephemeris is south of mine. The difference decreases to zero in October. This correction has been incorporated into my basic prediction only for the September 4th occultation. For the other events, the path computed with Yeomans' correct geocentric ephemeris will be south of my predicted path, as shown by the dashed path marked "Yeomans" (which should be considered the most likely path) on the regional maps published in this issue. Since we will not receive Sôma's world maps in time to include in this issue, regional maps for all North American and European cometary occultations into late October are published in this issue.

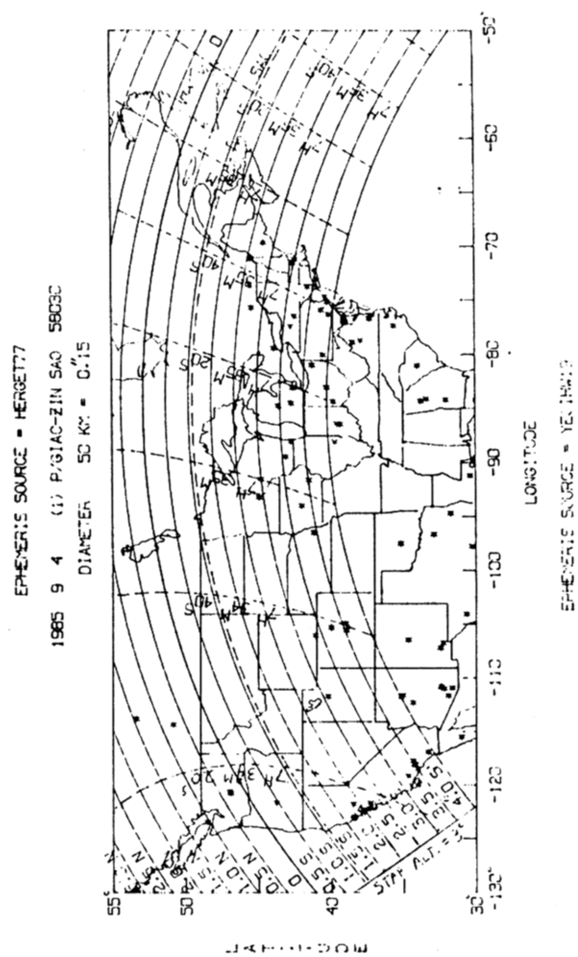
G-Z's fast motion of well over a degree per day caused problems with the finder charts. For the A.C. plots, all daily ephemeris points more than a short distance outside the box are deleted, with the result that only one tick mark is plotted, and no path, since all other daily tick marks are removed. However, there is no such logic in the program which produces the AGK3 plots, which are drawn several at a time, close to each other. The standard four-day path for G-Z extends well beyond the boundaries of the plot, usually extending onto an adjacent plot. I have tried to white-out most of the extraneous lines, but time has prevented me from checking and preparing the finder charts as well as I usually prefer. Also, I did not have time to annotate the charts by comparing them with the *True Visual Magnitude Star Atlas*. I will do this later, and will send copies of all charts for local events with significant changes to anyone who sends me a self-addressed (and stamped, if in the U.S.A.) envelope. Also, readers can telephone 301,585-0989 to find which finder charts have significant changes. In general, about a quarter of the charts have possibly important changes. I apologize for any resulting confusion and inconvenience. Some of the G-Z A.C. plots are almost hopelessly cluttered with hundreds of faint stars. Credit for the finder charts must be shared with my colleague Steve Stalos. Without his late-evening efforts, their production and this issue would have been delayed two weeks. The computer-generated charts can now be generated more easily than in the past.

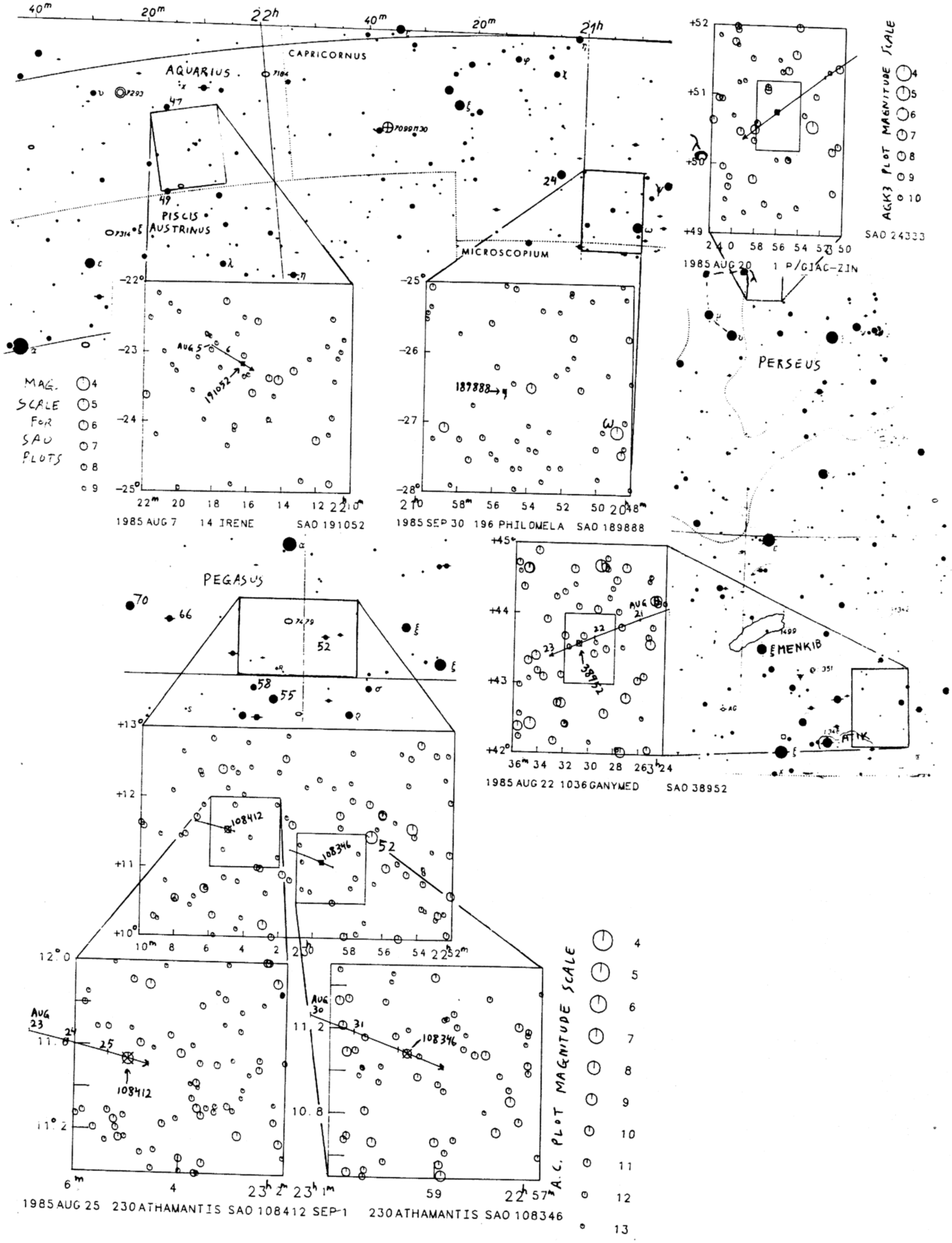
Predictions were computed for a few other events found by Edwin Goffin which are not in the table. Two of these were for the occultations on July 24, which occurred before this issue went to press. My calculations for the occultation of 55 Arietis by (2613) agreed well with Goffin's data, but my path for the (47) Aglaja occultation was about 1" south of his path, putting it over the southernmost part of Mexico just before sunrise. However, the observations of last September's occultation showed that Aglaja's ephemeris was about 1" in error. My path for the August 7th occultation by (14) Irene is a little south of Goffin's path, putting it over populous parts of the U.S.A. The southern declination causes the path to be very wide, so that large numbers of observers could time it. The event deserves a maximum effort, unless the first astrometry indicates a path a little farther north, off the earth's surface. The SAO position for SAO 162712, occulted by (374) Burgundia on October 7, is from the relatively poor G.C. catalog. The path computed from usually better Yale-catalog data, provided by Wayne Warren, misses the earth's surface to the north. My calculations for the occultation by (115) Thyra on December 14 puts the path over southeastern Alaska, north of Goffin's path.

[Ed: The remainder of this issue consists of figures relating not only to the occultations listed in the above article, but also relating to other asteroidal occultations; also included are two of Robert Sandy's grazing occultation reduction profiles.]









