Occultation Newsletter

Volume III, Number 10 December, 1984

Occultation Newsletter is published by the International Occultation Timing Association. Editor and compositor: H. F. DaBoll; 6 N 106 White Oak Lane; St. Charles, IL 60174; U. S. A. Please send editorial matters, renewals, address changes, and reimbursement requests to the above, but for new memberships, new subscriptions, back issues, and any special requests, write to IOTA; P. O. Box 3392; Columbus, OH 43210-0392; U.S.A.

FROM THE PUBLISHER

For subscription purposes, this is the fourth issue of 1984.

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 the last issue.

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 @ $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, $1.56[1.50] per graze limit prediction, and $2.60[2.50] for the papers explaining the use of the predictions.

Observers from Europe and the British Isles should join IOTA/ES, sending DM 20.-- to Hans-J. Bode, Bartold-Knaust Str. 8, 3000 Hannover 91, German Federal Republic..

IOTA NEWS

David W. Dunham

The second annual meeting of IOTA was held in Houston on October 20th. Chuck Herold's minutes of the meeting are on p. 203.

During a recent visit, Wolfgang Beisker described the IOTA/ES occultation photometer system for which he designed most of the components. I understand that seven of the systems are operational, and construction is proceding in Hannover on 13 more copies. One of them was used in Lübeck to record the occultation by (9) Metis last February. The system uses a TRS-80 computer, is easily transported, and seems to be fairly easy to set up and use. Wolfgang is spending a year working at Livermore Laboratories in California, and has set up his equipment to record occultations with the University of California's 30-inch telescope at Leuschner Observatory in Lafayette. The system can and has been run with much smaller telescopes. The photometer fits into a standard 1¼-inch eyepiece holder and uses a dichroic beam splitter so that the star can be watched visually as the data are recorded. After recording a few occultations at Leuschner Observatory, Wolfgang plans to write an article about the system for *O.N.* and offer further details. In the future, it may compete with the Chen photometer for manufacture in the United States.

The delay in receipt of residuals for total lunar occultation timings reported to ILOC has been noted by Dr. J. Dommanget; Observatoire Royal de Belgique; 3, Avenue Circulaire; 1180 Brussels, Belgium. He, as well as others, are concerned that observers have to wait two or more years to obtain the results of their observations, which can be especially discouraging for new observers. Dr. Dommanget hopes that the problem can be discussed at the next General Assembly of the International Astronomical Union, in New Delhi, India, next November. The I.A.U. commission which has handled the few questions about lunar occultations in the past is Commission 4 (Ephemerides), so a discussion of occultation residuals may be appropriate for one of their sessions. Others concerned about this might send their thoughts or suggestions to Dr. Dommanget. The Lunar Section of the British Astronomical Association and the Occultation Section of the Royal Astronomical Society of New Zealand have had some success in computing residuals for their own members with microcomputers. Unfortunately, with its many other activities, IOTA doesn't have the resources to mount its own effort to compute residuals.

The occultations of Astrographic Catalog stars by (51) Nemausa will be included in the local-circumstance appulse predictions for 1985 distributed by Joseph Carroll, contrary to the statement on p. 209.

Lick Observatory astrometry for several possible occultations by (747) Winchester showed that the stars to be occulted on December 9, 11, and 12 were very close to their Astrographic Catalog positions. This disproved my assumption stated in *O.N. 3* (8), 161, that all data for the Algiers zone of Fresneau's version of the A.C. are incorrect. Hence, many of the events which I said should be deleted did, in fact, occur. However, there are errors with some of the Algiers-zone (south of declination 3°.8) data, including the field traversed by Winchester in early November. I have found some other sections of the Algiers zones to be inexplicably devoid of stars.

On p. 182 of the last issue, I incorrectly stated that Bob Millis and Ted Bowell had predicted the improved path for the occultation by (47) Aglaja last September. Art Hoag exposed the plates while Larry Wasserman measured them and computed the improved occultation path from the measurements.

Berton Stevens recommends that all of the information about a predicted asteroidal occultation be published together on one page, so that it is ready to duplicate for local distribution. He suggests that this be done even if it means raising the price of *o.N.*, and noted that the costs could be held to a reasonable level by regional distribution. Others also have complained about the need to consult successive issues to obtain all the information about particular events. I agree that we should aim in this direction, and I have made related proposals in *o.N. 3* (6), 131 and page 182 of the last issue. The current situation has resulted from the relative speed of producing the lists of events (we want to give warning of events for the whole year as soon as possible) compared with the slower process of preparing the maps and finder charts, which consume much of my time. The addition of new events from various sources during the year, after the main list is published, complicates the process. After I complete the star catalog work described in the last issue, I hope to improve the efficiency of the generation of my material for *o.N.*, so that something like Berton's recommendation can be implemented. I will try to do it for the predictions of 1986 events.

SOLAR RADIUS INCREASING; OTHER ECLIPSE NEWS

David W. Dunham

1984 May 30: My analysis of 51 timings of Baily's beads obtained from my videotape of the May 30th broken annular eclipse yields a correction to the solar radius of +0".23 ±0".04. This seems to give a strong confirmation of the increase of the solar radius during eclipses since 1979, when the correction was -0".11, noted in *o.N. 3* (8), 164. The +0".09 correction obtained from analysis of data from the 1983 June 11th total eclipse first attracted me to the idea that the solar radius might be increasing during recent years. The analysis was done only to provide a preliminary result for updating the prediction for the November 22-23rd eclipse; some more data from other observers should be reduced to check consistency. Another possible problem is that virtually all of the observations of this eclipse were photographic or were obtained with video cameras, while the results for most of the other recent eclipses were derived from visual timings of the bead phenomena. Few useful visual timings could be made during this eclipse due to the similarity in angular sizes of the sun and moon. The bead phenomena generally were too complex for visual observers to time uniquely (that is, time and identify by position angle). During the total solar eclipse in Java in 1983 June, a few particular bead events were timed visually by observers near the southern limit, and also were timed from Alan Fiala's video record at the southern limit. The residuals (observed minus predicted location of solar limb relative to lunar valley bottom at reported time of bead event) for these different timings of the same feature nearly always agreed to better than 0".2, and usually better than 0".10. More statistics like these, especially by video and visual observers at the same limit (so that geometry and background light for the individual bead events will be similar), are needed before we can be completely satisfied with comparing visual and video results.

My data also gave substantial corrections to the predicted positions of the moon relative to the sun, amounting to +1".01 ±0".05 in ecliptic longitude and -0".47 ±0".06 in ecliptic latitude, respectively. The bead events were distributed rather uniformly around the limb of the moon. These corrections are similar to, but larger than, the positional corrections for the 1983 eclipse, apparently indicating a trend which, in longitude, goes back to 1976 October, the first relatively well-observed eclipse in the recent series. My eclipse predictions and analyses are done through the 80G version of USNO's OCC program. This version also has been found to be less accurate for graze predictions than the older 78A version, which, unfortunately, can not be used for eclipse calculations.

Unfortunately, Alan Fiala and I have not been able to complete the videotape of observations of the May 30th eclipse. We have added time display (with manual start) information to the central two or three minutes of all ½-inch VHS-format tapes which we have received. We also have eclipse coverage from the CNN and CBS networks. We still need to add to our master tape a few observations which we have only on Betamax or 3/4-inch VHS tapes. After this is done, we will send the tape to Peter Manly, who will make a copy of it using his device which generates a moving bar whose length is proportional to the audio signal. It will jump at the beginning of WWV seconds beats, allowing calibration of the manually set time display to the video frame accuracy of 0.03 second. I also hope to make a copy of my record including a cursor to point out and identify the beads which I have timed. This should help others to obtain times of identified beads on their records, which are needed for analysis. Unfortunately, all this will take more time; we may not be ready to distribute copies of the master tape until early February. If you need a copy sooner for a presentation, we can send you a copy of what we have sooner.

1984 November 22-23: Paul Maley led an expedition to sites just inside the predicted northern limit of totality southeast of Port Moresby, Papua New Guinea. Timed video records showing 2nd contact and some Baily's bead events were obtained at four sites, but clouds prevented 3rd-contact observations. A few other observers led by John Parkinson, from England, were at sites east of Port Moresby stretching from the central line to a couple of miles south of the southernmost observer in Maley's chain. They simply timed the duration of totality visually. Parkinson noted that their timed durations were shorter than predicted, tending to support the increased solar radius derived from the May and 1983 June eclipses. David Herald and some other Australians were able to reach sites near the southern limit in Papua New Guinea, but they were completely clouded out. Hans Bode and a few other Germans successfully observed the eclipse through hazy skies in West Irian. They were attempting to observe near the southern limit, but we do not know yet how close to it they were; they did not have good maps of the jungle area on the southwest side of New Guinea island. Presumably, they obtained timed photographs with 35-mm cameras with motorized backs, similar to successful observations which Bode obtained of the May 30th event. We hope that with this variety of data, it will be possible to derive a solar radius correction which can be compared with the other recent eclipses. The observers are to be congratulated for their overall apparently successful observational effort in a difficult and distant part of the world with uncertain weather prospects.

1985 May 4: Obtaining Astrographic Catalog data for the star fields to be traversed by the moon during the 1985 total lunar eclipses was discussed on p. 184 of the last issue. The data are needed for calculating extended-coverage total occultation predictions during the eclipses. David Herald already has reduced the appropriate A.C. data and calculated 1950 R.A.'s and Dec.'s for the stars in the field. He is sending me the data on floppy disk, in a form which can be read with a Commodore microcomputer and uplinked to the U. S. Naval Observatory's computer.

There is little to add to the discussion on expedition plans for the May 4th eclipse on pages 184 and 185 of the last issue; the November eclipse and various year-end commitments have detracted from these efforts. John Parkinson talked with Paul Maley about satellite receivers for determining geographic positions, noting that the receiver he uses records data from the Transit satellites, gives positions accurate to about 100 meters, costs about $1200, and is about the size of a large short-wave radio. Although the accuracy is marginal for occultation analysis, the system might be quite valuable for positioning observers in poorly mapped areas like the Sudan.

IOTA MEMBERS WELCOMED TO IAU SYMPOSIUM

Russell M. Genet

IOTA members have received a special welcome to attend International Astronomical Union (IAU) Symposium No. 118, "Instrumentation and Research Programmes for Small Telescopes." Top research astronomers from around the world will speak on topics of interest to small-telescope researchers, including occultation programs and high-speed photometry instrumentation. For occultation observations, where telescopes are located (or can be transported to) is of special importance, of course, and the special contributions of amateurs and their small telescopes is recognized.

The symposium will be held at the University of Canterbury, in Christchurch, New Zealand, on December 2-6, 1985. New Zealand has, of course, one of the most active occultation observation programs, as well as many other very active small-telescope research programs, and thus is a particularly appropriate location for this symposium. Early December is, down under, late spring — a time when New Zealand is at its most beautiful. Symposium attendees will be invited to visit Mt. John University Observatory at Lake Tekapo, and the official opening of their new 1-meter telescope. It is not true that participants will be asked to drive about the South Island at great speed on a last-minute grazing occultation expedition led by David Dunham.

Plan now to attend this special IAU symposium. For more information, write to: IAU Symposium No. 118, Secretariat, c/o Mount Cook Line, Private Bag, Christchurch, New Zealand. Go to New Zealand and discover for yourself why it is a hotbed of occultation activity!

MINUTES OF IOTA MEETING, 1984 OCTOBER 20

The annual meeting of IOTA was held once again at the Lunar and Planetary Institute on NASA Rd. 1 in Houston, Texas. It started at 10:20 AM CDT with 13 people present. Officers of IOTA present were: Dr. David Dunham, President: Paul Maley, Vice President: and Charles Herold, Executive Secretary.

Paul Maley introduced everyone present and then introduced Dr. David Dunham. Dr. Dunham briefly discussed the agenda for this annual meeting before starting. The meeting was conducted in two sections: (1) scientific meeting considering past effort and future efforts; (2) business meetings (old and then new business).

First on the agenda was the results of the May 30, 1984 eclipse. All of the video tapes and movie film and still pictures have been reduced. A 50-minute summary of many of the video tapes of the eclipse was played. Dr. Dunham's prediction that the eclipse would occur 2.5 to 3.0 seconds earlier than predicted was confirmed by the eclipse. See p. 202.

The occultation path involving the asteroid Aglaja on 16 Sept. 1984 shifted south. Numerous events were recorded in the southern U.S.A. Paul Maley and Chuck Herold had a miss located about 5 miles north of Mt. Enterprise, Texas. However, Chuck Herold had a secondary event that occurred about 20 seconds after a possible main event should have occurred. Chuck described the event and then played a tape of the event. See p. 182 of the last issue.

Further occultations of stars by asteroids and comets were discussed.

Dr. Dunham presented a list of occultations for next year, noting that a similar list would be printed in the January, 1985, issue of *Sky and Telescope*.

The eclipse of the sun by the moon on Nov. 23, 1984, was next discussed. Numerous methods of recording the event were presented. Dr. Dunham expressed a caution that in order to get good data that can be used in scientific measurements, the times when Baily's beads are just disappearing or just reappearing are most important.

Another attempt to measure the polar diameter of the moon will be made next year; see p. 202. The southern limb will be recorded by some IOTA members in South Africa and the northern limb will be attempted somewhere between Libya, Ethiopia, or Sudan. As can be reasoned from the locations, it is not possible to identify the sites yet; these will be determined at a future date.

A motion was made to break for lunch at noon. It carried. The meeting reconvened at 13:15 local time.

In the afternoon, the procedures for calculating graze predictions at the U. S. Naval Observatory were discussed. Things are slower because of U.S.N.O. procedures requiring two people to be present when the computer is being used. Asteroid predictions are being done primarily on another computer.

Dr. Dunham read a letter from H. F. DaBoll concerning charging various IOTA fees on MasterCard or VISA. This would ease making payments, particularly by foreign members; see pages 180 and 190 of the last issue.

Next, a form was presented by Dave Dunham to record member expense while performing IOTA experiments. Copies of this are being distributed with this issue to members residing in the U.S.A.

Next, IOTA letterhead stationery and a membership card were discussed. Joan Dunham volunteered to pursue this, since she is Secretary of the DC-area National Capital Astronomers, which also needs stationery and membership cards.

Next year's meeting probably will be held in conjunction with the Texas Star Party, which will run from May 13-19. We expect to hold the IOTA meeting on Saturday, May 18th. Work on the proposal will be coordinated with George Ellis of Ft. Worth.

Grants for conducting scientific research by IOTA were briefly discussed. Now that IOTA is incorporated, it may be possible to obtain some grant support, but preparation of good proposals will involve much work.

Joan Dunham motioned that the meeting be adjourned at 17:40 CDT. This was seconded by Don Stockbauer. The motion carried.

Respectfully,
Charles H. Herold
Executive Secretary, IOTA

[Ed: The form for recording member expense, mentioned above, may or may not be distributed with this issue. As of the morning of December 24th, we still have not received the original.]

GRAZING OCCULTATIONS

David W. Dunham

Predictions. The extra correction for northern-limit waning-phase positive latitude-libration grazes mentioned in *O.N. 3* (8), 157 does not need to be applied to predictions for 1985 grazing occultations. A correction of 0".08 (0.08 arc seconds) times the latitude libration expressed in degrees was previously applied to the predicted profiles by the ACLPPP, only if the latitude libration was negative. Our observations have shown that the correction is also valid for positive latitude librations (this has been confirmed by a more extensive analysis of graze data by Appleby and Morrison published in *Mon. Not. Royal Astron. Soc. 205*, p. 57), and all of the IOTA graze computors were asked to change their versions of the ACLPPP to apply this correction for all latitude librations. The only correction which should concern observers now is a 0.5 arc second southward correction recommended for waning-phase southern-limit Cassini-region grazes (that is, for all profile data between Watts angles 180° and 188°, and with latitude libration less than 1°). We need some observations for further confirmation and to give more detail, before we will change the profile computer program.

Observers and the graze computors should be careful with predictions for the double star 36 Ophiuchi, whose components are given separately in the Zodiacal Catalog. The northern component is Z.C. 2479 = SAO 185198 and the southern star is Z.C. 2480 = SAO 185199. Orbital elements are available for this pair, so both components have been given double star codes of "O." If this is not changed and double star data are specified, ACLPPP will assume that a mean position should be used, and will incorrectly shift both stars. The double star codes (in column 26 of the 5th card, for graze computors) should be changed to "N" for Z.C. 2479 and to "S" for Z.C. 2480; then, ACLPPP will correctly assume that the prediction is for the component specified. The magnitudes of both components are 5.3. For Z.C. 2479 during 1985, the separation (of the other star, Z.C. 2480) is 4".69 in position angle 153°; for Z.C. 2480, give the same separation, but 333° for the p.a. The component magnitudes, separations, and p.a.'s of some other bright stars occulted during 1985 are given in my article on lunar occultation highlights in the 1985 January issue of *Sky and Telescope*.