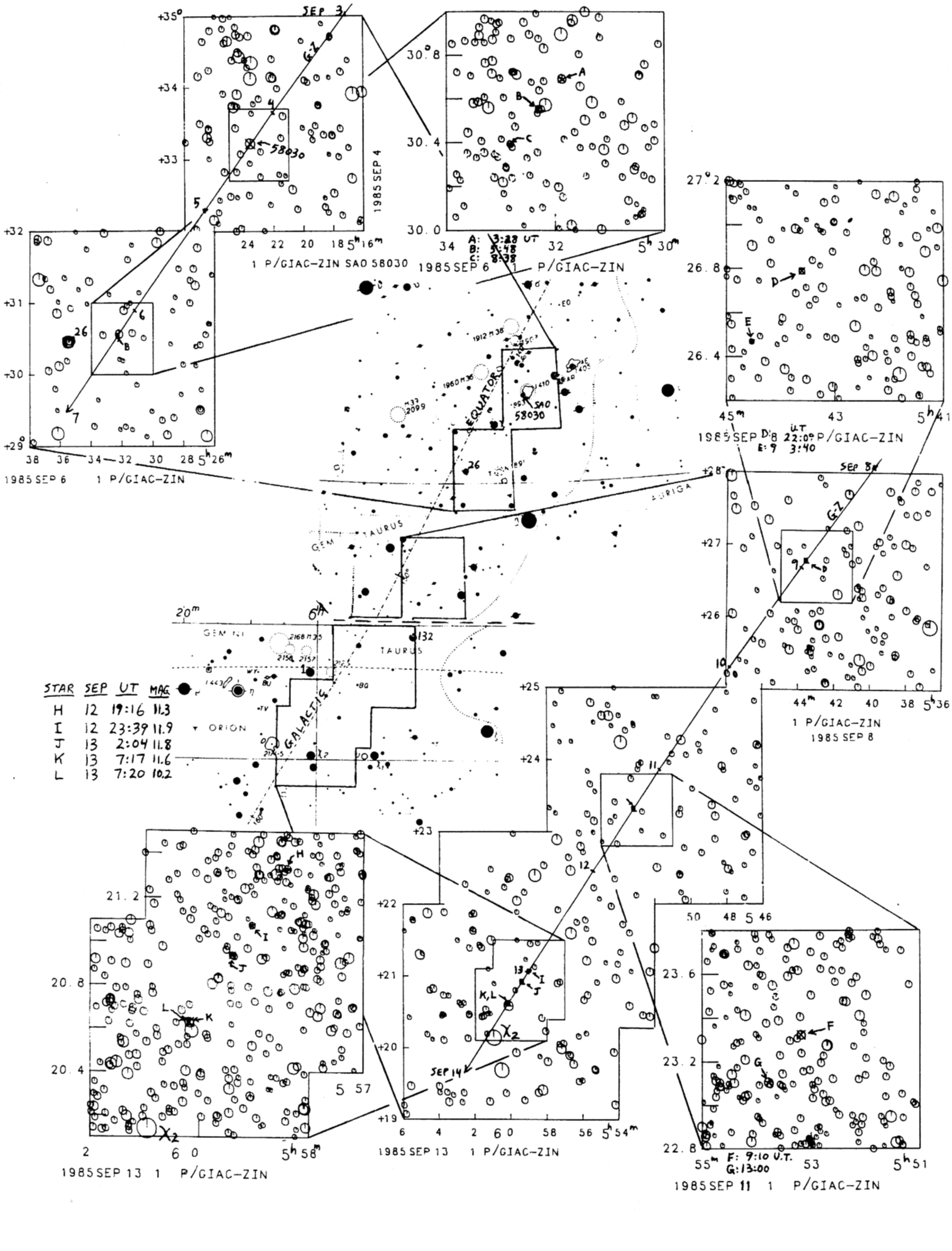
1985 AUG 7 14 IRENE SAO 191052

1985 SEP 30 196 PHILOMELA SAO 189888

1985 AUG 20 1 P/GIAC-ZIN SAO 24333

1985 AUG 22 1036 GANYMED SAO 38952

1985 AUG 25 230 ATHAMANTIS SAO 108412 SEP 1 230 ATHAMANTIS SAO 108346


SEP 3
1985 SEP 4
1 P/GIAC-ZIN SAO 58030
1985 SEP 6 1 P/GIAC-ZIN
A: 3:28 UT
B: 5:48
C: 8:38
1985 SEP D: 8 22:09 P/GIAC-ZIN
E: 9 3:40
SEP 8
1 P/GIAC-ZIN
1985 SEP 8
AURIGA
TAURUS
GEMINI
EQUATOR
GALACTIC
ORION
STAR SEP UT MAG
H 12 19:16 11.3
I 12 23:39 11.9
J 13 2:04 11.8
K 13 7:17 11.6
L 13 7:20 10.2
SEP 14
1985 SEP 13 1 P/GIAC-ZIN
1985 SEP 11 1 P/GIAC-ZIN
F: 9:10 U.T.
G: 13:00

1985 9 8 (1) P/GIACOBINI-ZINNER STAR "D"
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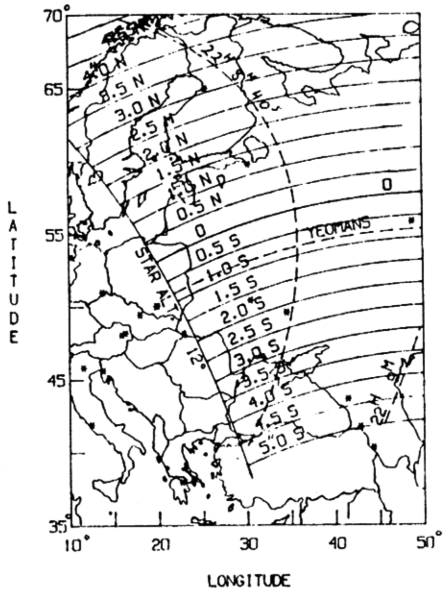

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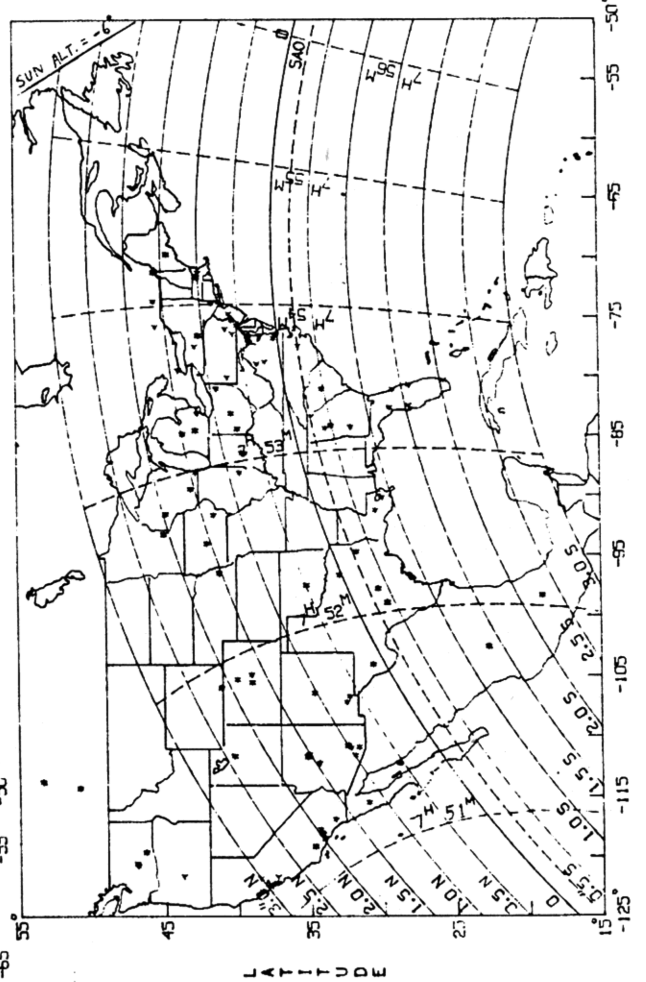
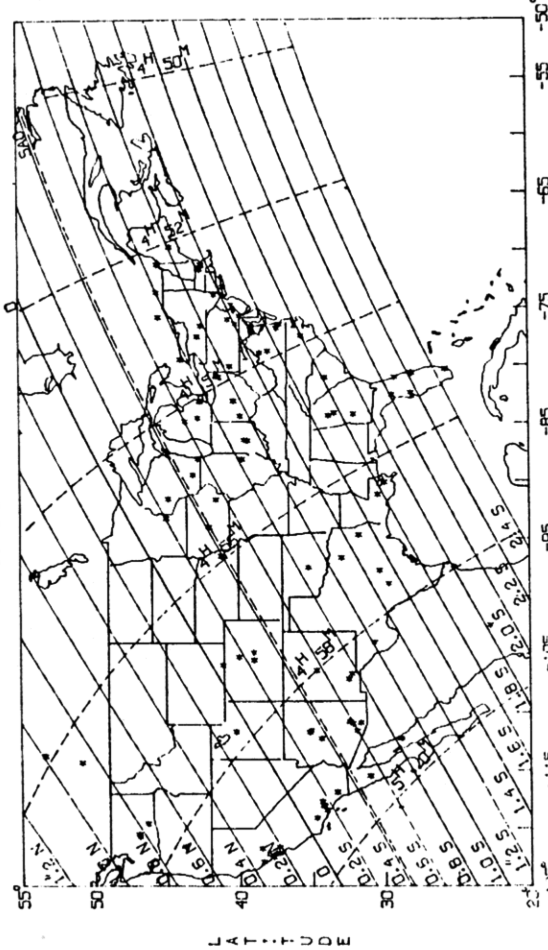
1985 8 22 (1036) GANYMED SAO 38952
DIAMETER 40 KM = 0."07



EPHEMERIS SOURCE - EMP 1985

1985 9 1 (230) ATHAMANTIS SAO 108346
DIAMETER 130 KM = 0."14



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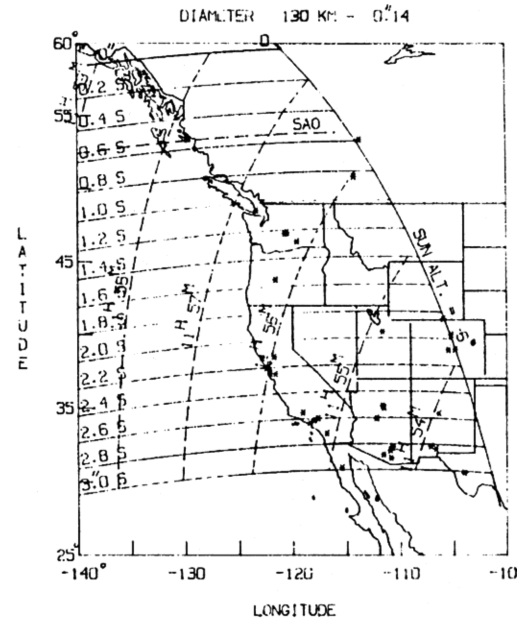
1985 8 25 (230) ATHAMANTIS SAO 108412
DIAMETER 130 KM = 0."14



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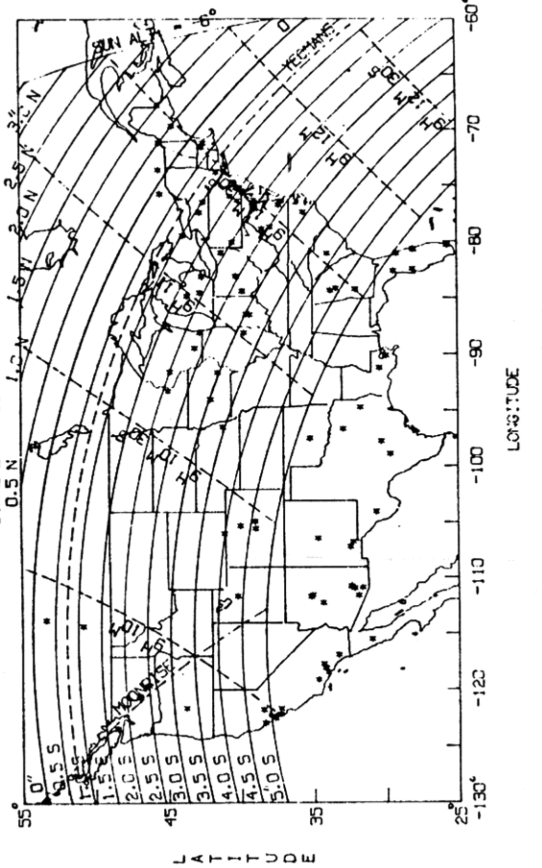
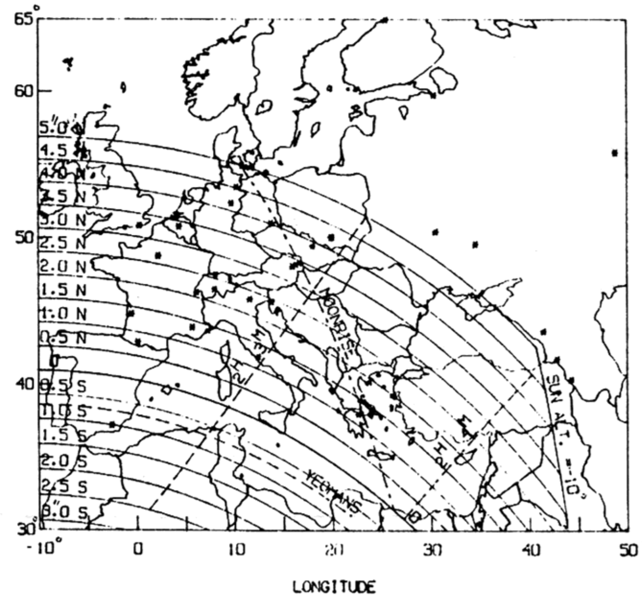


1985 9 11 (1) P/GIAC-ZIN STAR "F"
DIAMETER 50 KM = 0."15
EPHEMERIS SOURCE = YEOIHW19

1985 9 13 (1) P/GIAC-ZIN STAR "J"
DIAMETER 50 KM = 0."15



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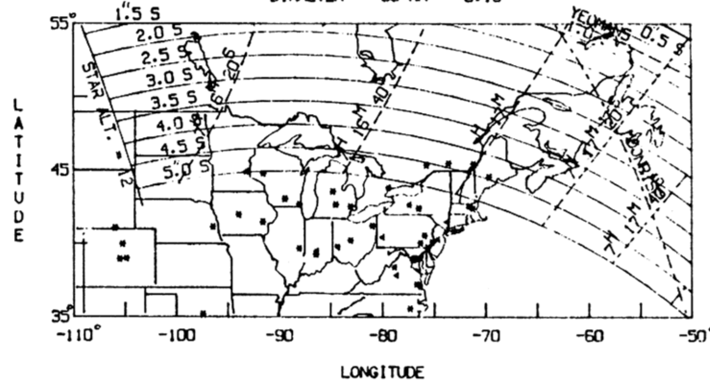

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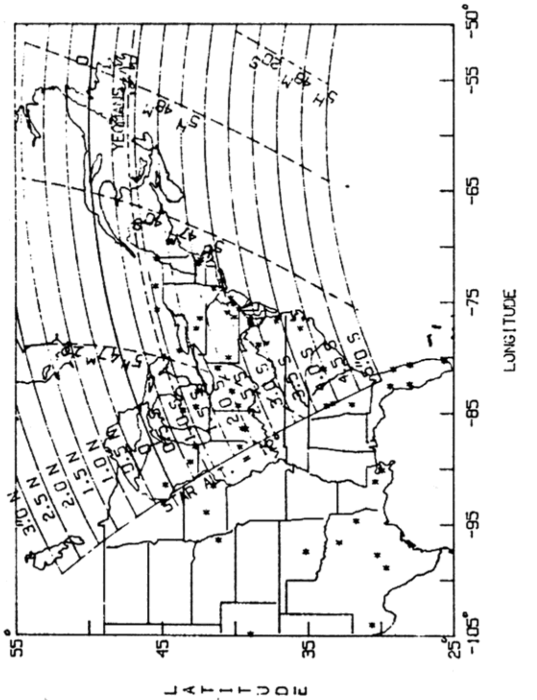

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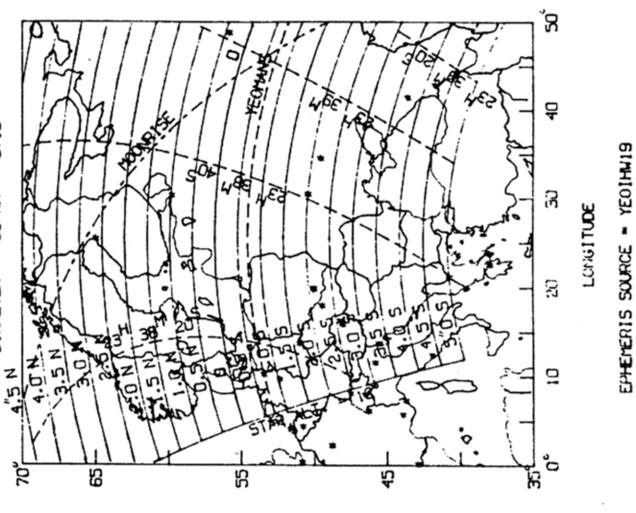