If you can get commitments from five or more observers for a particular graze of a star whose declination is less than -4° (that is, any C.D. star or B.D. star whose zone number (which follows "B.D." in the limit prediction heading) is less than -3, I will send you a predicted shift for the graze as computed from the Perth 70 catalog (the most accurate for the southern stars, except for rare FK4 stars) or from the Yale catalog (if the star is not in Perth 70 and the SAO used poor G.C. data for the star; these cases usually have probable errors of declination greater than 0".6). A list of most of the Z.C. and SAO numbers of Perth 70 stars in the southern part of the Zodiac appears in *O.N. 2* (1), 10; the list was not complete due to errors in the version of the catalog tape that was used. You need to supply me with the star's SAO number and either its Z.C. or X number, and the date and position angle of graze. Either send them to me at P.O. Box 7488, Silver Spring, Maryland 20907, U.S.A., or telephone me at 301,585-0989. Try to allow at least a week, plus a reasonable estimate for mail transit; Yale shifts for G.C. stars need two weeks. Version 80F (see "Future Concern" below) corrections for many individual stars also can be computed from previously observed occultation data, but experience has shown these to be of not much use, especially for northern stars, and I am willing to check only if at least seven are committed to try the graze.

In addition to the star position error, note that there are uncertainties in such parameters as the limb profile data and the ephemeris. Consequently, even for bright stars, you should plan for a possible shift of at least 0".3 (0".5 is recommended) either north or south, by extending the range of observers. You should try to allow for obtaining some data (that is, place one observer quite low on the profile) in case the path shifts as much as 1".0

towards the center of the moon.

Reporting Observations. Observers should use the IOTA/ILOC graze report forms, but the equivalent International Lunar Occultation Centre (ILOC) forms for total occultations also can be used. If the ILOC forms are used, observers should write in the information requested at the bottom of the back of the IOTA/ILOC form, which is not explicitly requested in ILOC's form. Not reporting these data makes it necessary for us to calculate the lunar % sunlit and look up the star's magnitude; other columns in our summary reports must be left blank because we do not have time to calculate other details (such as the cusp angle) of the graze. Also, observers preferentially should report the Z.C. number first (catalog code "R" for Robertson, the author of the Z.C.), the SAO number if the star is not in the Z.C., the DM number if it is in neither the Z.C. nor SAO, and USNO reference number if it is in none of the other catalogs; see the discussion about star number near the beginning of the Observations section below.

Both addresses for returning the IOTA/ILOC forms given on the back are now wrong. You should no longer send the reports to me, but instead should send the forms to Don Stockbauer; 2846 Mayflower Landing; Webster, TX 77598; U.S.A., and preferably a copy also should be sent to ILOC. Don henceforth will be IOTA's primary recipient of grazing occultation observation reports. He will check to be sure that the reports have been completed correctly, send blank forms when requested (enclosing a self-addressed envelope will expedite this), ensure that ILOC gets a copy, send me reports requiring immediate analysis or reduction profiles to be drawn by Robert Sandy for *O.N.*, and (most important) write future summary articles on grazes for *O.N.* I am confident that Don will be able to respond to received reports more quickly and in more detail than I have been able. He also will be able to provide more frequent documentation of your observational efforts in *O.N.*, which is important for warning others of stars with bad positions as well as giving recognition. The full address for ILOC is: International Lunar Occultation Centre; Geodesy and Geophysics Division; Hydrographic Department; Tsukiji-5, Chuo-ku; Tokyo, 104 Japan. This is the same as on the form except for the division. I understand that an observer in the U.K. using the old division had his total occultation report returned. Be sure to indicate to whom copies of your report have been sent. If this is not indicated on forms sent to IOTA, it will be assumed that we are the only recipient and we will copy the report and send it to ILOC.

Unfortunately, many observers do not report the "Shift" at the bottom of the back of the IOTA/ILOC form. This is the expedition leader's estimate of the shift of the graze shadow from its predicted position as defined by the ACLPPP profile. It is important for giving observers of future grazes of the star some idea of where to set up relative to the nominal prediction. It can be very approximate, perhaps determined by knowing the location on the profile (distance from predicted limit) of the southernmost or northernmost observer who had a miss (no occultation), or by comparing the observer's predicted distance from the limit with the distance from the limit on the profile where the observed length of occultation (in case there is only one disappearance and one reappearance seen) matches the predicted duration. This difference in miles or kilometers should be converted to arc seconds either by multiplying it times the VPS (vertical profile scale) given at the bottom of the profile, or by noting the distance in arc seconds with the arc-seconds scale on the left side of the profile. This is sufficient, but a better estimate of the shift can be made by plotting the observations on the profile. This can be done by drawing horizontal lines at the elevation-corrected distances of each observer from the limit line, and converting the horizontal scale into U.T. by adding the "minutes from central graze" at the top of the profile to the U.T. of central graze given in the limit predictions for the longitude of the chain of observers (don't worry about the difference of a mile or two in the east-west placement of observers). An example of this is Graham Blow's profile of a southern-limit graze of Z.C. 3106 at the bottom of p. 190 of the last issue. The average value of the distance difference of the observed contacts from the predicted profile is the shift; this can be estimated rather than calculated. In the example on p. 190, the observations indicate an average small north shift of the shadow, but it can not be quantified since the vertical scale is not given. Also, the Watts angle ("W.A.") requested after "Shift" should be the approximate average of the Watts angles of all observed contacts, which may differ from the W.A. of central graze. Differences can occur if one side of the profile is sunlit or if most of the timings are made on a high mountain a degree or more from cental graze. If you don't estimate a shift value, we will do it for you if you send with your report a copy of the predicted profile with your observations plotted on it, as described above.

Occultation Manual. I plan to distribute a preliminary version of the long-delayed IOTA occultation manual, including mostly information for using graze predictions to set up expeditions. This will replace the current set of papers used for this purpose, some written nearly a saros cycle ago, which have much out-of-date information. I tried to get the new version ready by last October, in time to distribute to new observers responding to the *Astronomy* article discussed below, but other pressing matters prevented it. I hope that the distribution to IOTA members will be made in late January or February; others will be able to purchase it from IOTA for a price to be determined later.

Astronomy Article and Graze Videos. Early last year, I proposed to write an article on lunar occultations, with emphasis on grazes, for *Astronomy* magazine. The article, "Chasing Moon Shadows" by Don Stockbauer and me, was published in *Astronomy 12* (10), 50 (1984 October issue). Stockbauer's first name is given incorrectly there as "Donald"; "Don" is not an abbreviation. The article includes a map showing favorable paths across the U.S.A. during the last quarter of 1984; it was the first IOTA graze map to be produced with the Meeusmap and Grazemap programs, and published (see p. 188 of the last issue). During that quarter, an unusually large number of favorable graze paths crossed, or passed very close to, major American metropolitan areas. The article included my discussion on the value of lunar occultation observations, a rather extensive section on visual timing methods, information about IOTA, and the names, addresses, and telephone numbers of expedition organizers planning efforts for the plotted grazes near large cities. Unfortunately, they were not able to include my discussion on recording occultations with video equipment [this was only partially addressed on p. 37, without pictures, in Peter Manly's article in the December issue of *Astronomy 12* (12)]. Also not included was a mention of *Solar System Photometry Handbook*, edited by Russ Genet and described in *O.N. 3* (7), 148. Instead of using any of the 1:250,000-scale maps showing the graze paths across six cities, the sequence of photoes I made from the Delta Cancri graze videotape [see *O.N. 3* (4), 84], or the Delta Cancri graze reduction profile which we provided, *Astronomy* instead used some photoes of occultations of planets by the moon to illustrate the article. I was rather disappointed in this choice, especially since observations of lunar occultations of planets are now of virtually no scientific value. The Delta Cancri graze videotape has generated much interest when it has been shown at various meetings, proving it to be a valuable tool for educating many astronomers, as well as the general public, about the dynamism of graze phenomena. I think that interest in grazes could be increased if a sequence of photoes from the videotape could be widely disseminated, but neither *Sky and Telescope* nor *Astronomy* has been willing to publish them. I am open to suggestions about another magazine where these photoes might be published and fairly widely distributed in the astronomical community.

Cassini Grazes and Luna Incognita. An article about "Luna Incognita," the last unmapped section of the moon, appeared in *Sky and Telescope 67* (3), 284 (1984 March). This region, at and just beyond the lunar south pole, is known to be lower than the average lunar radius and might contain ice in valleys which remain in perpetual darkness. Such a source of water could be important for possible future efforts to colonize the moon. Grazes also occur in this region, which includes much of the southern "Cassini" area. The "Cassini" area, named after Cassini's third law of lunar rotation because it results in this area never being adequately illuminated as seen from the earth, could not for this reason be included in Watts' charts of the marginal zone of the moon used for most of our predicted graze profiles. Hence, grazes are especially useful for mapping this region, which has been done crudely from previous grazes. Large expeditions giving more detail of the observed profile are of the most value for this effort. Most grazes in Luna Incognita are southern-limit events on the dark limb during the moon's waning phases. It is presented in profile from Watts angle (W.A.) 178° to 188° at all librations, and from W.A. 188° to 205° for latitude librations less than -3°; check your predicted profiles for grazes in these areas. Remember that observations of all grazes with latitude librations between -1°.0 and +1°.0 also have special value for improving profile data for solar eclipse analysis.

Future Concern. The limit predictions are computed with the U. S. Naval Observatory's version 80G OCC (occultation calculation) program. This version includes corrections derived from a fit of an improved model of the various lunar, geodetic, and stellar parameters to occultation observations through 1977. But graze observations during recent years have agreed better with the previous version 78A of OCC, which we consequently are using for calculating the ACLPPP profiles which form the ultimate base for IOTA's graze predictions. For version 80G, the positions of all zodiacal stars were updated with data from the Perth 70 catalog, when available. Although the Perth 70 data usually are the best for Southern Hemisphere stars, that catalog also contains data for most Northern Hemisphere zodiacal stars brighter than about 5th magnitude. Since these northern stars culminate at relatively low altitude at Perth, the Perth 70 data for them are not as accurate (with probable systematic errors) as the original XZ-catalog data used with version 78A. This is probably why version 78A agrees better with observations, especially of Northern Hemisphere stars, than 80G, in spite of the better modelling for the latter.

Version 78A of OCC exists only in load-module form and can be run only with the old MVT operating system on the IBM 4341 computer at USNO. The 80G version, for which largely undocumented FORTRAN source code is available, runs with the new CMS operating system; there is an equivalent 80F version for MVT. Unfortunately, starting 1985 October 1, the MVT system will be discontinued at USNO, and then it will not be possible to run 78A in its current form. Marie Lukac and I will try to solve this problem during the next several months, but we are not sure how or if it can be done. Perhaps the 78A load modules can be configured to run under CMS, or the 78A corrections can be incorporated into the 80G OCC source code to create a special version which can be used with the old XZ stellar data to create a separate version which mimics 78A closely. But either approach will need some help from Tom Van Flandern, who created all versions of OCC but who can devote very little time for this work these days. It would be best to redo the 80G solutions using stellar data uncorrupted with Perth 70 data in the Northern Hemisphere, and ideally including as many observations made since 1977 as possible, but this can not be done with Van Flandern away from USNO.

Observations. The table lists successful, or partly successful, expeditions for lunar grazing occultations which have been received since the list in *O.N. 2* (16), 220 (1982 April).

The first 2 columns of the table give the Universal Time month and day numbers. A "V" is given between the date and star number if a video record of some graze contacts was obtained from at least one of the stations, and a "P" is similarly given if a photoelectric record was obtained. Star numbers are usually Z.C. (4 digits) or SAO numbers (6 digits, if the star is not in the Z.C.). The B.D. or C.D. number is given for non-SAO stars. These DM numbers consist of a declination zone (in degrees) followed by a sequential number in the zone. The sequential number for C.D. stars is always greater than 10000, while it is always less than 9999 for B.D. stars. A number prefixed by a letter is a USNO reference number, used only if the star is not in one of the other catalogs mentioned above. Observations made near the limits of annularity or totality of solar eclipses (grazes of the sun) no longer will be included in these tables. In case of close double stars, the combined magnitude is given. Under the next column, the percent of the moon's apparent disk sunlit, + signifies waxing phases, - waning phases, and E that a lunar eclipse is in progress (the percent sunlit is then the percent of the moon's diame-

Mo	Dy	Star Number	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap cm	Organizer	St	WA	b
1984														
3	10	076668	7.8	42+	6S	Niantic, CT	2	6	1	10	Philip Dombrowski			
3	20	Saturn	0.5	85—	10S	Taylor Valley, NZ	2	18		20	Brian Loader			
3	23	2500	3.4	60-	16S	Claxton, GA	8	50	1	6	David Dunham	0		
3	27	3106	5.4	19-	12S	Masterton, NZ	7	38	1	6	Graham Blow	3N	190	57
4	6	0651	5.9	18+	2S	Cannon Falls, MN	2	12	1	15	James Fox		176	4
4	6	076593	8.0	19+	3N	Fellsmere, FL	2	5	1	15	Harold Povenmire			
4	10	080191	8.5	61+	7N	Dayton, TX	1	4	1	20	Don Stockbauer	4N	8	-50
4	21	2721	3.3	68-	6S	Toulouse, France	7	59	1	12	Herve le Tallec		189	43
4	21	187898	7.4	63-	4S	Levin, New Zealand	1	1		20	Graham Blow			
5	5	1055	5.8	23+	3N	Gjerrild, Denmark	1	6	1	6	N. Wieth-Knudsen		0	-31
5	9	1484	3.6	58+	9N	Magnolia, MS	2	14	1	25	Benny Roberts		9	-61
5	11	119252	8.5	82+		Brisbane, Austral.	1	9		40	Peter Anderson			
5	25	0083	6.9	22-	5N	Bundaberg, Austral.	2	12		20	D. Lowe			
6	6	099406	8.7	46+	9N	Hillersden, N.Z.	1	5		20	Brian Loader			
7	3	1532	7.6	19+	13N	Canton, MS	1	0	1	33	Benny Roberts		10	-61
7	4	1647	6.7	29+	13N	Jarratt, VA	3	14	1	13	David Dunham	0	13	-58
7	4	1659	6.8	30+	11N	Sealy, TX	8	31	1	20	Don Stockbauer	1S	9	-58
7	21	0300	7.8	48-	15N	Danbury, TX	1	8	1	20	Don Stockbauer	5N	343	43
7	21	0300	7.8	48-	16N	Burns, TN	3	15	2	20	Michael Crist		342	43
7	23	0517	6.4	29-	11N	Mercersburg, PA	1	1	2	20	Jay Miller		346	18
7	24	076609	7.5	20-	11N	Hagerstown, MD	1	1	3	20	David Dunham		347	4
8	18	0372	7.6	64-	20N	Vinton, LA	1	4	2	32	Don Stockbauer	3N	339	30
8	29	138992	8.7	9+	14N	Murray Brdg, Austl.	1	4	1	25	David Steicke		9	-53
8	31	158679	9.1	27+	11N	Brisbane, Austral.	1	5		25	C. Smith			
9	17V	0709	4.3	61-	13N	Eloy, AZ	6	29	1	15	Gerald Rattley	4S	346	-7
10	1	2623	7.5	44+	5S	Okaramio, N.Z.	2	6		20	Brian Loader			
10	1	2721	3.3	51+	4N	Grenada, MS	2	5	1	20	Benny Roberts		5	52
10	14	0634	5.3	85-	12N	Jenners, PA	3	12	1	10	David Dunham	5N	347	-3
10	28	185637	8.9	18+	6S	Blenheim, N.Z.	3	14		20	Brian Loader			
11	16V	1484	3.6	47-	5S	Diamond Bar, CA	1	2	1	20	John Sanford	S	187	-67
11	16	1484	3.6	47-	5S	Idyllwild, CA	3	11	1	20	David Werner	S	187	-67
12	12	128592	9.0	67+	13S	Crystal Springs, MS	1	2	1	33	Benny Roberts			61

ter which is not in the umbral shadow). Next is the cusp angle in degrees from the north or south cusp. During a lunar eclipse, there is no cusp, and the umbral distance [percentage distance of star from center of umbra (0) to its edge (100) is given, followed by a "U." Only the number of stations reporting useful data (including possibly one station reporting no occultation) is given under # Sta. Next is the number of timings, which count ½ for "possibly spurious" events and nothing for "most likely spurious" ones. Only contact timings are counted, and only if they are timed to, at worst, 2 seconds accuracy. Totals involving halves are rounded up. SS is the best (lowest) sky steadiness code (col. 49 of the form) reported by any observer in the expedition. Ap cm gives the aperture, in centimeters, of the smallest telescope in the expedition which achieved the sky steadiness listed under SS (in case more than one observer achieved it). St gives the estimated shift from the USNO prediction, in tenths of a second of arc on the predicted profile (see the last paragraph of "Reporting Observations" above). N and S indicate whether the observed shadow passed north or south of the predicted one. C indicates the Cassini region, where Watts' limb data are not available (for Watts angles within 7° of 0° or 180°, and with latitude libration, b, less than -1° for southern-limit grazes and greater than +1° for northern-limit grazes). WA is the Watts angle of the center of observed data (usually central graze), and b is the latitude libration, in tenths of a degree (e.g., "-50" signifies -5°). For comparison purposes, remember that SS depends on twilight, clouds, and other factors not indicated in the table.

Observations of grazes of the same star during two or more months can be especially helpful in studies of the moon's shape and motion, since the uncertainty in the star's position can be largely removed. So if you see a graze of a star listed in the table in your upcoming predictions, try to assign the event special priority. There may be opportunities to observe occultations of a particular star for only a few more months, and then not again for many years, so prompt reporting of observations is encouraged.

Unfortunately, most of the favorable grazes near large American cities noted in the *Astronomy* article above were clouded out. Especially disappointing was the spectacular "Luna Incognita" graze of the close 3rd-mag. double star Eta Leonis early the morning of November 16; the path crossed over Griffith Observatory and central Los Angeles, CA, as well as major suburban areas. During the evening of the 15th, it rained throughout the area as a major Pacific storm moved in. However, after midnight, by which time most observers had become discouraged and had gone to bed, the rain became intermittent and holes appeared in the cloud cover. Satellite photoes showed solid cloud cover over southern Arizona (where 5 video cameras and 11 visual observers were ready to record the event) and from Los Angeles westward. However, there were large breaks in areas just east of Los Angeles, and a few persistent observers timed the graze. The path was south of the prediction and the profile was not as rugged as predicted, resulting in only one occultation of the star for most observers. Also effects of the star's duplicity were not evident.

On 1984 October 1, Don Stockbauer led a 4-station expedition for a southern-limit graze of 8.2-mag. C.D. -26° 12457 (USNO K07211) near Chocolate Bayou, TX. One of the observers, Carl Sexton, timed 31 events during the graze, a new record, as far as I know, surpassing the previous record of 28 events. Although Carl is an experienced observer, there were unfortunately no observers closely bracketing his position to give good confirmation. I will let Don give a fuller account of this event in his first grazing occultation summary article in the next issue.

Unfortunately, my year-end schedule prevents preparation of a list of all the graze reports received since the last summary list was published. Only the most recent events are listed here. I have assumed that these are the most important, since grazes of the same stars might occur in the near future. A continuation of this list, including all of the rest of the reports which I have received since *O.N. 2* (16) was published in 1982 April, will appear in the next issue. I have misplaced reports of grazes organized by H. Povenmire in July-August and by J Fox (Z.C. 709) in September, but I expect to find them as I clean up during the next few weeks and will add them to the continuation list.

PLANETARY OCCULTATIONS DURING 1985

David W. Dunham

Predictions of occultations of stars by major and minor planets during 1985 are given in two tables below, which are presented in the same format as those for last year's events. The tables are given on alternating pages, so that all data for a given event are available on facing pages. Explanations of the data given in the tables, and of the finder charts, and regional and world maps appearing in *O.N.*, as well as information about local circumstances (appulse predictions) sent to IOTA members, were given in the article about 1983 events in *O.N. 3* (1), 9. Joseph E. Carroll, 4261 Queen's Way, Minnetonka, MN 55345, computes the appulse predictions. Special requests for the appulse predictions should be sent to his address, which was given incorrectly in the *O.N.* article about 1983 events. Specific information about some of the events is given at the end of this article. Preprints of the tables for the first half of 1985, and finder charts for the occultations on January 1 and 3, were distributed to IOTA members with the 1985 appulse predictions by Joseph Carroll, since his mailing for these urgent events will occur before distribution of this issue of *O.N.* For North Americans, information about them may also be available sooner in my article on planetary occultations in the 1985 January issue of *Sky and Telescope*. In general, you should watch the Celestial Calendar section of *Sky and Telescope*, since their more frequent publication schedule often allows information about important new events or astrometric updates to be published there more quickly than in *O.N.*

The proposed changes for asteroidal occultation predictions discussed on pages 181-2 of the last issue have not been incorporated; currently known photoelectric-only events are included in the list. This is because virtually all of the predictions are derived from computer comparisons of ephemerides with the AGK3 and SAO catalogs, which include only stars which are usually much brighter than the occulting objects. Hence, there are very few events in the list which can only be detected photoelectrically, so the work of separating them out is not justified. Also, since the stars are relatively bright, the positions do not need to be given to more precision than in previous lists. The changes which were proposed in the last issue will be made after predictions of fainter stars for 1985 are computed. Only recently, I have begun the star catalog work mentioned in the last issue, and it will be at least a month before it is completed. Since there are some good occultations of SAO stars in early January, I decided that it was more important to get these predictions published and distributed, and wait for the next issue, probably to appear in March, for the fainter stars. This will permit time to complete the star catalog work, my computer comparisons with ephemerides, and selection for publication. This work will include Halley's Comet and Comet Giacobini-Zinner. General information about cometary occultations, and predictions for some probable events in 1985, will be published by Bowell, Wasserman, Baum, and Millis in the Proceedings of the International Halley Watch Astrometry Network Workshop.

Reporting Observations. Observations of appulses and occultations of stars by asteroids should be sent to Jim Stamm; Route 13, Box 109; London, KY 40741, U.S.A., telephone 606,846-7763. Jim writes the summary accounts of these observations for *O.N.*; clouded-out attempts usually are not mentioned and need not be reported. If a definite occultation is seen which could use some analysis for comparison with others, send copies of the report to me at P.O. Box 7488, Silver Spring, MD 20907, U.S.A., and to the chairman of the International Astronomical Union's (I.A.U.) Commission 20 Working Group on Predictions of Occultations by Satellites and Minor Planets, who is Gordon Taylor; c/o H. M. Nautical Almanac Office; Royal Greenwich Observatory; Herstmonceux Castle; Hailsham, Sussex BN27 1RP; England. Taylor will remain chairman of the Working Group until 1985 November; see *O.N. 3* (8), 161. Alternatively, you can send your report to a local or regional coordinator who can then send the results to Stamm, Taylor, and me. Europeans can send their reports to R. Boninsegna; Rue de Mariembourg, 33; 6381 Dourbes, Belgium; he has been sending good summary reports to us. Preferably, the report forms of the International Lunar Occultation Centre (ILOC), or the equivalent IOTA/ILOC graze report forms, should be used for reporting timed occultations. The only difference from reporting lunar events is that the name of the occulting body should be written prominently at the top of the form, and the report should not be sent to the ILOC. For appulse (no occultation) observations, you can either use the forms, or just state the start and end Universal Times of observation and your geographical coordinates; it is also helpful to give the predicted time and distance of closest approach. Be sure to write on the report everyone to whom copies are being sent. Copies of the report forms can be obtained either from the ILOC, from IOTA (Columbus address given in the *O.N.* masthead), from Jim Stamm, or from me. Sending a self-addressed envelope will expedite your request.

Prediction Sources. The occultations by all the major planets were found by Gordon Taylor at the Royal Greenwich Observatory and published in his Bulletin 33 of the I.A.U.'s Working Group on Predictions of Occultations by Satellites and Minor Planets. Douglas Mink and Arnold Klemola have scanned Lick Observatory plates to find occultations by Uranus, Neptune, and Pluto from 1985 through 1990, and have included them in an article which will appear soon, probably in the *Astronomical Journal*. This work does not confirm the tentative Pluto events noted by Taylor in his Bulletin 32, and also indicates that even the rings of Uranus will not occult SAO 184819 on June 25. The brightest stars which Mink and Klemola find to be occulted during 1985 are 12.2 for Uranus (May 24, 8^h U.T., Americas), 11.9 for Neptune (June 7, 21^h, Africa and Asia), and 12.8 for Pluto (Aug 19, 18^h, Europe?). The first two can be detected only photoelectrically with large observatory telescopes. The Pluto event might be seen with a large telescope, and predictions will be published later if same-plate astrometry a few months beforehand confirms the event.

Most of the asteroidal occultations of SAO and AGK3 stars were found first by L. Wasserman, E. Bowell, and R. Millis, who published them in "Occultations of Stars by Solar System Objects. IV. Occultations of Catalog Stars by Asteroids in 1984 and 1985" in *Astron. J. 88* (11), 1670 (1983 Nov.). The other events were found by G. Taylor and published by him in "Occultations of Stars by the Four Largest Minor Planets, 1981-1989" in *Astron. J. 86* (6), 903 or in Bulletin 32 of the I.A.U. Working Group (1984 April). These events first found by Taylor include the ones on: Jan. 20 and 22 (B.D. +10° 1040); Feb. 22; March 28; April 19 and 23; May 16 (B.D. +2° 2711) and 30; July 17, 21, and 28; Aug. 17; Sept. 12; and Nov. 16. The other occultation on May 16 involves a non-AGK3 star in the Lick Saturn-Voyager Reference Star Catalog and was reported by Millis and Wasserman in *Bull. Amer. Astron. Soc. 16* (3), 697-8. Ten occultations of Astrographic Catalog stars by (51) Nemausa during early 1985 are included in the lists. They were found by me during the work described in *O.N. 3* (8), 159. Unfortunately, I did not add them to the 1985 dataset before I sent copies to J. Carroll for the appulse predictions and to M. Sôma to generate the world maps. Observations of occultations by Nemausa are valuable for dynamic studies to accurately locate the celestial equator. An occultation of a 12th-mag. star by (65) Cybele on January 9 is not included in the lists with this article, but was published in the table in *O.N. 3* (8), 159 and in *Astron. J. 89* (5), 698. Information about several additional occultations of SAO stars by small asteroids predicted for North America is given in a supplement for North American observers, being mailed with this issue.

General guidelines for the ephemerides used for my predictions were given in my article about 1983 events referenced above. Table 3, listing ephemeris differences for several 1985 events, is in the same format as similar tables for 1983 and 1984 events.

Prediction Updates. Some general information was given in *O.N. 3* (6), 131. My telephone, 301,585-0989 in Silver Spring, MD, is now the main IOTA source for prediction updates from last-minute astrometry. A beeper allows me to retrieve received messages, and update the outgoing message, from remote telephones when I am out of town. Updates for European events might be obtained from Taylor at the Royal Greenwich Observatory, England, telephone 0323,833171, ext. 3252. Information for North American events also can be obtained from Astro-Alert in Chicago, IL at 312,259-2376; Paul Maley in Houston, TX at 713,488-6871; Lowell Observatory in Flagstaff, AZ at 602,774-3358; and the Astronomical Society of Harrisburg observatory at Lewisberry, PA at 717,938-6041.

Notes about Individual Events. The visual double star data were supplied by Wayne Warren, Astronomical Data Center, Goddard Space Flight Center, Greenbelt, MD.

Jan. 1: E. Goffin's prediction using an ephemeris computed from orbital elements published in the Leningrad Ephemerides of Minor Planets for 1975 (EMP 1975) and SAO stellar data shifts the path 0".40 north (into the southwestern U.S.A.) and causes the event to occur 1.9 minutes earlier than the nominally predicted time. See the supplement for North American observers.

Jan 3: The small Δm will make this event quite difficult for visual observers.

Jan 18: SAO 94422 is number 785 in the Zodiacal Catalog (Z.C.). It is possibly a close double, consisting of 9.2 and 10.1-magnitude components about 0".04 apart, according to a photoelectric record of a lunar occultation at McDonald Observatory, Texas, on 1977 Feb. 27. The projection position angle (P.A.) was 281°.

Feb. 16: The star is Z.C. 796.

March 4: (29) Amphitrite is of special interest since the Galileo spacecraft may fly close to this asteroid late in 1986, obtaining the first close-up photoes of an asteroid.

Table 3.

Ephemeris Differences for 1985

Date	MP#	Shift	Δt	Ephem. Source
Jan 1	40	0".06S	$-1^m.6$	EMP 1984
Jan 6	144	0.08N	1.0	EMP 1980
Jan 10	97	4.01S	-4.5	EMP 1975
Jan 19	488	0.69S	1.8	HERGET81
Feb 1	488	0.75S	2.0	HERGET81
Feb 18	372	0.79N	-0.7	EMP 1982
Feb 22	74	1.01N	0.2	EMP 1982
Feb 25	93	0.00S	-0.4	HERGET78
Mar 4	51	1.79W	0.3	ITA 1977
Mar 4	29	0.31S	-2.3	EMP 1975
Mar 5	375	5.26S	15.7	HERGET78
Mar 27	24	0.17N	-0.4	ITA 1977
Mar 28	42	0.77S	4.4	EMP 1984
Apr 19	57	0.15S	-0.3	EMP 1981
Apr 23	4	0.13S	0.9	EMP 1984
Apr 28	372	0.03N	2.9	EMP 1982
May 16	4	0.32S	1.1	EMP 1984
May 30	145	0.76N	-2.3	HERGET78
Jul 18	192	1.27S	-10.3	ITAB 152
Jul 20	145	0.66S	2.9	HERGET78
Jul 28	4	0.02N	-0.5	EMP 1984
Aug 17	28	0.95S	4.5	ITA 1977
Aug 26	216	0.02N	42.7	EMP 1981
Sep 7	18	0.37N	-1.1	HERGET78
Sep 9	386	5.27N	-3.1	EMP 1981
Sep 12	4	0.03S	-0.3	EMP 1984
Sep 18	185	0.33S	0.6	EMP 1982
Sep 28	105	1.13N	-2.8	EMP 1980
Sep 30	196	0.24W	-6.6	EMP 1981
Oct 5	18	0.57N	-1.6	HERGET78
Oct 17	33	0.21S	-2.9	EMP 1984
Nov 16	508	17.36E	-8.0	EMP 1982
Nov 29	18	0.11S	9.1	HERGET78
Dec 6	115	0.95S	3.4	ITA 1977
Dec 30	18	1.06N	3.1	HERGET78

March 17: The star is Z.C. 290. Visual observers will probably just see the star merge into Mars, since the 4".3 disk, being 96% sunlit, will have no significant defect of illumination. Since the star is of spectral type A6, photoelectric observers can decrease the light of Mars by monitoring only frequencies near the calcium K absorption line. A central occultation will occur close to latitude +45°; sensitive photoelectric equipment might detect a central flash, as was recorded during Mars' occultation of Epsilon Geminorum in 1976.

March 27: SAO 93440 is Aitken Double Star (ADS) 2542. The components are 1".0 apart in p.a. 168°.