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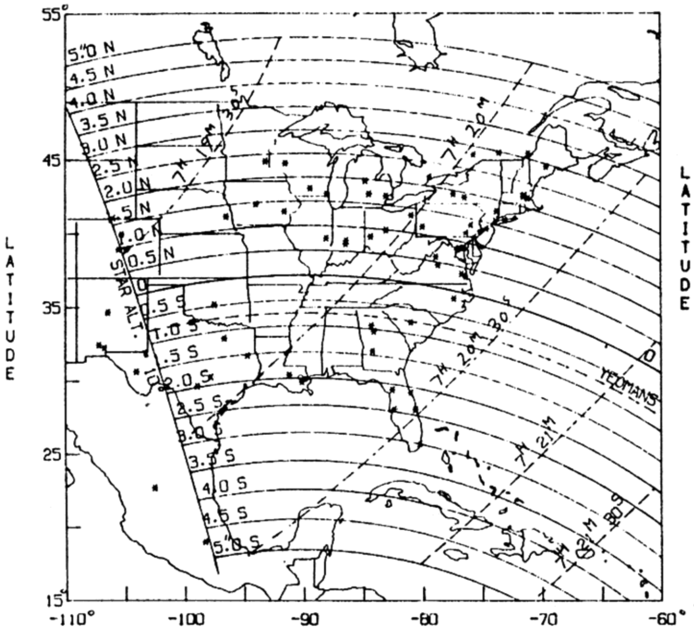
EPHEMERIS SOURCE = YEOIHW19

1985 9 13 (1) P/GIAC-ZIN STAR "L"

DIAMETER 50 KM = 0."15



LONGITUDE

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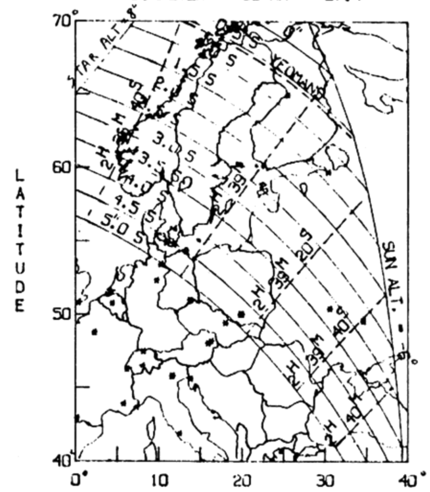
DIAMETER 50 KM = 0."14



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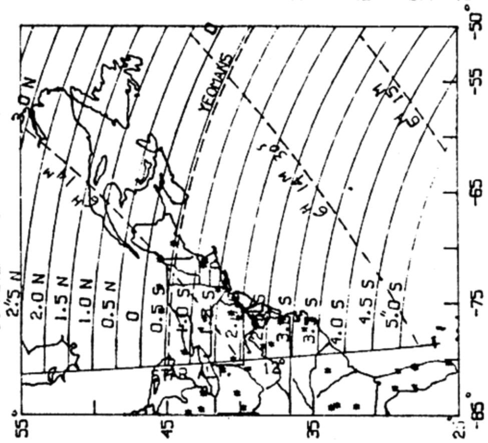

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1985 9 21 (1) P/GIAC-ZIN STAR "S"

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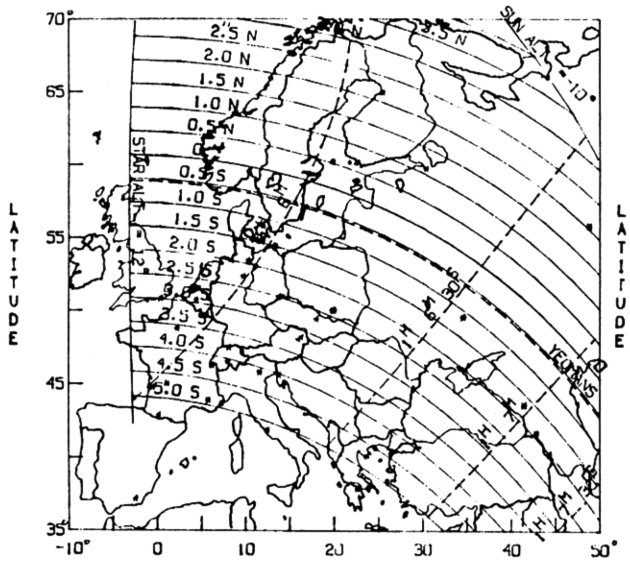

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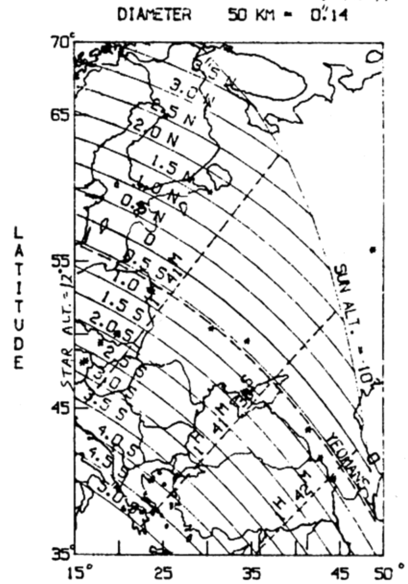

LONGITUDE

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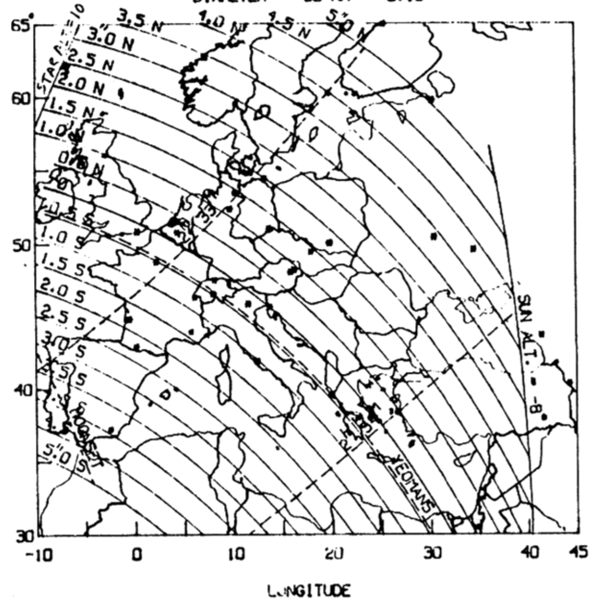

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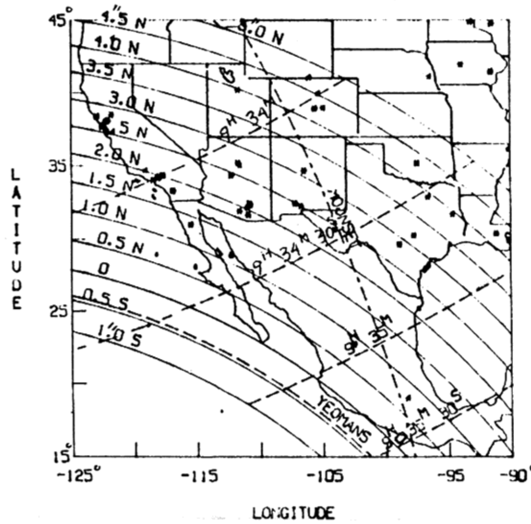

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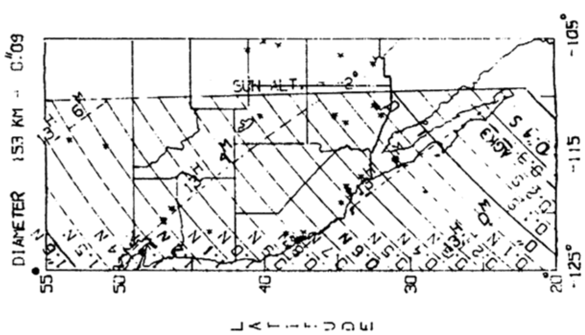
1985 9 26 (70) PANOPAEA SAO 76868

DIAMETER 153 KM = 0."09



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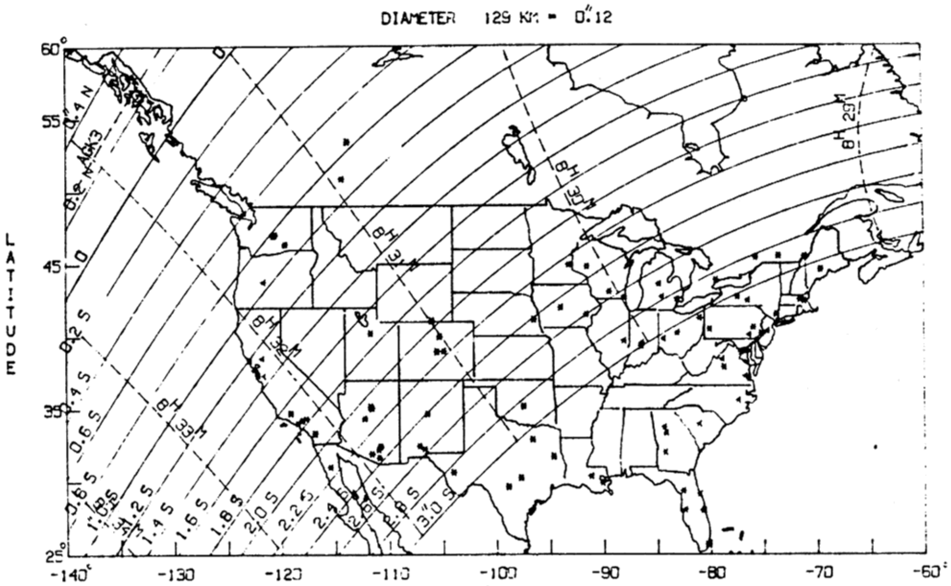
1985 9 28 (105) ARTEMIS SAO 109095

DIAMETER 129 KM = 0."12



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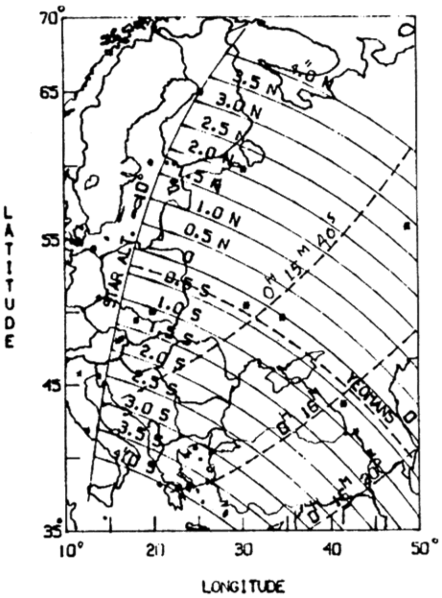

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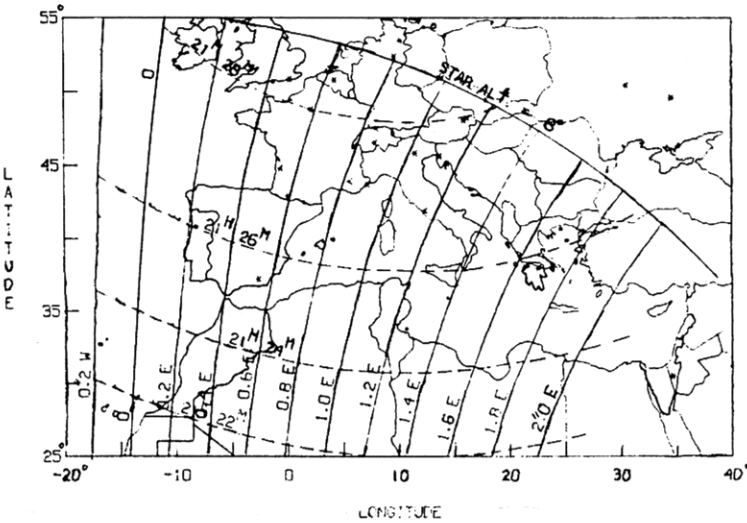
DIAMETER 162 KM = 0."09



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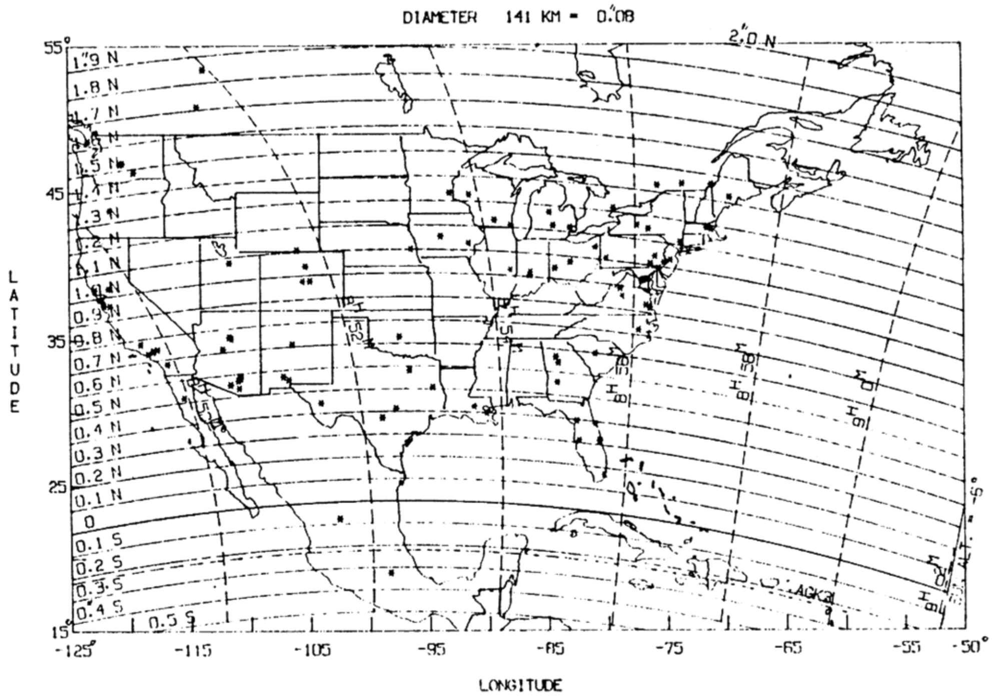