April 11: Due to the unusually slow motion, the straight-line approximation used to generate the world maps is inaccurate due to the earth's rotation. The curved path shows the correct predicted path on the world map. Harold Povenmire reported a blink during an appulse of (129) Antigone to a 6th-

(Text continues on page 211)

Table 1, Part A

1985 DATE	UNIVERSAL TIME	PLANET NAME	PLANET m_v	PLANET Δ,AU	STAR SAO No	STAR m_v	STAR Sp	STAR R.A.(1950)	STAR Dec.	OCCULTATION Δm	OCCULTATION Dur	OCCULTATION df	OCCULTATION P	OCCULTATION Possible Area	El SUN	MOON El	MOON %Snl	MOON Up	Ephem. Source
Jan 1	12^h00^m-18^m	Harmonia	9.7	1.29	78419	8.4	G0	$6^h25^m.9$	23°51'	1.6	11^s	21	16	n. Mexico, Aleutians, U.S.S.R.	175°	61°	71+	w145°W	HERGET78
Jan 3	7 38-53	Hebe	8.6	1.29	113607	9.0	A0	6 11.1	6 06	0.6	17	20	10	W.Indies,w.USA, Alaska, e.Siberia	160	39	85+	w 70 W	BRANHAM
Jan 6	14 01-13	Vibilia	11.5	1.62	92993	8.9	F0	2 29.7	13 14	2.7	15	28	18	India, China, Korea, Japan	114	60	100+	all	HERGET77
Jan 10	2 06-15	Nemausa	10.3	1.33		11.0		7 57.3	5 25	0.4	16	23	13	northern Russia; Europe?s	161	34	89-	all	KRSTNN77
Jan 10	19 29-38	Klotho	10.6	1.43	130148	8.0	F2	2 48.9	-0 52	2.7	9	20	19	w. Africa, s.e. Europe	109	119	83-	e 20 E	HERGET78
Jan 18	1 23-49	Hersilia	12.6	1.79	94422	8.9	F8	5 12.9	18 35	3.8	19	45	23	Mediterranean, n. Canada, Alaska	141	173	10-	none	EMP 1982
Jan 19	20 31-38	Kreusa	11.4	1.70	60442	9.3	G5	7 51.8	30 42	2.3	15	22	15	Japan, Korea, Manchuria, Siberia	169	169	2-	none	EMP 1984
Jan 20	23 58	Stereoskopia	14.1	3.29	139116	8.9	K5	13 00.2	-0 30	5.3	24	57	32	South Africa	106	105	0-	none	EMP 1984
Jan 21	6 46-64	Nemausa	10.2	1.31		11.0		7 46.4	6 20	0.4	15	22	12	Brazil, Ecuador, Hawaii	165	160	0+	none	KRSTNN77
Jan 22	7 40-55	Winchester	10.6	1.35	95375	7.4	B5	6 09.5	10 21	3.3	21	23	9	Tahiti?n; Samoa?s; Hokkaido?n	148	133	2+	w155 E	LANDGRAF
Jan 22	21 48-63	Winchester	10.7	1.35		9.7	A0	6 9.2	10 29	1.3	21	23	9	n.e. Africa, central Europe	148	126	4+	none	LANDGRAF
Jan 25	2 43-62	Nemausa	10.2	1.31		12.0		7 42.6	6 43	0.2	15	22	12	central Africa, U. S. A.	163	123	16+	w 95 W	KRSTNN77
Jan 27	10 20-28	Nemausa	10.2	1.31		11.1		7 40.4	6 59	0.4	15	22	12	New Zealand?s; n.e. Australia	162	96	34+	all	KRSTNN77
Jan 30	10 54	Fortuna	12.6	3.17	184542	9.2	K2	16 38.0	-21 34	3.4	7	11	20	n.w. South America?n	59	163	62+	none	EMP 1981
Jan 31	0 31	Flora	10.2	1.72		10.9	G5	2 14.9	8 42	0.4	7	11	16	n.w. South America	84	27	68+	all	BRANHAM
Feb 1	4 48-64	Kreusa	11.6	1.72		11.4	K0	7 40.7	31 45	0.8	17	26	15	nw. Africa, n. Canada, e. Siberia	157	36	78+	w 20 W	EMP 1984
Feb 8	18 33-47	Nemausa	10.4	1.35		11.0		7 30.3	8 30	0.5	18	26	13	Philippines, China, w. Siberia	151	71	87-	all	KRSTNN77
Feb 16	21 09-17	Iris	9.1	1.45	94467	6.8	A0P	5 17.4	19 32	2.4	23	25	10	Iberia, Mediterranean, Mideast	112	145	9-	none	BRANHAM
Feb 18	12 0-9	Palma	11.0	1.70	118291	9.0	F5	10 22.9	5 22	2.2	13	17	13	Pacific Ocean, northern Australia	172	157	2-	none	HERGET77
Feb 19	0 43-57	Nemausa	10.6	1.41		10.2		7 24.9	9 51	0.9	22	34	13	western Africa; western Europe?e	140	146	1-	none	KRSTNN77
Feb 22	19 42-55	Galatea	13.5	2.37		10.5	K0	11 17.4	1 17	3.1	8	21	30	Australia?n; central Africa	164	161	9+	w 10 E	HERGET78
Feb 25	12 12	Minerva	12.1	2.15	183414	9.3	K0	15 19.6	-23 14	2.8	13	22	18	Hawaii	103	165	27+	none	EMP 1981
Feb 27	0 52-62	Kalypso	11.4	1.31		10.8	K0	10 44.6	10 30	1.1	11	23	17	Pakistan, Iran, s.e. & n. Europe	178	101	41+	w 20 E	HERGET79
Mar 3	3 40-55	Mathesis	12.2	1.41	99560	9.1	K0	11 17.5	13 18	3.2	9	23	23	South Africa?n; Brazil, Peru	171	55	80+	w 30 W	EMP 1984
Mar 4	23 10-28	Nemausa	11.2	1.52	96887	8.9	K0	7 23.0	11 36	2.5	28	44	14	nw S. America, ne USA, e Canada	126	29	94+	all	KRSTNN77
Mar 4	23 25-29	Amphitrite	10.8	2.27	183620	8.8	G5	15 34.0	-24 09	2.1	23	35	17	Greece, Egypt, Arabia	107	102	94+	all	HERGET78
Mar 5	23 13-21	Ursula	12.4	2.44	157187	8.9	K0	12 14.8	-12 00	3.5	16	23	17	Antarctica, s. Patagonia (low)	155	41	98+	all	EMP 1981
Mar 12	21 10-20	Mathesis	12.2	1.41	99489	9.0	G5	11 08.3	13 52	3.3	9	24	23	northern Africa	168	88	59-	e 35 E	EMP 1984
Mar 14	13 10-23	Nemausa	11.0	1.61		12.0		7 25.4	12 39	0.4	22	37	15	Western Australia, New Guinea	117	158	41-	none	KRSTNN77
Mar 17	18 31-34	Mars	1.4	2.19	92739	6.1	A6	1 56.8	12 03	0.01	41	6	1	w. Europe, n.w. Africa	35	77	13-	none	NA0001
Mar 25	6 32	Nemausa	11.2	1.72		10.7		7 31.4	13 37	1.0	15	26	16	Mexico?n	108	68	12+	none	KRSTNN77
Mar 27	15 37	Themis	13.1	3.58	93440A	9.6	G0	3 24.7	19 01	3.5	6	10	23	southern U.S.S.R., Tibet	47	20	30+	all	HERGET78
Mar 27	15 37	Themis	13.1	3.58	93440B	10.2	G0	3 24.7	19 01	2.9	6	10	23	northern Siberia	47	20	30+	all	HERGET78
Mar 28	8 32-43	Isis	11.6	1.93		9.8	G5	11 22.9	17 51	2.0	8	22	27	U.S.A., s. Alaska, Kamchatka	154	82	37+	w115 W	HERGET77
Apr 2	18 56-66	Io	11.7	1.86	158545	8.7	M0	14 21.8	-12 12	3.1	14	25	18	Antarctica, South Africa	155	62	89+	all	HERGET78
Apr 11	2 50-90	Antigone	11.5	2.00		10.5	F5	9 50.4	20 30	1.4	84	207	26	w.South America, e.North America	122	135	61-	s 45 S	EMP 1980
Apr 15	2 01-21	Sapientia	11.7	1.38	139564	6.8	K2	13 46.1	-2 36	4.9	12	25	19	n. Africa, s.e. Canada	172	123	22-	e 15 E	EMP 1981
Apr 16	9 56	Nemausa	11.5	1.97		11.9		7 53.0	14 52	0.6	9	16	19	South Australia, New Zealand	92	132	13-	none	KRSTNN77
Apr 19	14 17-16	Mnemosyne	12.2	2.53	137722	9.2	F8	10 38.4	-0 24	3.1	14	39	32	w.Australia?e: India, Tadzhikstan	132	138	0-	none	HERGET78
Apr 21	21 13-23	Victoria	9.8	1.19	183095	8.8	K0	14 58.9	-21 02	1.3	17	27	13	s. and n.w. Africa	162	176	2+	none	HERGET77
Apr 23	3 28	Vesta	5.8	1.21	120229	8.7	K0	13 58.9	1 15	0.07	62	24	3	Palmer Peninsula,Tierra del Fuego	166	141	7+	none	APAENAXX
Apr 23	4 26	Nemausa	11.6	2.04		10.3		8 01.5	15 02	1.6	8^s	14	19	U. S. A.	87	55	8+	w105 W	KRSTNN77
Apr 25	16 21-31	Saturn	1.0	8.99	159413	9.3	K0	15 36.2	-16 55	0.0	53^m	32	2	w.Pacific, Australia, s.&e. Asia	159	140	25+	w 80 E	NA0001
Apr 28	4 52-74	Palma	12.2	2.36		9.9	F8	9 45.0	2 18	2.4	30^s	46	17	Hawaii (dusk)?s; Chile	110	26	50+	w 85 W	HERGET77
May 16	3 32-53	Vesta	6.1	1.27		10.5		13 39.8	1 46	0.02	93	37	3	Iberia, e. & s. U. S. A.	146	168	12-	e 5 W	
May 16	6 19-40	Vesta	6.1	1.28		10.3	B5	13 39.8	1 45	0.02	93	38	3	Florida Keys, Mexico; Hawaii?n	146	169	12-	none	APAENAXX
May 30	6 01-08	Adeona	13.5	2.65	190841	7.5	K0	21 59.4	-23 51	6.0	13	31	28	northern South America	104	129	79+	w 55 W	EMP 1984
May 31	14 00	Loreley	13.0	3.00	137693	9.0	G0	10 35.5	-1 58	4.1	16	24	19	Western and South Australia	92	54	91+	all	HERGET78
Jun 3	10 39	Venus	-5.9	0.63	110111	6.6	A0P	1 43.1	8 19	0.07	34	9	1	w. and s. South America	45	130	100-	all	NA0001
Jun 6	11 40-57	Papagena	11.2	2.19	189954	9.2	F5	20 59.4	-27 15	2.1	20	40	22	Fiji?w; New Zealand?w	125	11	85-	all	EMP 1980
Jun 2[illegible]	9 15-34	Hestia	12.1	1.61	159657	9.1	K5	16 00.5	-17 02	3.1	15	29	18	Mexico?n; Hawaii?n; Guam?s	152	117	9+	w175 E	HERGET77

mag. star in 1973 October, the first report of a secondary occultation during an asteroidal appulse, as far as I know (astrometry the night of the event showed that the path crossed Colombia, over 3000 km south of Povenmire's location).

June 3: The star, Z.C. 258, is probably a spectroscopic binary. Venus' 26".9 disk will be 44% sunlit, so the star's reappearance on the dark side should be easy to see with moderate-sized telescopes. A central flash might be seen with large telescopes near latitude -40°. The northern limit crosses Costa Rica.

Table 2, Part A

1985	MINOR	PLANET					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.
Jan 1	40	Harmonia	118	0.13	375	S	0.272	280°	78419	+23°1371		0.19	178	17	0.8	XA	N23°	674	-0".64	-0m.7	6h28m.0	23°50'
Jan 3	6	Hebe	186	0.20	733	S	0.284	300	113607	+06 1164		0.06	55	5	0.2	AS	N 6	699	-1.26	-1.2	6 13.0	6 05
Jan 6	144	Vibilia	132	0.11	432	C	0.184	57	92993	+12 347		0.09	103	11	0.4	XA	N13	205	-0.02	0.2	2 31.6	13 24
Jan 10	51	Nemausa	153	0.16	556	U	0.243	285								C					7 59.2	5 20
Jan 10	97	Klotho	109	0.11	290	M	0.270	48	130148	-01 398		0.14	149	13	0.6	PA	S 0	305	-0.08	-1.6	2 50.7	-0 45
Jan 18	206	Hersilia	111	0.09	397	C	0.108	284	94422	+18 806	K	0.13	164	28	0.6	ZA	N18	426	-0.00	-1.3	5 14.9	18 37
Jan 19	488	Kreusa	168	0.14	749	C	0.224	297	60442	+30 1602		0.18	218	19	0.8	AS	N30	857	1.33	4.6	7 54.0	30 37
Jan 21	566	Stereoskopia	147	0.06	847	C	0.063	92	139116	-00 2647		0.58	1390	223	3.9	PX	S 0	1800	-0.03	-1.6	13 02.0	-0 43
Jan 21	51	Nemausa	153	0.16	555	U	0.264	292								C					7 48.2	6 14
Jan 22	747	Winchester	208	0.21	867	C	0.249	332	95375	+10 1044		0.10	96	9	0.4	AS	N10	705	1.39	-0.7	6 11.4	10 20
Jan 22	747	Winchester	208	0.21	867	C	0.247	333		+10 1040		0.04	36	4	0.2	A	N10	702			6 11.2	10 28
Jan 25	51	Nemausa	153	0.16	554	U	0.261	295								C					7 44.5	6 38
Jan 27	51	Nemausa	153	0.16	554	U	0.257	296								C					7 42.3	6 54
Jan 30	19	Fortuna	226	0.10	1224	C	0.331	97	184542	-21 4399		0.30	701	22	2.0	PX			0.13	-0.1	16 40.1	-21 39
Jan 31	8	Flora	160	0.13	493	S	0.456	63		+08 355		0.08	106	4	0.4	A	N 8	252			2 16.7	8 52
Feb 1	488	Kreusa	168	0.13	746	C	0.188	291		+31 1655		0.09	108	11	0.4	A	N31	805			7 43.0	31 40
Feb 8	51	Nemausa	153	0.16	552	U	0.212	308								C					7 32.3	8 26
Feb 16	7	Iris	222	0.21	871	S	0.217	90	94467	+19 898		0.16	168	18	0.7	ZA	N19	439	0.49	-0.1	5 19.4	19 34
Feb 18	372	Palma	196	0.16	950	CEU	0.289	260	118291	+05 2332		0.11	136	9	0.5	XA	N 5	1522	-0.01	-0.1	10 24.7	5 11
Feb 19	51	Nemausa	153	0.15	550	U	0.160	325								C					7 26.8	9 47
Feb 22	74	Galatea	113	0.07	516	C	0.204	295		+01 2551		0.13	226	15	0.7	A	N 1	1368			11 19.2	1 06
Feb 25	93	Minerva	173	0.11	751	C	0.199	125	183414	-2210961		0.29	451	35	1.6	X					15 21.7	-23 21
Feb 27	53	Kalypso	110	0.12	342	C	0.247	302		+10 2203		0.11	108	11	0.5	A	N10	1352			10 46.4	10 19
Mar 3	454	Mathesis	88	0.09	255	CU	0.236	287	99560	+13 2389		0.25	256	25	1.1	AS	N13	1129	-0.49	-2.4	11 19.4	13 06
Mar 4	51	Nemausa	153	0.14	549	CU	0.119	11	96887	+11 1585		0.35	389	71	1.6	AS	N11	848	-0.79	-2.0	7 24.9	11 32
Mar 4	29	Amphitrite	199	0.12	986	S	0.124	127	183620	-2312414		0.22	367	43	1.2	X					15 36.1	-24 16
Mar 5	375	Ursula	214	0.12	1356	C	0.183	269	157187	-11 3272		0.35	611	45	2.0	S					12 16.6	-12 12
Mar 12	454	Mathesis	88	0.09	254	CU	0.234	282	99489	+14 2355		0.20	208	21	0.9	AS	N13	1117	-0.16	0.5	11 10.2	13 41
Mar 14	51	Nemausa	153	0.13	547	U	0.141	44								C					7 27.3	12 35
Mar 17		Mars	6782	4.27	*****		0.725	69	92739	+11 261		0.26	405	8	1.4	PZ	N12	218	0.10	0.1	1 58.6	12 13
Mar 25	51	Nemausa	153	0.12	546	U	0.191	65								C					7 33.3	13 33
Mar 27	24	Themis	228	0.09	1328	C	0.335	75	93440	+18 485	A	0.10	250	7	0.7	XA	N19	266	0.11	-0.2	3 26.7	19 08
Mar 27	24	Themis	228	0.09	1328	C	0.335	75	93440	+18 485	B					XA	N19	266	0.11	-0.2	3 26.7	19 08
Mar 28	42	Isis	104	0.07	391	S	0.213	286		+18 2490		0.14	197	16	0.7	A	N17	1215			11 24.8	17 39
Apr 2	85	Io	149	0.11	656	C	0.189	310	158545	-11 3735		0.88	1191	112	4.4	PX			0.27	-0.0	14 23.7	-12 21
Apr 11	129	Antigone	113	0.08	413	U	0.022	7		+20 2390		0.05	78	58	0.3	A	N20	1138			9 52.4	20 20
Apr 15	275	Sapientia	107	0.11	339	C	0.219	295	139564	-02 3737		0.92	916	100	4.0	AG	S 2	828	-0.68	-0.1	13 47.9	-2 46
Apr 16	51	Nemausa	153	0.11	544	U	0.293	84								C					7 54.9	14 46
Apr 19	57	Mnemosyne	115	0.06	522	S	0.105	346	137722	+00 2690		0.11	206	26	0.7	PA	S 0	1527	0.39	-0.0	10 40.2	-0 36
Apr 21	12	Victoria	135	0.16	438	S	0.219	304	183095	-20 4138		0.23	196	25	0.9	X					15 00.9	-21 11
Apr 23	4	Vesta	555	0.63	3710	U	0.245	285	120229	+01 2872		0.38	334	37	1.5	PA	N 1	1597	0.14	0.0	14 00.7	1 04
Apr 23	51	Nemausa	153	0.10	543	U	0.319	87								C					8 03.5	14 56
Apr 25		Saturn	57822	8.87	*****		0.067	284	159413	-16 4129		0.28	1837	101	3.1	X					15 38.2	-17 02
Apr 28	372	Palma	196	0.11	1012	CEU	0.092	133		+02 2250		0.08	134	21	0.4	A	N 2	1302			9 46.8	2 08
May 16	4	Vesta	555	0.60	3684	U	0.155	262				0.08	70	12	0.3	H					13 41.6	1 35
May 16	4	Vesta	555	0.60	3684	U	0.154	262		+02 2711		0.03	24	4	0.1	A	N 1	1574			13 41.6	1 35
May 30	145	Adeona	137	0.07	633	C	0.128	111	190841	-2416959		0.56	1078	105	3.4	S					22 01.4	-23 41
May 31	165	Loreley	228	0.10	1417	C	0.156	102	137693	-01 2414		0.15	319	23	0.9	AS	S 1	1510	-0.49	-2.0	10 37.3	-2 09
Jun 3		Venus	12220	26.91	*****		0.880	73	110111	+07 275	V	0.14	63	4	0.4	ZA	N 8	202	-0.50	0.2	1 44.9	8 29
Jun 6	471	Papagena	145	0.09	650	S	0.109	161	189954	-2715203		0.10	155	21	0.5	S					21 01.5	-27 06
Jun 21	46	Hestia	133	0.11	505	F	0.177	279	159657	-16 4203		0.49	574	66	2.3	X					16 02.5	-17 08