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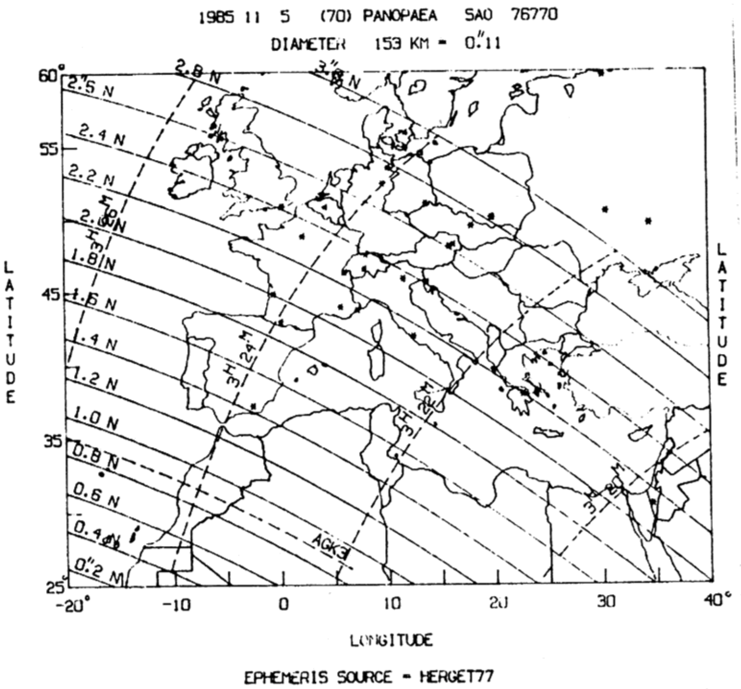
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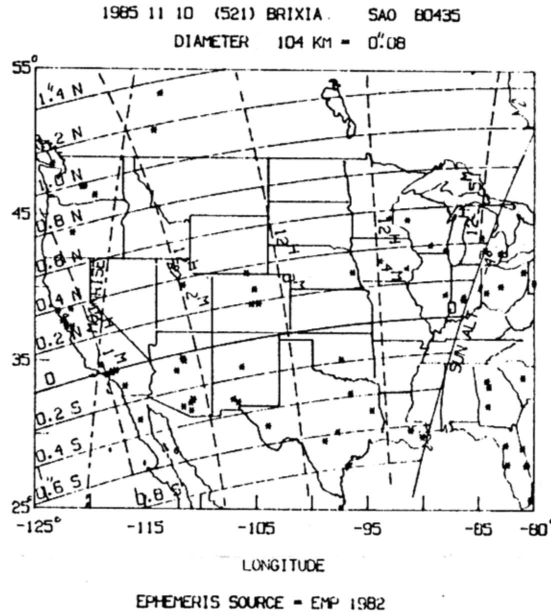
LATITUDE
LONGITUDE
EPHEMERIS SOURCE = HERGET77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LONGITUDE
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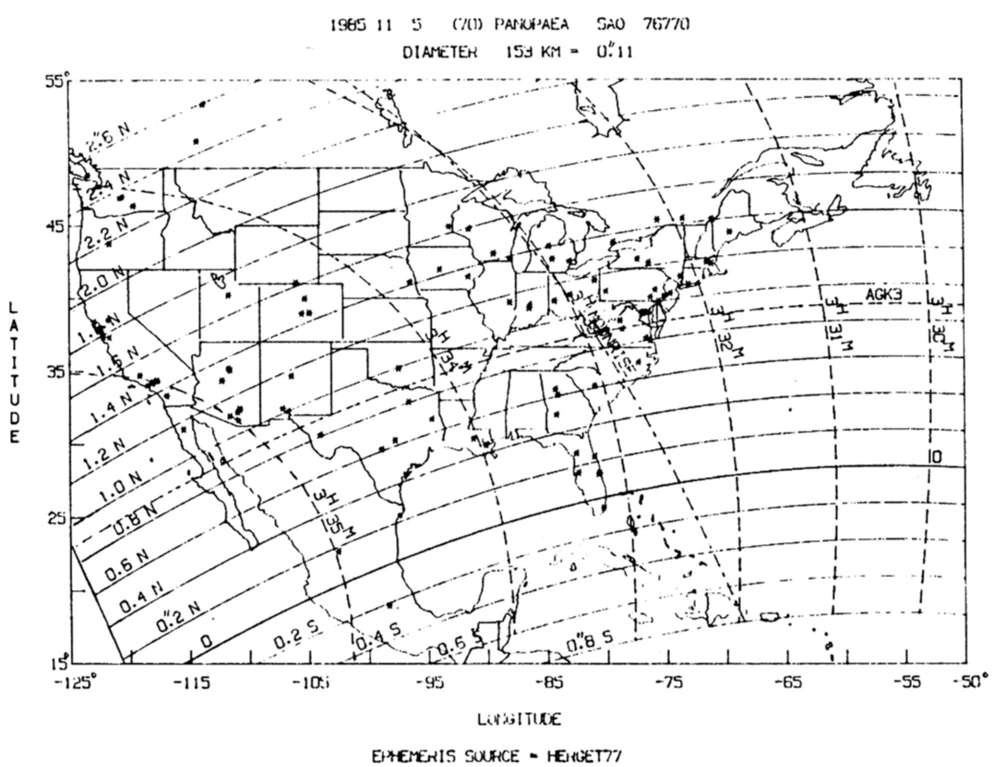
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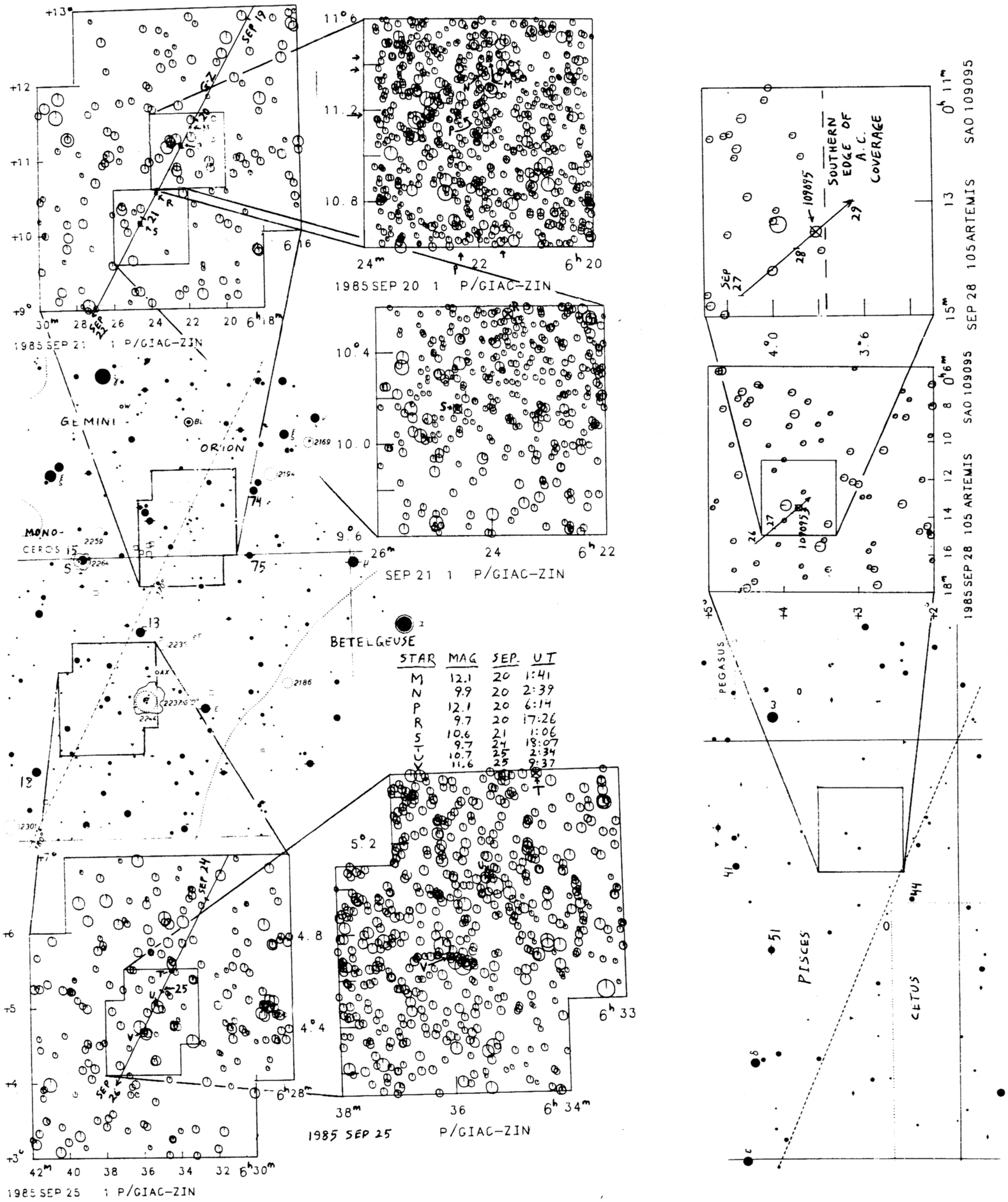
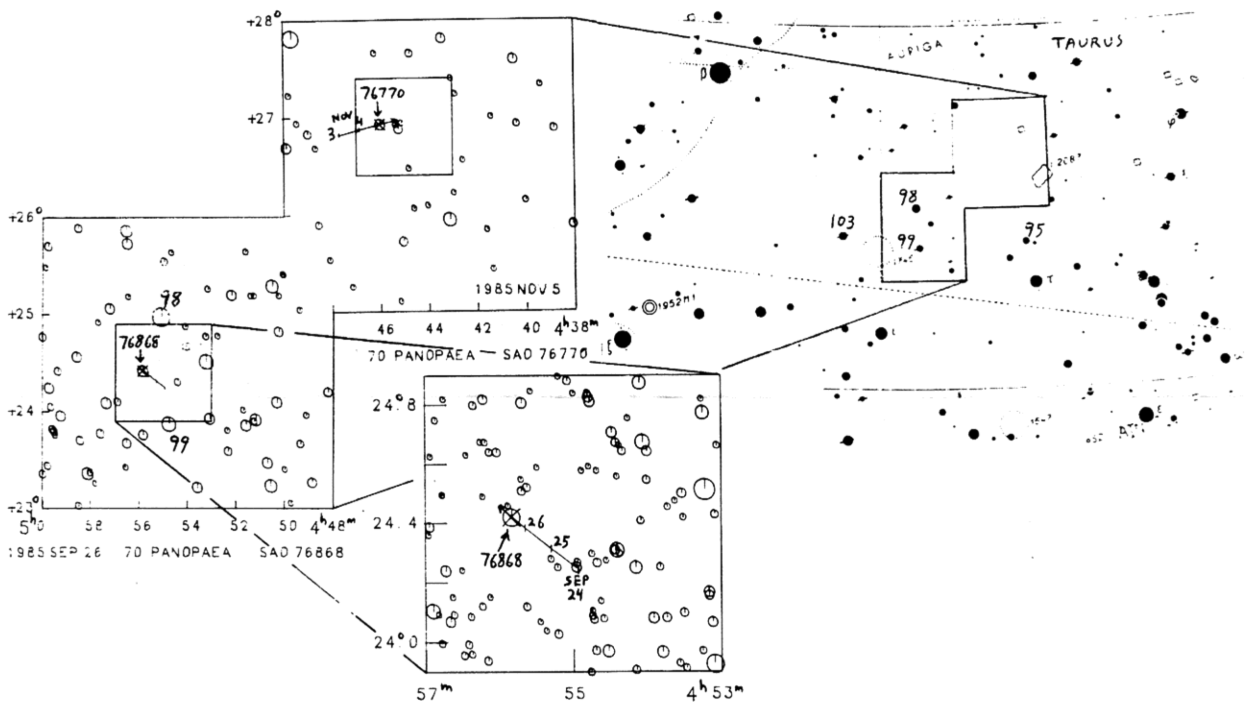
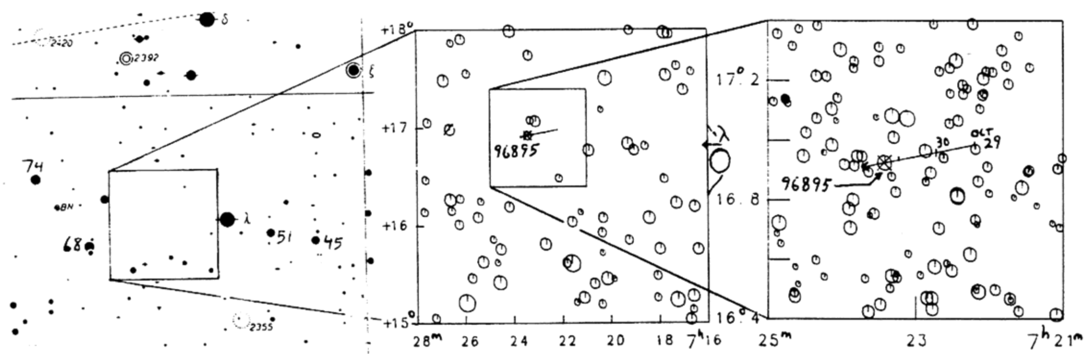
DIAMETER 153 KM = 0.″11
LATITUDE
LONGITUDE
EPHEMERIS SOURCE = HERGET77