July 20: SAO 190822 = Eta Piscis Austrini = ADS 15536. If seeing is not good enough to resolve the

Table 1, Part B

1985 DATE	UNIVERSAL TIME	PLANET NAME	PLANET m_v	PLANET Δ,AU	STAR SAO No	STAR m_v	STAR Sp	STAR R.A.(1950)	STAR Dec.	OCCULTATION Δm	OCCULTATION Dur	OCCULTATION df	OCCULTATION P	OCCULTATION Possible Area	El SUN	MOON El	MOON %Snl	MOON Up	Ephem. Source
Jun 25	22h02m-10m	Uranus-R	5.5	18.12	184819	9.3	G5	16h53.m7	-22°36'	0.0	40m	40	3	SAfrica?Antarctic?s;sSAmerica?n	161°	69°	52+	w 30°E	NA0001
Jul 6	17 35-52	Nemesis	11.2	1.69	188456	9.1	K0	19 38.8	-27 01	2.2	11s	23	21	Fiji?s; s.e. Australia,S.Africa?n	170	45	80-	e 40 E	HERGET78
Jul 16	12 48-54	Marianna	12.6	2.00		10.9	G5	0 45.8	11 03	1.9	8	17	21	southern Pacific Ocean	99	81	2-	none	HERGET78
Jul 17	12 33	Medea	14.3	3.43	157588	8.6	F0	12 52.2	-10 10	5.7	7	19	37	northern Australia	82	88	0-	none	EMP 1984
Jul 18	6 14-28	Nausikaa	10.5	1.23	128570	9.0	K0	0 02.6	-2 08	1.7	10	23	18	Bolivia, Brazil, Senegal	115	119	0+	none	HERGET78
Jul 20	2 39-51	Adeona	12.8	2.12	190822	5.8	B8	21 58.0	-28 42	7.0	11	24	22	U.K., Iberia, Amazon, Peru	151	170	5+	none	EMP 1984
Jul 20	2 44	Adeona	12.8	2.12	190822	6.8		21 58.0	-28 42	6.0	11	24	22	Bermuda (low)	151	170	5+	none	EMP 1984
Jul 21	17 5-10	Hygiea	11.2	3.20	92597	8.9	G0	1 41.0	14 47	2.4	30	24	10	Philippines; Japan?n	90	136	16+	none	SCHMADEL
Jul 28	6 44	Vesta	7.3	1.95	139767	9.0	K2	14 07.5	-7 08	0.2	27	14	5	Hawaii?s; California (low)?n	88	47	84+	all	APAENAXX
Aug 9	7 05	Lutetia	11.5	1.79	93083	5.2	A7	2 42.2	12 14	6.3	7	17	23	northwestern South America	94	11	45-	all	EMP 1984
Aug 12	22 45-50	Bettina	12.3	2.45	213017	7.9	K0	21 24.5	-33 06	4.4	19	22	13	Antarctica?n	162	142	14-	none	HERGET81
Aug 17	21 28-47	Bellona	11.9	2.28	162924	9.1	K0	19 40.2	-16 40	2.9	10	28	30	Pakistan,Arabia,c.Africa,s.Brazil	149	129	3+	w 40 W	HERGET78
Aug 25	11 58-76	Athamantis	10.4	1.31	108412	8.8	F8	23 05.0	11 32	1.8	17	29	15	southern Alaska, Japan, China	154	82	75+	w170 E	EMP 1980
Aug 25	21 01-16	Isolda	12.6	2.27	75635	8.9	F2	2 52.2	20 36	3.7	16	29	20	China, India, Kenya	105	130	78+	w 70 E	HERGET81
Aug 26	18 14-19	Kleopatra	10.8	1.76		10.5	G5	3 43.3	21 17	0.9	7	15	20	China, Manchuria, Hokkaido	95	130	86+	w110 E	HERGET77
Aug 27	15 21-26	Panopaea	13.0	2.59		10.0	F2	4 36.0	22 14	3.1	8	17	25	New Guinea, Hawaii	83	130	92+	w180	HERGET77
Sep 1	4 46-64	Athamantis	10.3	1.28	108346	8.9	K5	22 59.5	11 05	1.6	15	26	14	Ireland?s; e.Canada,w.USA,Hawaii	160	21	97-	e145 W	EMP 1980
Sep 7	21 07	Melpomene	10.1	1.88	95210	9.0	F0	6 02.4	13 19	1.4	6	10	18	southwestern Australia	74	18	47-	all	EMP 1980
Sep 7	21 23-40	Athamantis	10.2	1.27	108266	9.3	K2	22 53.8	10 26	1.3	14	24	14	s.e. China, India, central Africa	163	89	46-	e 35 E	EMP 1980
Sep 9	10 26-41	Meliboea	12.0	1.83	142583	8.4	G0	18 42.4	-5 33	3.7	15	27	17	Philipp's,NewGuinea,Fiji;Tahiti?n	114	158	32-	none	EMP 1982
Sep 9	20 18	Siegena	10.4	1.48	146494	8.9	K5	23 02.2	-5 26	1.8	16	19	11	N. Territory and W. Australia	178	118	28-	all	LANDGRAF
Sep 12	22 21	Vesta	7.7	2.44	159188	7.5	K0	15 18.2	-15 12	0.9	16	9	6	Patagonia (dusk); Falklands?s	62	87	5-	none	APAENAXX
Sep 18	5 28	Eunike	12.2	2.33	132709A	9.3	B9	5 56.4	-1 20	3.0	9	15	18	Argentina (low)? with 2".0 n. shift	86	128	16+	none	HERGET77
Sep 18	5 31	Eunike	12.2	2.33	132709B	10.3		5 56.4	-1 20	2.1	9	15	18	Argentina (low)? with 1".4 n. shift	86	128	16+	none	HERGET77
Sep 21	17 11-18	Terpsichore	13.0	1.85		10.8		5 02.9	30 13	2.3	8	19	24	Calcutta, China, eastern Siberia	101	166	53+	w 90 E	EMP 1979
Sep 26	12 44-62	Panopaea	12.7	2.25	76868	8.0	B5	4 55.8	24 25	4.7	22	43	21	N.Island(low);Tahiti?s;BajaCalif.	107	101	94+	w130 W	HERGET77
Sep 28	8 30-42	Artemis	11.6	1.52	109095	9.1	G0	0 13.5	3 48	2.6	9	17	17	n.w. Canada, Hawaii, Queensland	178	9	100+	all	HERGET
Sep 30	21 00-28	Philomela	11.5	2.40	189888	9.0	K2	20 55.3	-26 33	2.6	56	105	21	Ascens'nIs,nwAfr;Iberia,Irel'd?e	121	79	97-	all	HERGET
Oct 5	2 21-27	Melpomene	9.9	1.66	96175	8.9	K0	6 47.4	11 20	1.3	8	14	16	central Africa	89	28	70-	all	EMP 1980
Oct 9	12 08-28	Athamantis	10.5	1.36	127622	8.8	F8	22 33.2	5 59	1.9	20	35	15	Siberia,e.China,Vietnam,Singapore	144	145	27-	none	EMP 1980
Oct 17	12 57-76	Polyhymnia	8.7	1.00		8.5	F8	1 31.1	10 39	0.8	10	31	24	Alaska?s: Siberia, Kazakhstan	178	135	16+	w 85 E	HERGET77
Oct 24	16 17-25	Pallas	8.4	1.79	171571	6.5	K2	6 17.5	-22 05	2.1	31	15	5	e.Siberia,Hokkaido,Fiji;NewZ'l'd?w	107	101	86+	w160 E	SITARSKI
Oct 26	15 18	Papagena	11.2	2.39	212168	9.2	K2	20 26.0	-33 37	2.2	8	17	24	Arabia, Iran, s. Cen. U.S.S.R.	88	69	96+	all	EMP 1980
Oct 27	14 54-80	Semiramis	10.2	0.91	55372	8.5	G5	2 11.4	34 40	1.9	9	29	23	Alaska, e.Siberia, w.China, India	158	30	99+	all	HERGET77
Oct 31	8 50-60	Aemilia	13.0	2.33	96895	8.9	K2	7 23.4	16 56	4.2	17	36	24	Mexico, Greater Antilles	107	45	94-	all	EMP 1982
Nov 5	3 18-35	Panopaea	12.2	1.90	76770	7.7	G0	4 46.0	26 56	4.5	14	25	18	n.w. Africa, Florida, Mexico	148	50	57-	e 70 W	HERGET77
Nov 10	11 56-65	Brixia	12.8	1.81	80435	9.2	F8	8 45.5	20 53	3.6	8	21	25	Hawaii, s.w.and central U. S. A.	99	70	7-		EMP 1982
Nov 12	9 43-56	Camilla	12.1	2.57		11.1	G0	1 04.2	-0 31	1.4	28	35	15	nwAlaska, Kamchatka,Japan,eChina	145	147	0-	none	HERGET78
Nov 16	14 54-78	Princetonia	13.4	2.58		9.2	K0	7 37.2	34 49	4.2	19	44	27	NewZ'l'd?w; Hawaii?e; w. Alaska	122	172	22+	none	LANDGRAF
Nov 23	14 47-60	Eunomia	8.5	1.33		11.3	G0	0 49.5	25 37	0.1	46	40	7	Marshall Is; (Papua,Queensland)?w	137	21	87+	all	BRANHAM
Nov 25	14 29-39	Pretoria	13.5	2.82	77051	8.7	F2	5 12.2	21 25	4.9	11	20	23	Hawaii?n; eastern Indonesia	164	37	97+	all	EMP 1981
Nov 29	10 54-103	Melpomene	9.1	1.24	115329	9.0	K0	7 19.3	7 28	0.8	41	61	12	Nicaragua, equatorial Pacific Ocean	134	29	96-	all	EMP 1980
Dec 1	3 03	Nemesis	12.5	2.91	189508	9.4	G	20 35.1	-23 51	3.2	3	10	36	southern Chile, Patagonia (low)	57	163	88-	e 64 W	HERGET78
Dec 6	23 50-56	Thyra	10.9	1.59	127949	7.3	K5	23 02.1	8 35	3.5	6	15	24	n. S. America; n.w. Africa?n	96	158	32-	none	LNDGRF79
Dec 9	8 06-18	Julia	10.1	1.54	41024	9.1	A5	6 15.7	42 02	1.4	15	22	13	U. S. A., Hawaii	155	124	10-	none	EMP 1983
Dec 20	14 18-33	Julia	10.0	1.53	40825	8.6	A0	6 00.5	41 19	1.7	13s	19	13	Calif.?n; Hokkaido,Korea,s.e.Asia	162	76	65+	w165 E	EMP 1983
Dec 28	17 17	Jupiter	-1.9	5.74	164338	7.2	G0	21 19.1	-16 29	0.0	32m	13	1	Europe, most of Africa	41	155	98-	e 20 E	NA0001
Dec 29	14 19-26	Marianna	12.6	2.05	74058	8.8	K0	0 28.8	21 12	3.9	9s	17	21	s.cen.USSR, nChina, Korea, Japan	98	106	95-	e 60 E	HERGET78
Dec 30	1 49-66	Melpomene	8.7	1.17	114658	9.0	F0	6 54.0	8 39	0.6	15	21	11	Yemen, n. Africa, s. Canada	165	32	92-	e115 W	EMP 1980

secondary star, the magnitude drop at occultation will be 1.0. The 6.8-magnitude companion is 2"0 away in position angle 131°. Its occultation might occur in Bermuda, but low altitude and the unocculted primary probably will preclude observation.

Aug. 9: The star is 38 Arietis = Z.C. 404 = UV Arietis, a Delta Scuti variable of small amplitude.

Sept. 12: SAO 159188 might be a double star with 7.8 and 8.9-mag. components, according to a photoelectric occultation recorded in P.A. 311° at McDonald Observatory, TX, on 1978 June 18; the projected separation was 0"246.

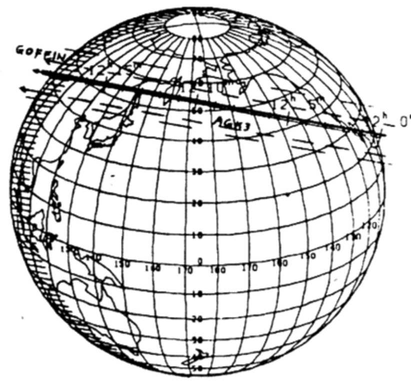
Sept. 18: SAO 132709 = ADS 4570, sep. 2"0 in p.a. 131°.