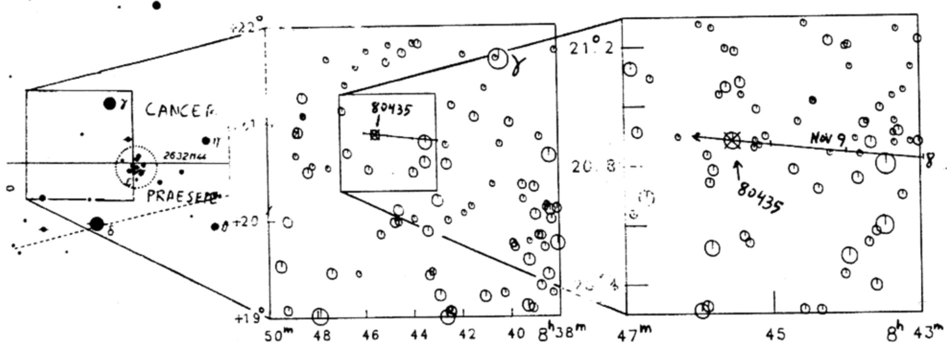

1985 SEP 20 1 P/GIAC-ZIN
1985 SEP 21 1 P/GIAC-ZIN
SEP 21 1 P/GIAC-ZIN
GEMINI
ORION
MONOCEROS
BETELGEUSE
STAR MAG SEP. UT
M 12.1 20 1:41
N 9.9 20 2:39
P 12.1 20 6:14
R 9.7 20 17:26
S 10.6 21 1:06
T 9.7 24 18:07
U 10.7 25 2:34
V 11.6 25 9:37
1985 SEP 25 P/GIAC-ZIN
1985 SEP 25 1 P/GIAC-ZIN
SOUTHERN EDGE OF A.C. COVERAGE
SEP 28 105 ARTEMIS SAO 109095
1985 SEP 28 105 ARTEMIS SAO 109095
PEGASUS
PISCES
CETUS



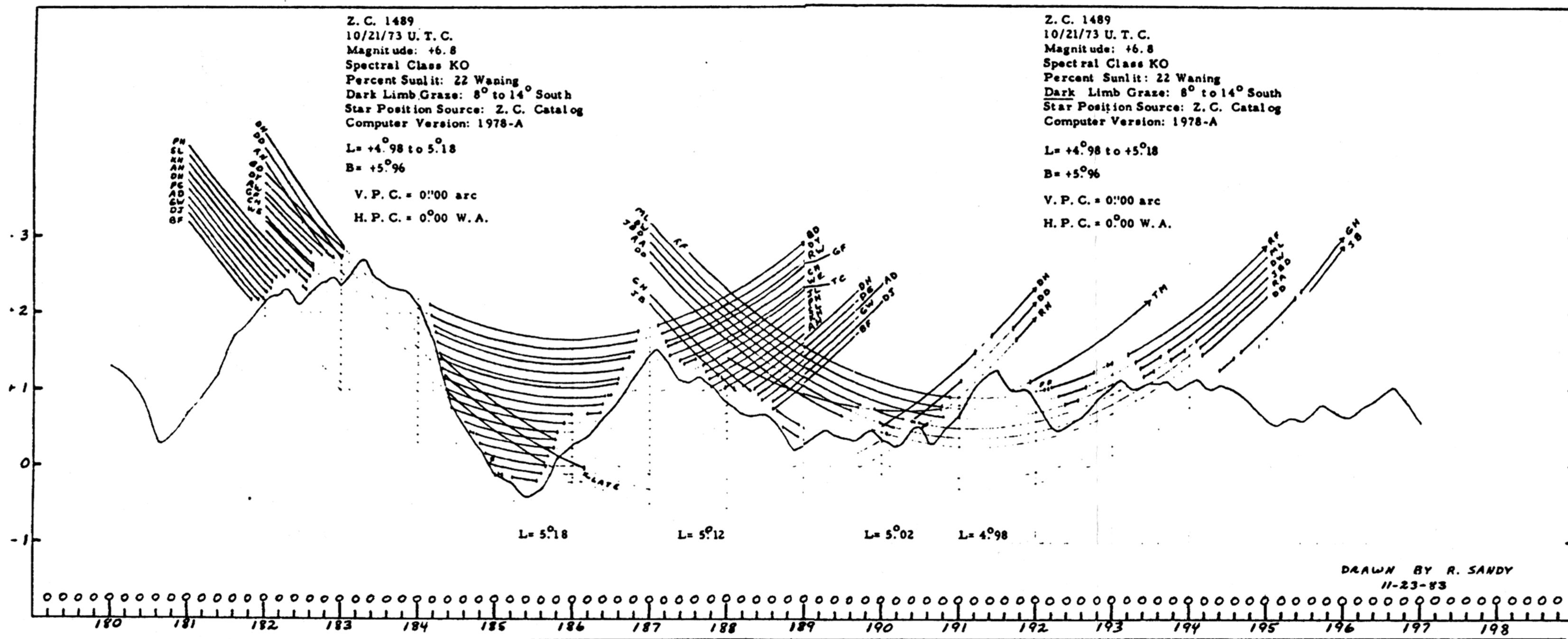
1985 SEP 26 70 PANOPAEA SAO 76868



1985 OCT 31 159 AEMILIA SAO 96895 OCT 31 159 AEMILIA SAO 96895



1985 NOV 10 521 BRIXIA SAO 80435 NOV 10 521 BRIXIA SAO 80435


Z. C. 1489
10/21/73 U. T. C.
Magnitude: +6.8
Spectral Class KO
Percent Sunlit: 22 Waning
Dark Limb Graze: 8° to 14° South
Star Position Source: Z. C. Catalog
Computer Version: 1978-A
L= +4.°98 to 5.°18
B= +5.°96
V. P. C. = 0.″00 arc
H. P. C. = 0.°00 W. A.
L= 5.°18
L= 5.°12
L= 5.°02
L= 4.°98
DRAWN BY R. SANDY
11-23-83
180
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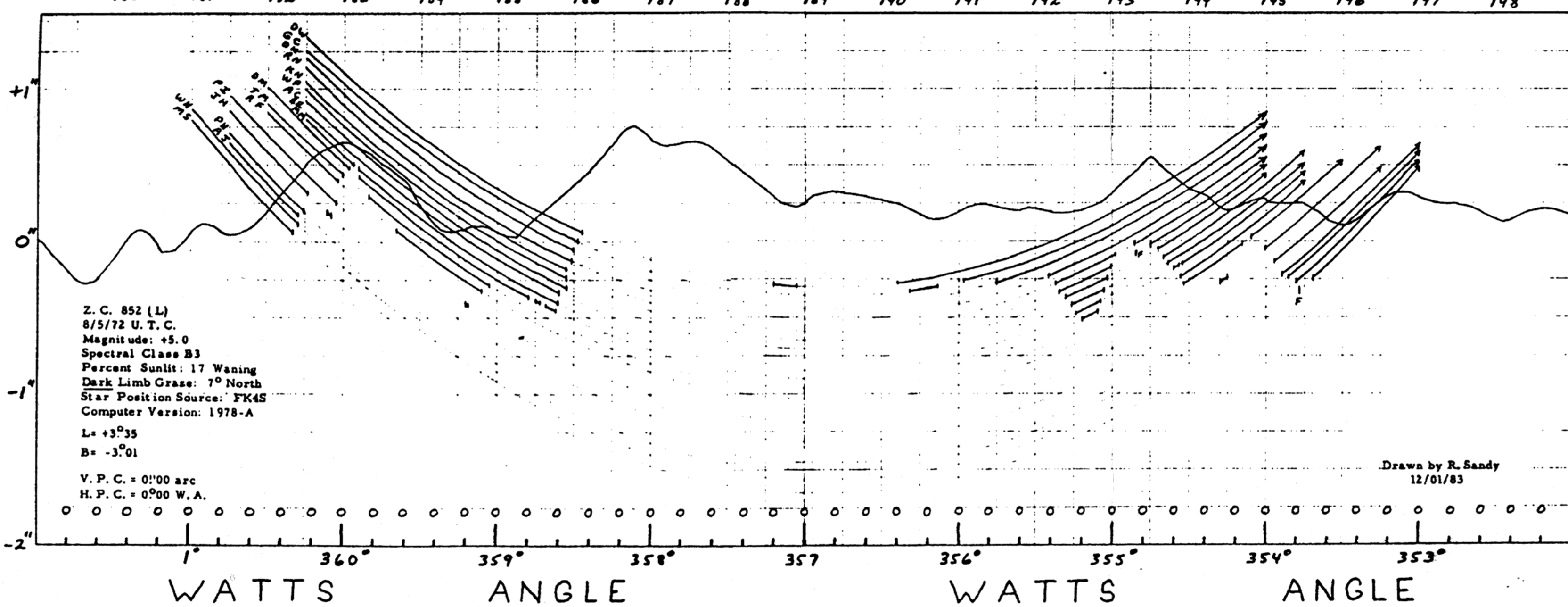
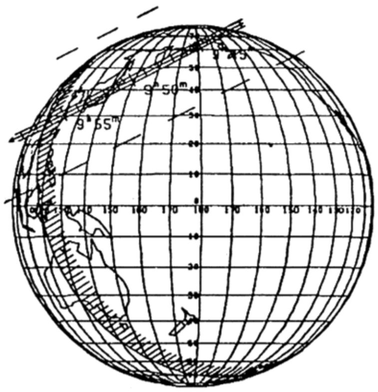
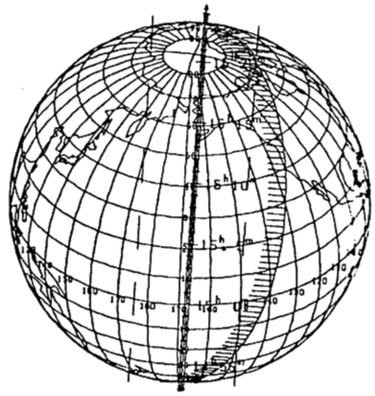
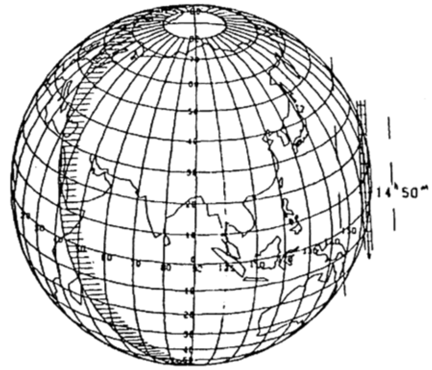

Z. C. 852 (L)
8/5/72 U. T. C.
Magnitude: +5.0
Spectral Class B3
Percent Sunlit: 17 Waning
Dark Limb Graze: 7° North
Star Position Source: FK4S
Computer Version: 1978-A
L= +3.°35
B= -3.°01
V. P. C. = 0.″00 arc
H. P. C. = 0.°00 W. A.
Drawn by R. Sandy
12/01/83
+1″
0″
-1″
-2″
1°
360°
359°
358°
357
356°
355°
354°
353°
WATTS ANGLE
WATTS ANGLE



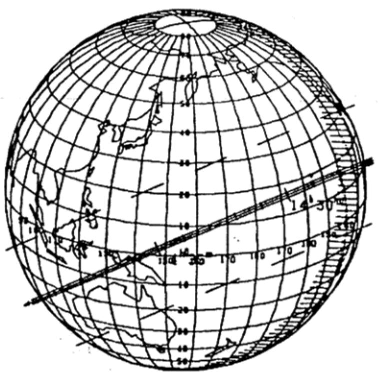
-01° 145 by Camilla 1985 Nov 12



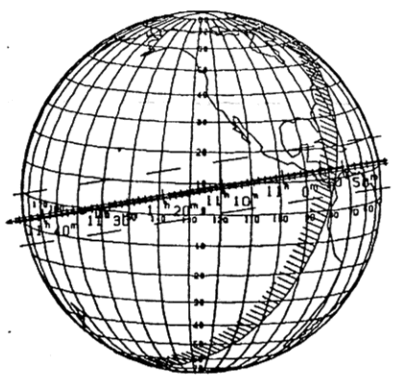
N34 833 by Princetonia '85 Nov 16



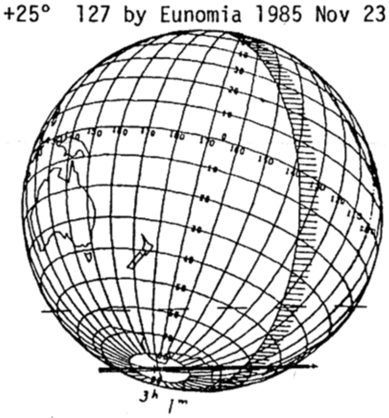
+25° 127 by Eunomia 1985 Nov 23



SAO 77051 by Pretoria 1985 Nov 25

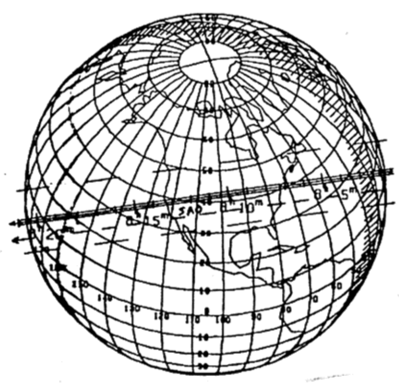


SAO 115329 by Melpomene '85 Nov 29

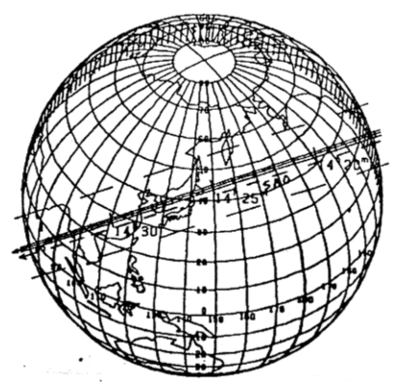


SAO 189508 by Nemesis 1985 Dec 1

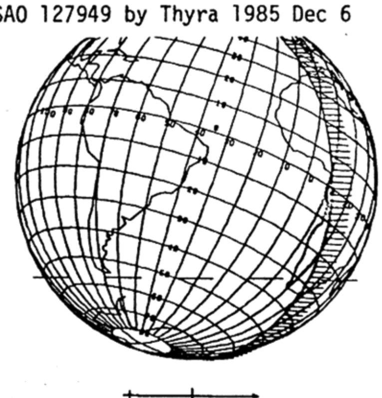
SAO 127949 by Thyra 1985 Dec 6



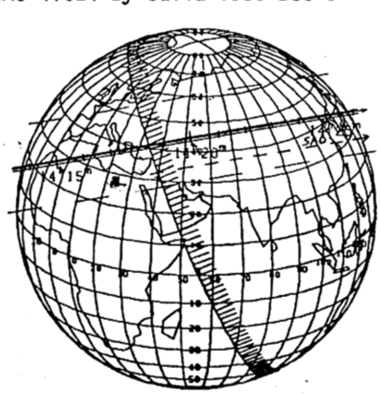
SAO 41024 by Julia 1985 Dec 9



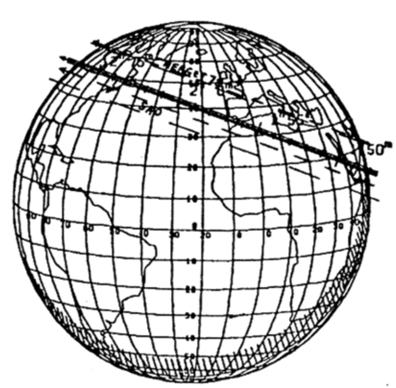
SAO 40825 by Julia 1985 Dec 20



SAO 164338 by Jupiter 1985 Dec 28



SAO 74058 by Marianna 1985 Dec 29



SAO 114658 by Melpomene '85 Dec 30