Table 2, Part B

1985	MINOR	PLANET					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.
Jun 25		Uranus	50300	3.83	*****		0.038	276°	184819	-2211733		0.17	2286	110	2.7	X					16h55m8	-22°39'
Jul 6	128	Nemesis	116	0.09	434	CEU	0.216	250	188456	-2714202		0.32	391	36	1.5	X					19 41.0	-26 56
Jul 16	602	Marianna	139	0.10	501	C	0.279	41		+10° 94		0.08	123	7	0.4	A	N11	78			0 47.6	11 14
Jul 17	212	Medea	133	0.05	679	C	0.185	108	157588	-09 3584		0.11	270	14	0.7	PX			0.16	0.4	12 54.1	-10 21
Jul 18	192	Nausikaa	99	0.11	241	S	0.256	54	128570	-02 6090		0.33	295	31	1.3	XS			2.55	-0.0	0 04.4	-1 56
Jul 20	145	Adeona	137	0.09	630	C	0.186	227	190822	-2918119	A	0.18	279	23	1.0	PG			-1.11	-0.6	22 00.0	-28 31
Jul 20	145	Adeona	137	0.09	630	C	0.186	227	190822	-2918119	B					PG			-0.62	-1.1	22 00.0	-28 31
Jul 21	10	Hygiea	443	0.19	4030	C	0.150	62	92597	+14 263		0.13	309	21	0.9	XA	N14	146	-0.43	-0.8	1 42.9	14 58
Jul 28	4	Vesta	555	0.39	3631	U	0.344	120	139767	-06 3945		0.33	468	23	1.7	X					14 09.3	-7 18
Aug 9	21	Lutetia	114	0.09	333	M	0.287	75	93083	+11 377		0.42	542	35	2.1	PZ	N12	295	-0.46	0.3	2 44.2	12 23
Aug 12	250	Bettina	270	0.15	1958	EMP	0.190	259	213017	-3315576		0.36	640	45	2.1	PS			1.12	-1.1	21 26.7	-32 56
Aug 17	28	Bellona	109	0.07	468	S	0.155	242	162924	-16 5421		0.25	414	39	1.4	X					19 42.3	-16 35
Aug 25	230	Athamantis	130	0.14	432	S	0.196	255	108412	+11 4938		0.13	126	16	0.6	AS	N11	2891	-0.54	-0.0	23 06.8	11 44
Aug 25	211	Isolda	168	0.10	762	C	0.149	69	75635	+20 475		0.10	158	15	0.5	XA	N20	262	0.17	0.7	2 54.3	20 45
Aug 26	216	Kleopatra	128	0.10	392	M	0.332	92		+20 626		0.10	130	7	0.5	A	N21	339			3 45.4	21 24
Aug 27	70	Panopaea	153	0.08	650	C	0.234	70		+22 722		0.06	109	6	0.3	A	N22	441			4 38.1	22 18
Sep 1	230	Athamantis	130	0.14	431	S	0.223	248	108346	+10 4866		0.56	523	60	2.3	AS	N11	2882	-0.42	-0.7	23 01.3	11 17
Sep 7	18	Melpomene	148	0.11	436	S	0.463	97	95210	+13 1102		0.09	125	5	0.5	AS	N13	527	0.69	-0.7	6 04.4	13 19
Sep 7	230	Athamantis	130	0.14	431	S	0.240	243	108266	+09 5137		0.47	437	47	2.0	AS	N10	3151	-0.68	-3.3	22 55.6	10 38
Sep 9	137	Meliboea	153	0.12	589	C	0.179	128	142583	-05 4745		0.19	258	26	1.0	S					18 44.3	-5 31
Sep 9	386	Siegena	203	0.19	928	C	0.286	214	146494	-05 5921		0.58	621	48	2.6	S					23 04.1	-5 14
Sep 12	4	Vesta	555	0.31	3623	U	0.460	110	159188	-14 4182	K	0.66	1166	34	3.8	PX			-0.23	0.3	15 20.1	-15 19
Sep 18	185	Eunike	188	0.11	823	C	0.294	115	132709	-01 1080	A	0.05	77	4	0.3	AG	S 1	663	2.08	-3.3	5 58.2	-1 19
Sep 18	185	Eunike	188	0.11	823	C	0.294	115	132709	-01 1080	B					AG	S 1	663	2.08	-3.3	5 58.2	-1 19
Sep 21	81	Terpsichore	112	0.08	345	C	0.257	66		+30 781						A	N30	481			5 05.2	30 16
Sep 26	70	Panopaea	153	0.09	663	C	0.101	47	76868	+24 719		0.07	122	18	0.4	XA	N24	442	-0.25	0.3	4 58.0	24 29
Sep 28	105	Artemis	129	0.12	476	C	0.318	220	109095	+03 27		0.14	151	10	0.6	XA	N 3	27	0.26	-0.6	0 15.4	4 00
Sep 30	196	Philomela	162	0.09	808	S	0.040	13	189888	-2615356		0.33	576	198	1.9	S					20 57.5	-26 25
Oct 5	18	Melpomene	148	0.12	448	S	0.350	104	96175	+11 1321		0.34	405	23	1.6	AS	N11	746	-0.80	-1.3	6 49.4	11 18
Oct 9	230	Athamantis	130	0.13	429	S	0.160	206	127622	+05 5037		0.13	128	20	0.6	AS	N 5	3290	1.36	2.9	22 35.0	6 10
Oct 17	33	Polyhymnia	62	0.08	125	S	0.208	255		+10 203		0.15	109	17	0.6	A	N10	167			1 33.0	10 50
Oct 24	2	Pallas	538	0.41	3687	U	0.318	157	171571	-22 1379		2.96	3852	224	14.6	PG			1.56	-1.5	6 19.0	-22 05
Oct 26	471	Papagena	145	0.08	575	S	0.243	66	212168	-3314959		0.30	523	30	1.7	S					20 28.2	-33 30
Oct 27	584	Semiramis	57	0.09	103	S	0.232	235	55372	+34 396		0.26	169	26	0.9	AS	N34	217	-0.35	1.4	2 13.5	34 51
Oct 31	159	Aemilia	141	0.08	602	C	0.119	102	96895	+17 1575		0.35	597	72	2.0	XA	N16	769	-0.22	1.8	7 25.5	16 51
Nov 5	70	Panopaea	153	0.11	680	C	0.190	285	76770	+26 752		0.22	307	28	1.1	XA	N26	449	0.89	0.2	4 48.2	26 59
Nov 10	521	Brixia	104	0.08	300	C	0.234	83	80435	+21 1914		0.11	144	11	0.5	XA	N20	1039	0.00	0.4	8 47.6	20 45
Nov 12	107	Camilla	252	0.14	1766	C	0.116	243		-01 145		0.05	90	10	0.3	A	S 0	116			1 06.1	-0 20
Nov 16	508	Princetonia	139	0.07	679	C	0.092	2				0.24	446	62	1.4	A	N34	833			7 39.6	34 44
Nov 23	15	Eunomia	261	0.27	1172	S	0.142	175		+25 127		0.04	42	7	0.2	A	N25	92			0 51.4	25 49
Nov 25	790	Pretoria	178	0.09	1154	P	0.195	247	77051	+21 800		0.11	216	13	0.7	XA	N21	499	0.06	1.6	5 14.3	21 28
Nov 29	18	Melpomene	148	0.16	477	S	0.096	260	115329	+07 1695		0.34	302	84	1.4	AS	N 7	976	-0.43	5.2	7 21.3	7 24
Dec 1	128	Nemesis	116	0.05	405	CEU	0.392	74	189508	-2416160		0.12	250	7	0.7	X					20 37.2	-23 43
Dec 6	115	Thyra	95	0.08	231	S	0.341	77	127949	+08 4988		0.84	965	59	3.9	AS	N 8	3182	0.02	1.0	23 03.9	8 47
Dec 9	89	Julia	168	0.15	692	S	0.243	261	41024	+42 1531		0.35	390	35	1.6	AS	N42	724	-0.54	7.6	6 18.3	42 01
Dec 20	89	Julia	168	0.15	698	S	0.272	251	40825	+41 1342		0.07	78	6	0.3	AS	N41	629	-0.29	0.4	6 03.0	41 19
Dec 28		Jupiter	70452	16.92	****		0.209	72	164338	-16 5850		0.33	1374	38	2.9	X					21 21.0	-16 20
Dec 29	602	Marianna	139	0.09	504	C	0.261	80	74058	+20 52		0.36	540	33	1.9	AS	N21	39	-0.66	0.3	0 30.7	21 24
Dec 30	18	Melpomene	148	0.17	494	S	0.287	289	114658	+08 1572		0.09	76	8	0.4	AS	N 8	871	-0.50	0.5	6 56.0	8 36

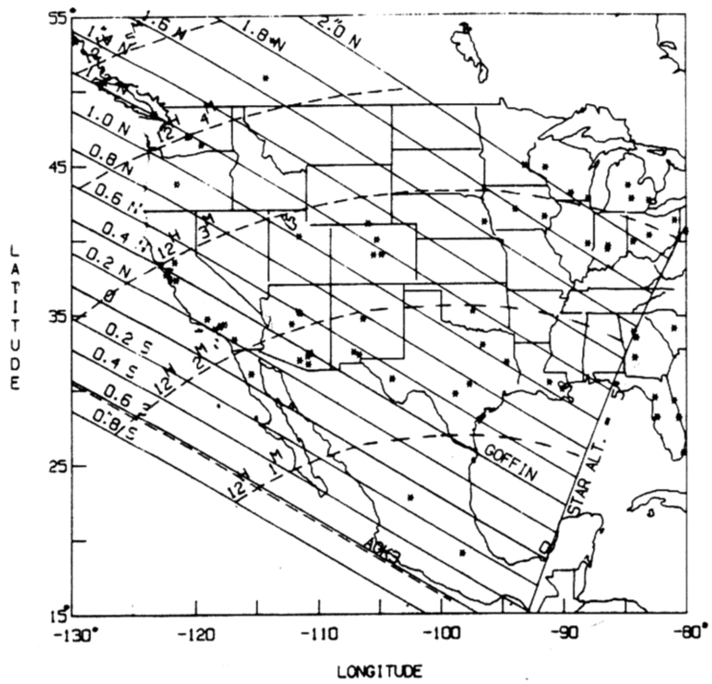
Nov. 16: The AGK3 lists 5.2 as the star's magnitude, but this is an error; Gordon Taylor's visual estimate is given in the table.

Dec. 28: Jupiter's 17" disk will have a negligible defect of illumination of 0".15. The star's spectral type is G0, similar to the sun's. Perhaps the only hope of meaningful observation is by photoelectric recording in one of Jupiter's methane absorption bands. I have not checked the geometry to see if an occultation by Jupiter's ring is possible.

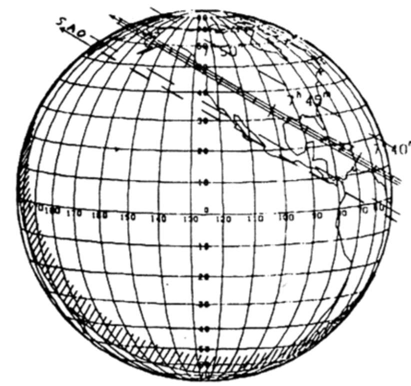


SAO 78419 by Harmonia 1985 Jan 1

1985 1 1 (40) HARMONIA SAO 78419
DIAMETER 118 KM = 0".13



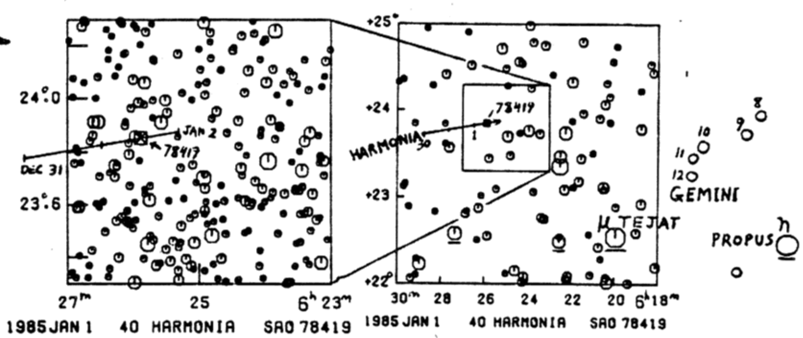
EPHEMERIS SOURCE = HERGET78

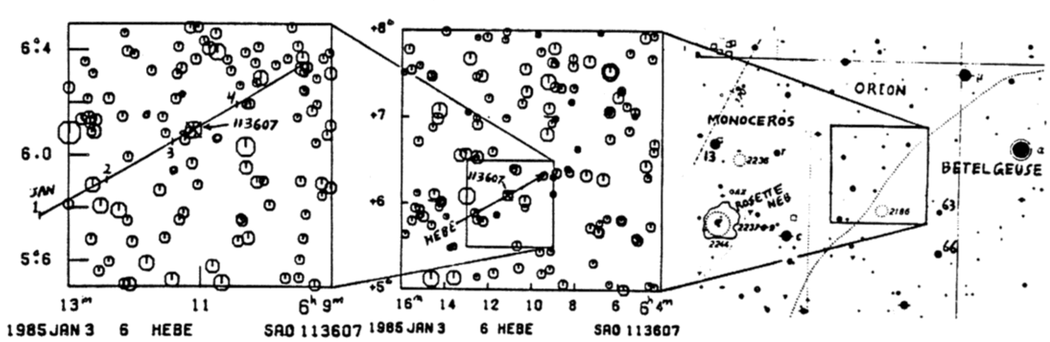


SAO 113607 by Hebe 1985 Jan 3

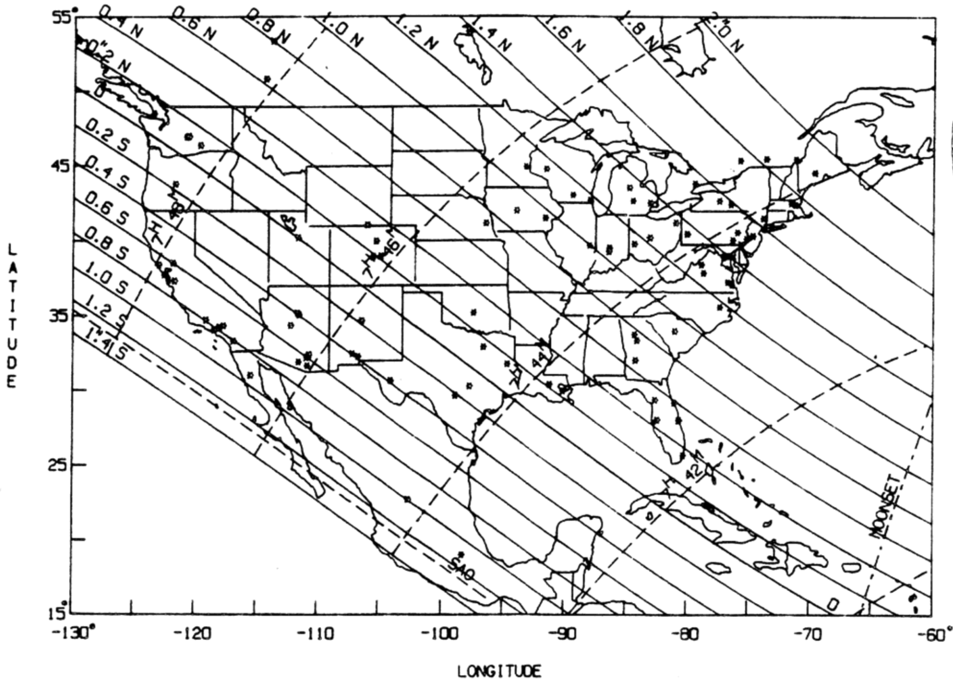
SAO 92993 by Vibilia 1985 Jan 6

Track was incorrectly labeled "Hebe" on earlier version

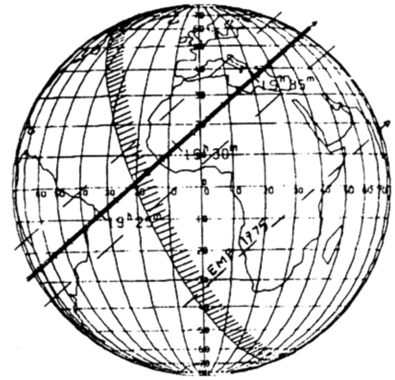




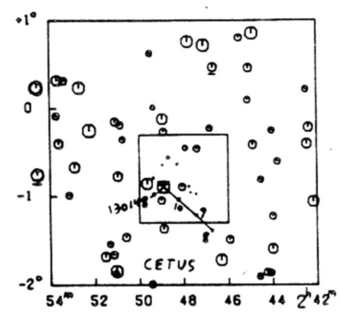
1985 1 3 (6) HEBE SAO 113607
DIAMETER 186 KM = 0".20



EPHEMERIS SOURCE = BRANHAM

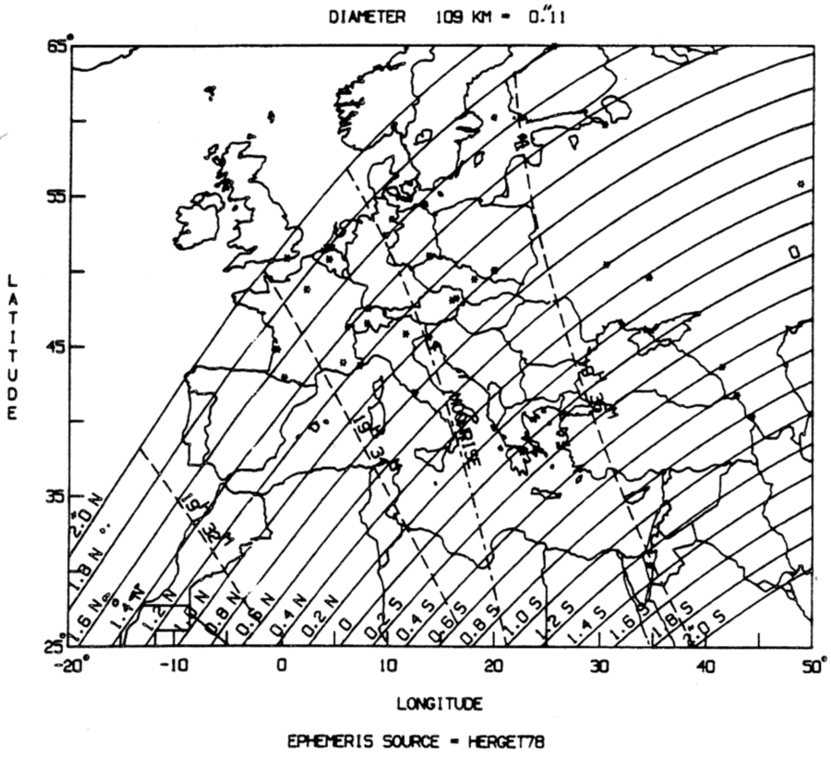


SAO 130148 by Klotho 1985 Jan 10

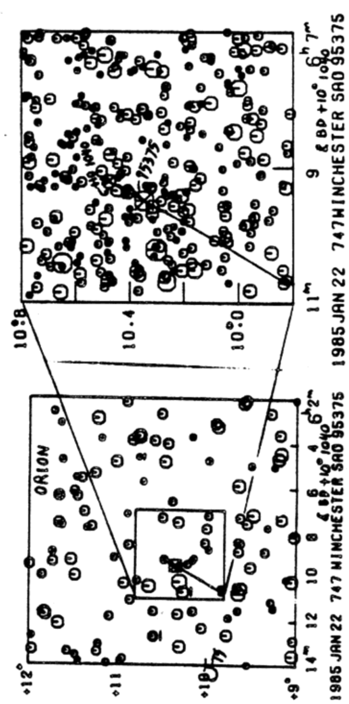


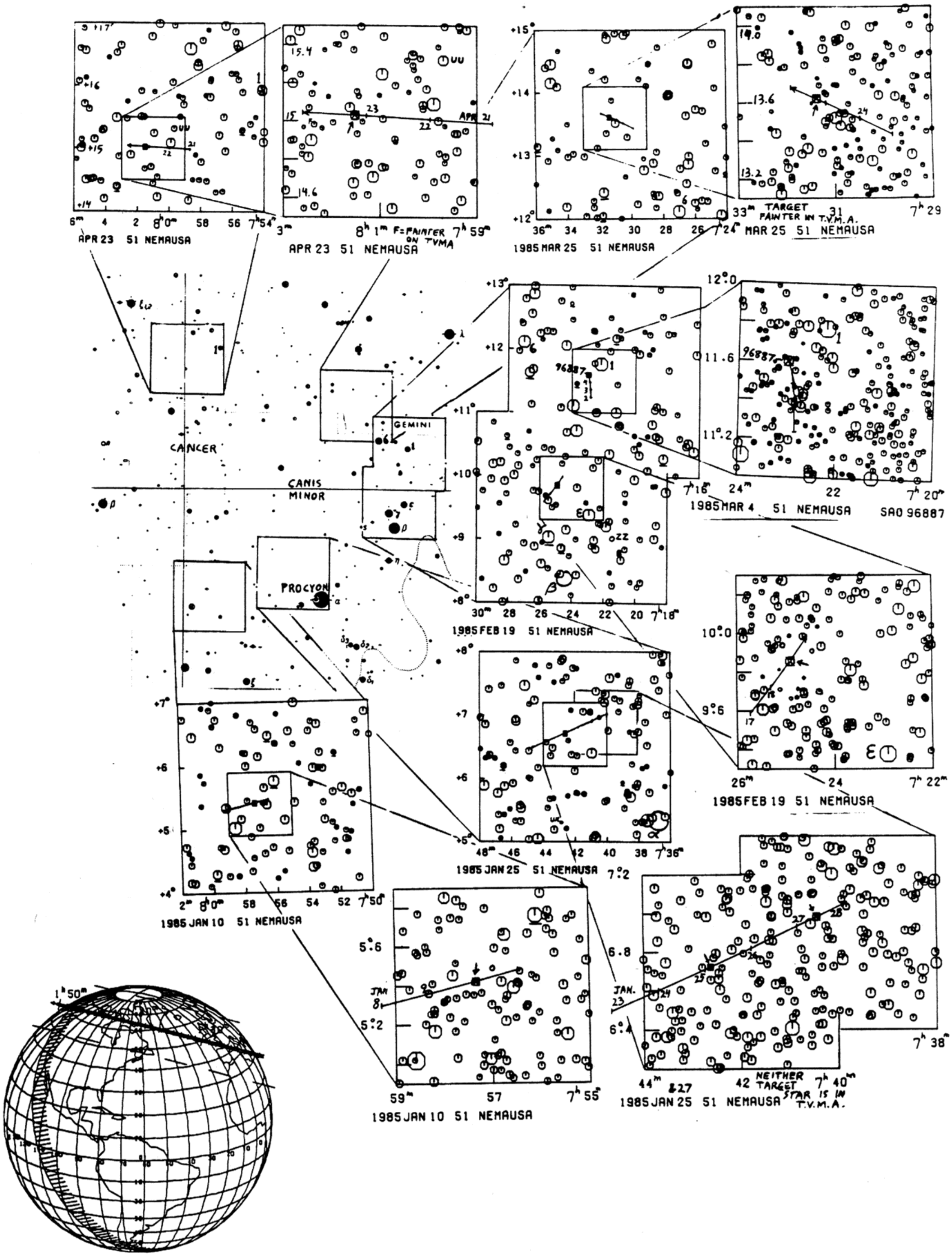
1985 JAN 10 97 KLOTHO SAO 130148

1985 1 10 (97) KLOTHO SAO 130148
DIAMETER 109 KM = 0".11

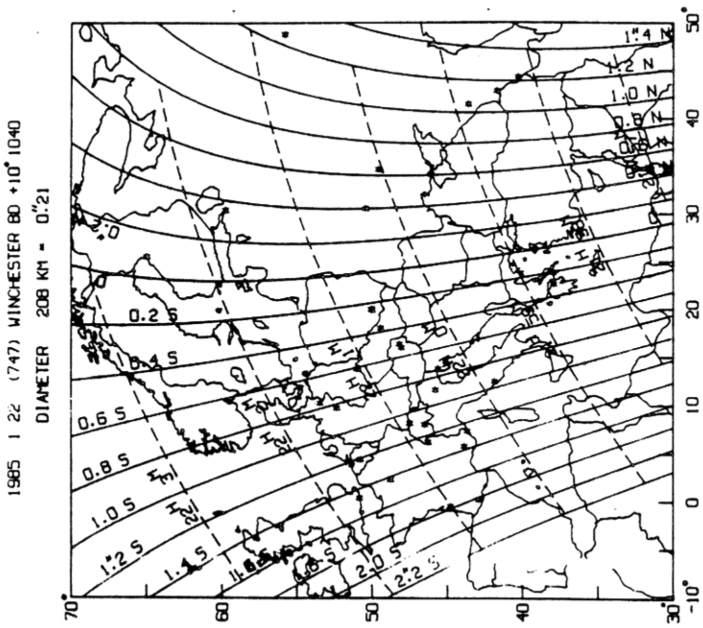


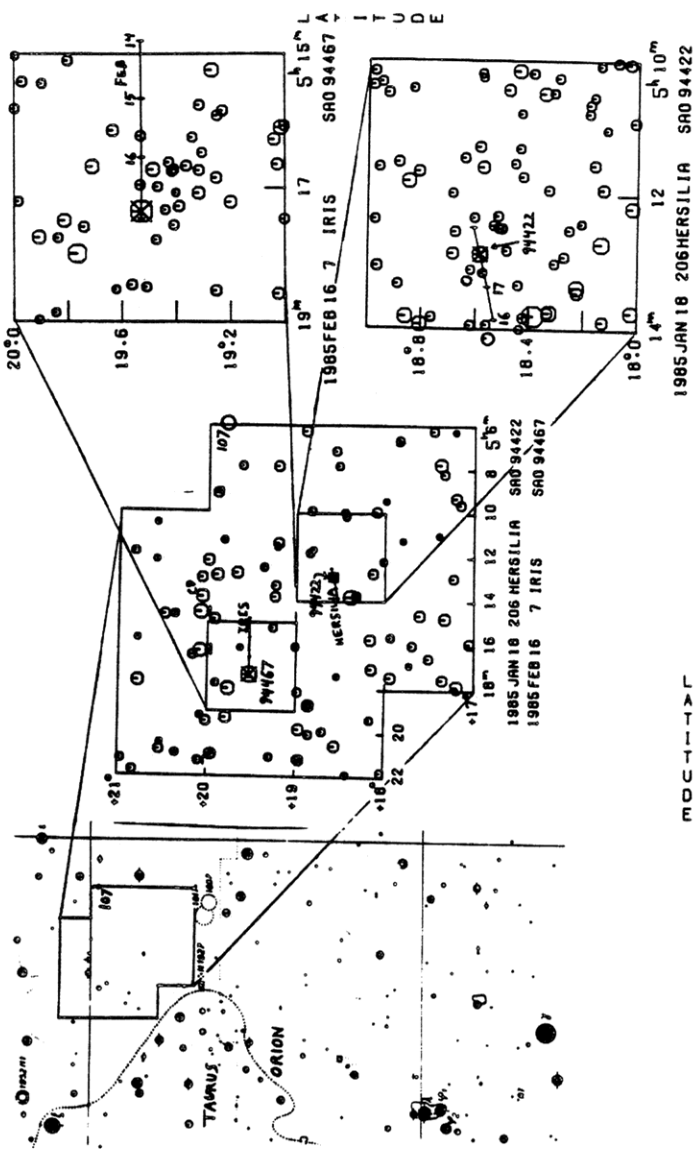
EPHEMERIS SOURCE = HERGET78





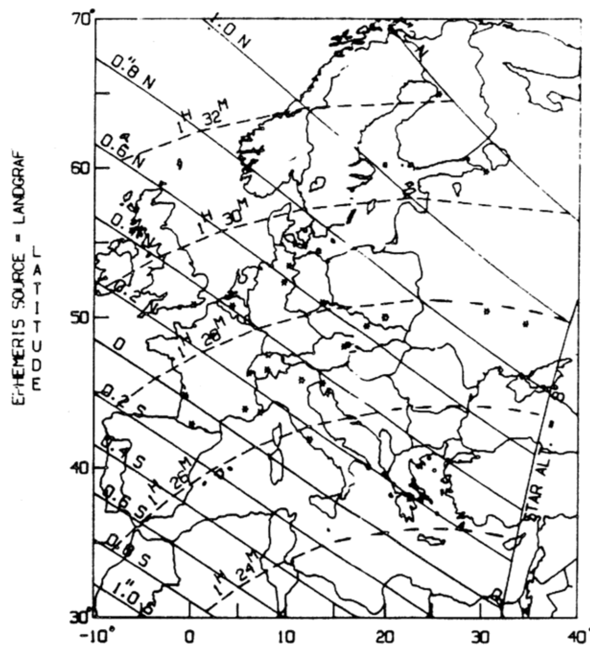
SAO 94422 by Hersilia 1985 Jan 18





1985 1 18 (206) HERSILIA SAO 94422

DIAMETER I:: KM = 0."09

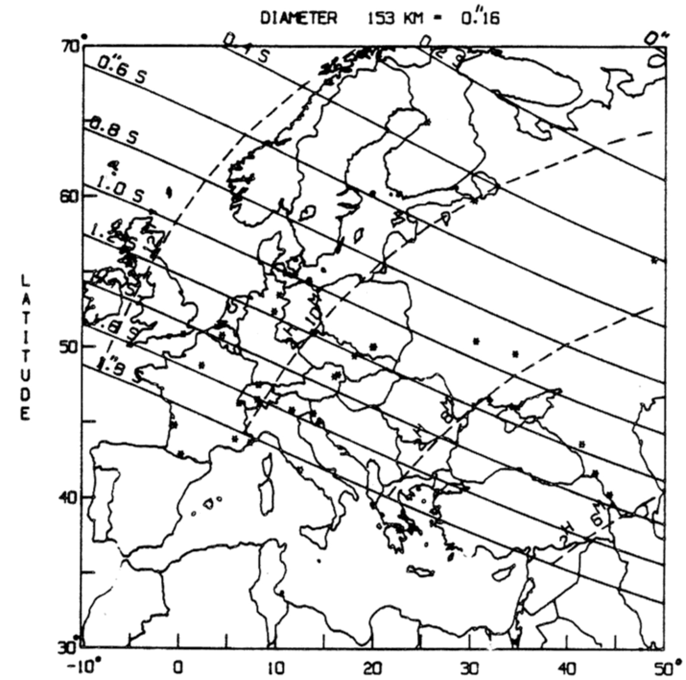


LONGITUDE

EPHEMERIS SOURCE = EMP 1982

1985 1 10 (51) NEMAUSA

DIAMETER 153 KM = 0."16

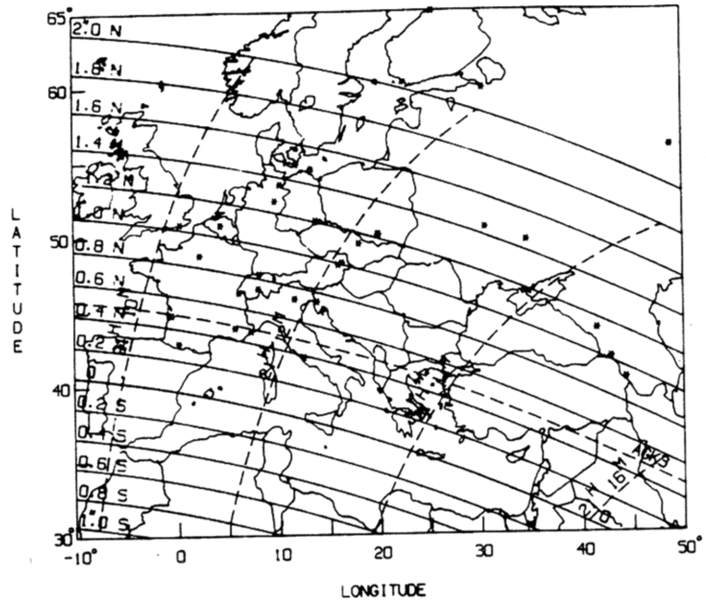


LONGITUDE

EPHEMERIS SOURCE = KRSTNN77

1985 2 16 (7) IRIS SAO 94467

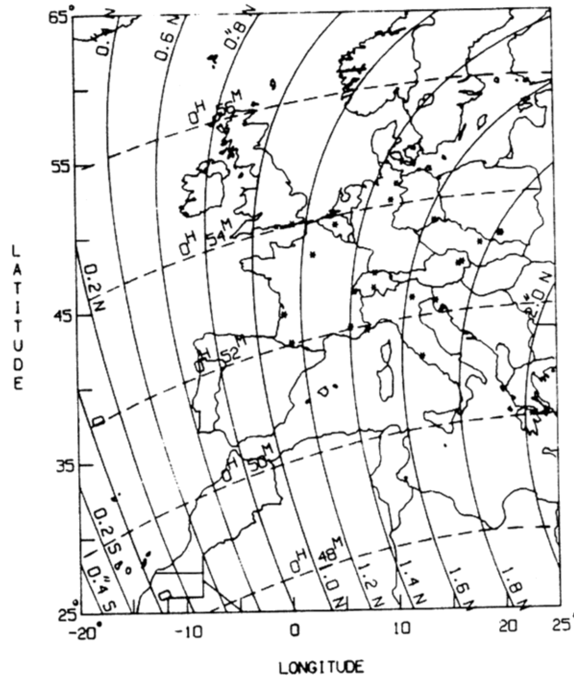
DIAMETER 222 KM = 0".21



EPHEMERIS SOURCE = BRANHAM

1985 2 19 (51) NEMAUSA

DIAMETER 153 KM = 0".15



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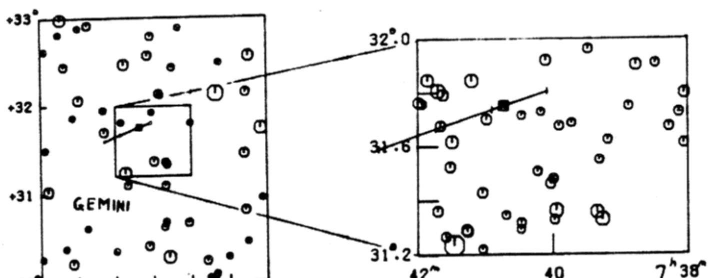
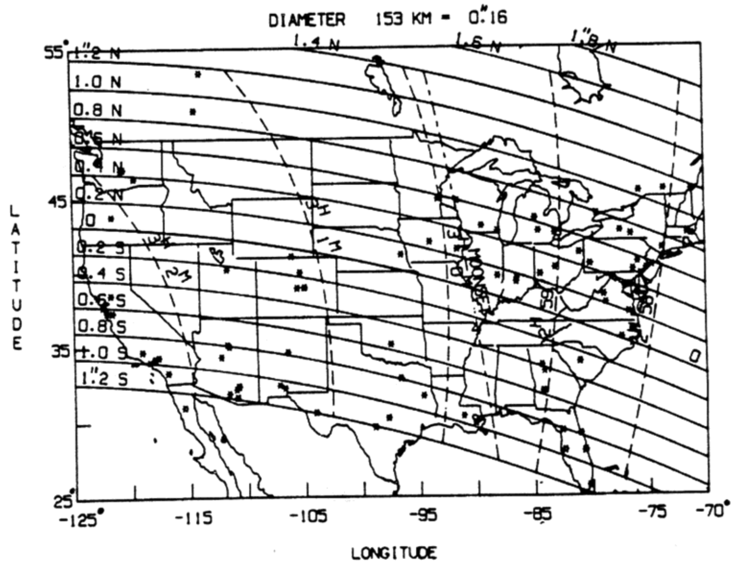


1985 FEB 1 488 KREUSA BD +31° 1655

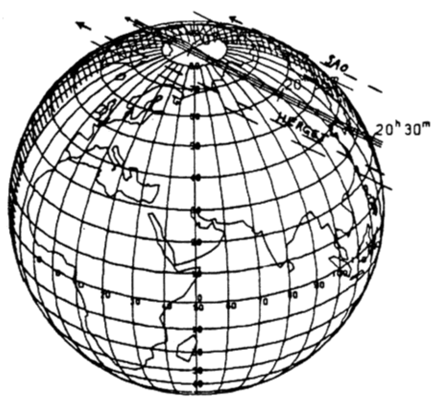
1985 FEB 1 488 KREUSA

1985 1 25 (51) NEMAUSA

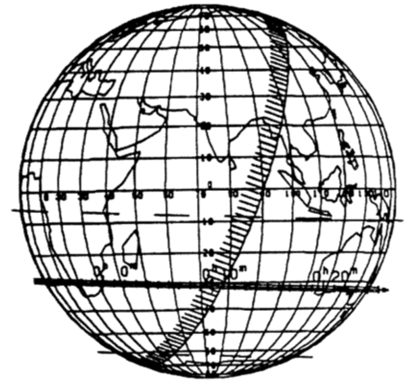
DIAMETER 153 KM = 0".16



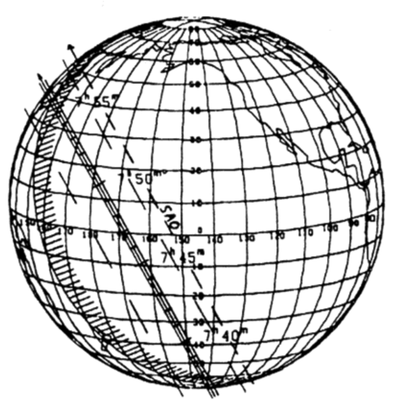
EPHEMERIS SOURCE = KRSTNN77



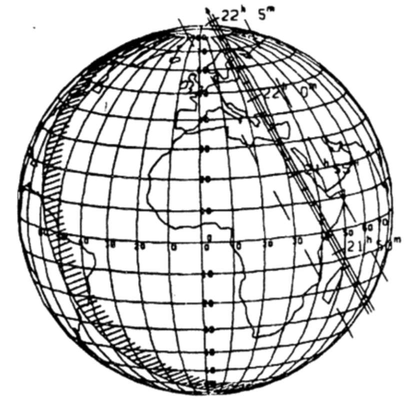
SAO 60442 by Kreusa 1985 Jan 19



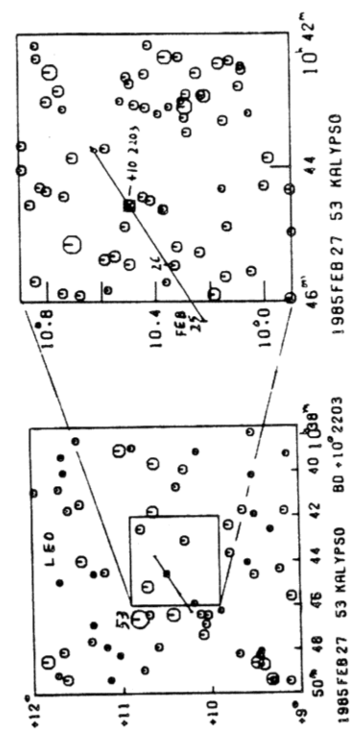
SAO139116 by Stereoskopia 85 Jan 21

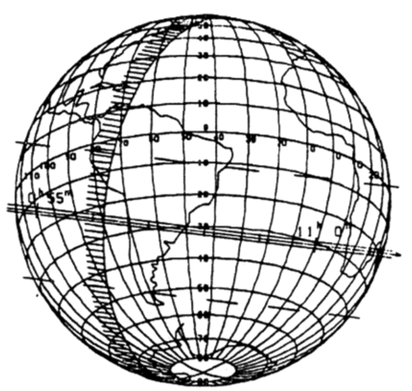


SAO 95375 by Winchester '85 Jan 22

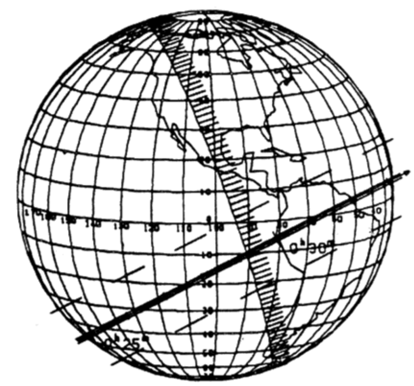


+10°1040 by Winchester 1985 Jan 22

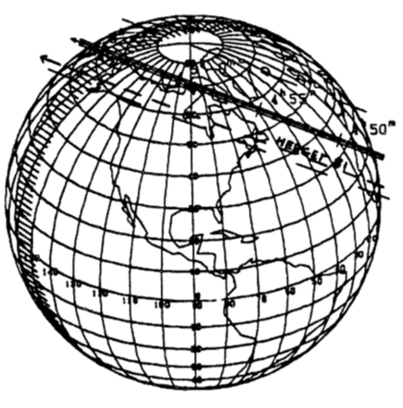




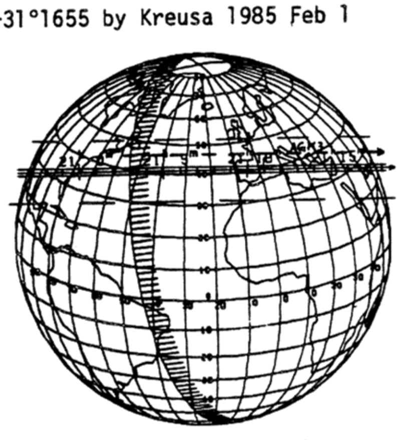
SAO 184542 by Fortuna 1985 Jan 30-



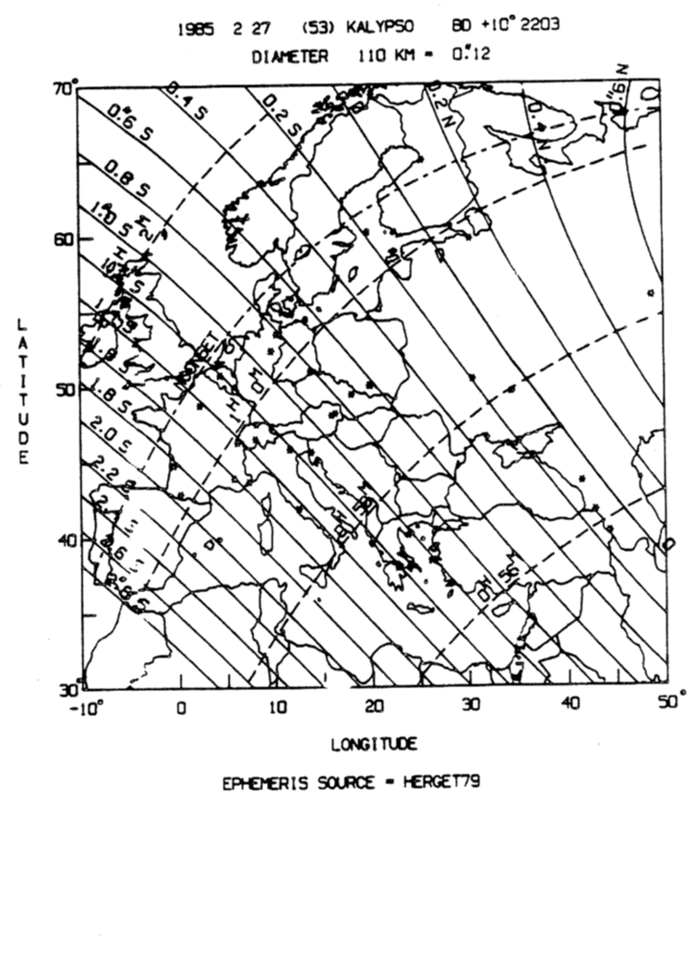
+08° 355 by Flora 1985 Jan 31

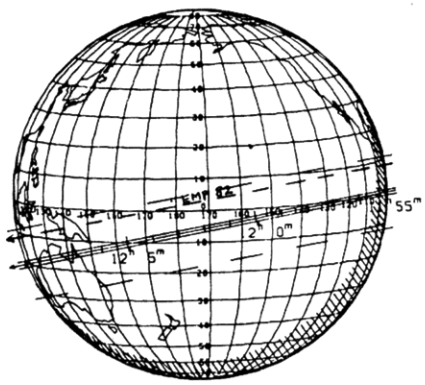


+31°1655 by Kreusa 1985 Feb 1

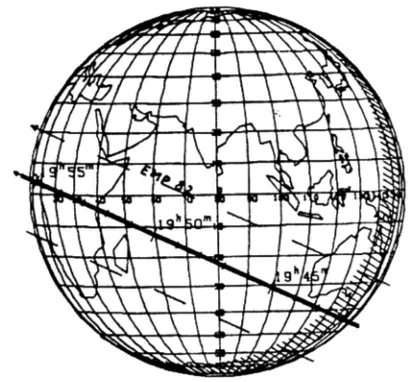


SAO 94467 by Iris 1985 Feb 16



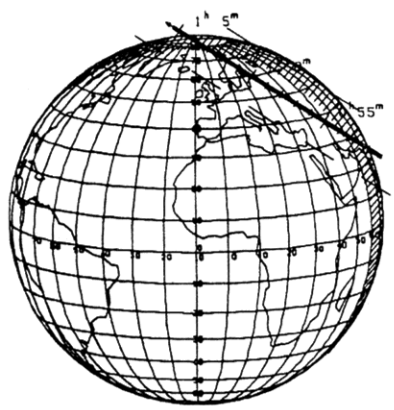


SAO 118291 by Palma 1985 Feb 18



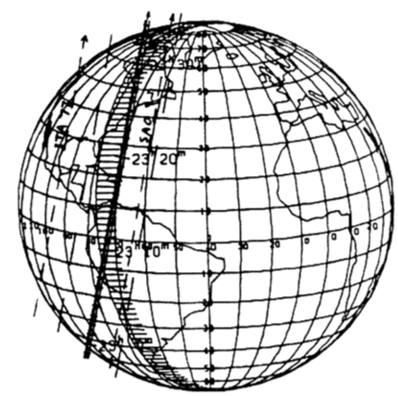
+01°2551 by Galatea 1985 Feb 22

SAO 183414 by Minerva 1985 Feb

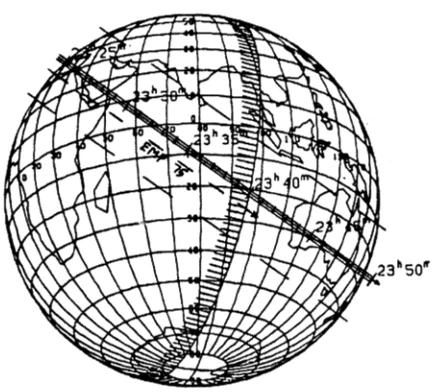


+10°2203 by Kalypso 1985 Feb 27

SAO 99560 by Mathesis 1985 Mar 3

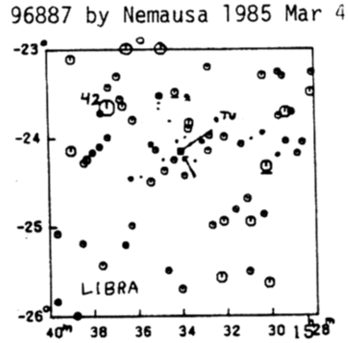


SAO 96887 by Nemausa 1985 Mar 4



SAO 183620 by Amphitrite '85 Mar 4

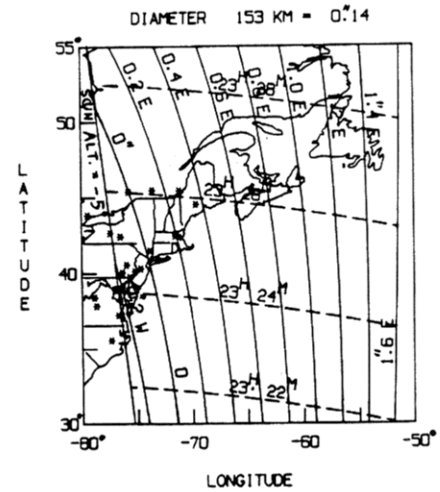
SAO 157187 by Ursula 1985 Mar 5



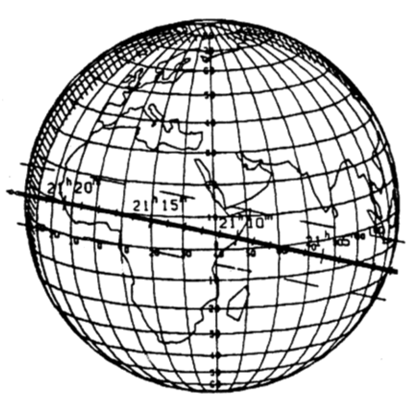
1985 MAR 4 29 AMPHITRITE SAO 183620

1985 3 4 (51) NEMAUSA SAO 96887

DIAMETER 153 KM = 0."14

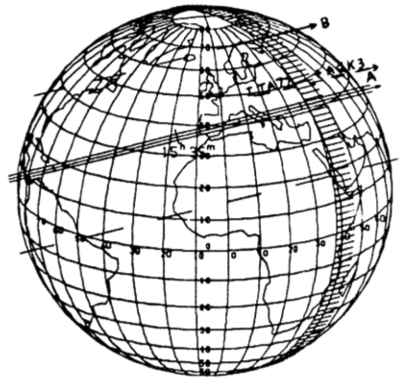


EPHEMERIS SOURCE = KRSTNN77

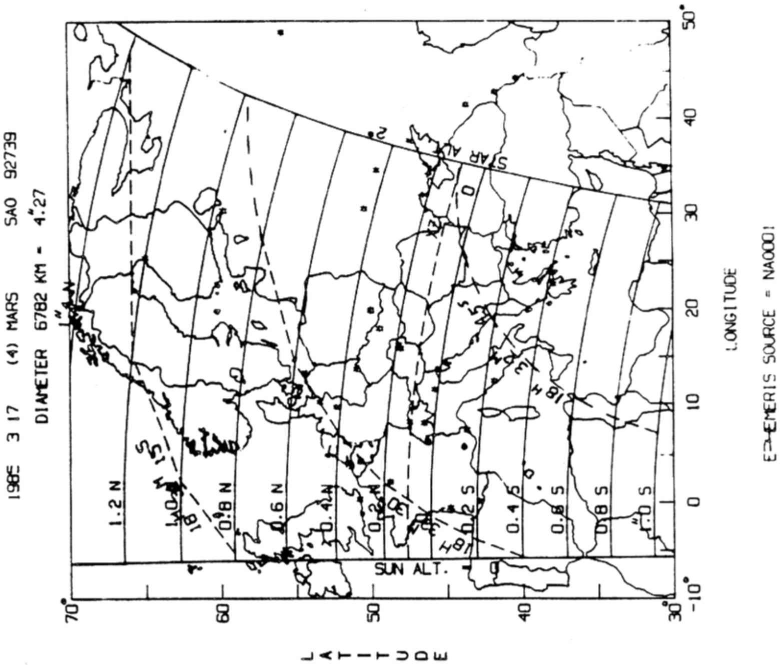


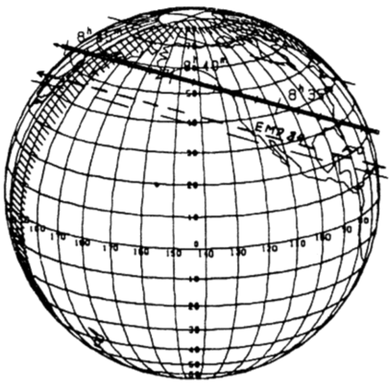
SAO 99489 by Mathesis 1985 Mar 12

SAO 92739 by Mars 1985 Mar 17



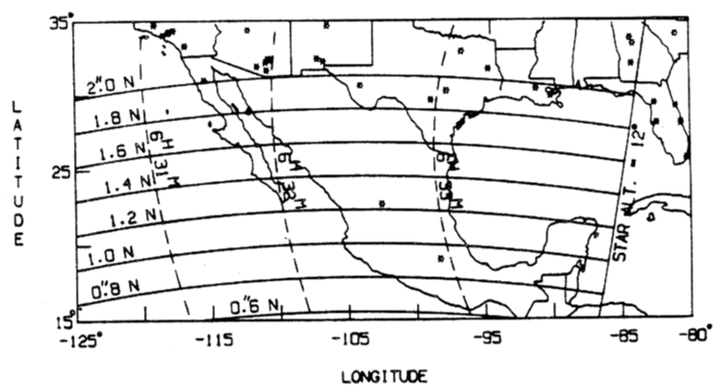
SAO 93440 by Themis 1985 Mar 27





+18°2490 by Isis 1985 Mar 28

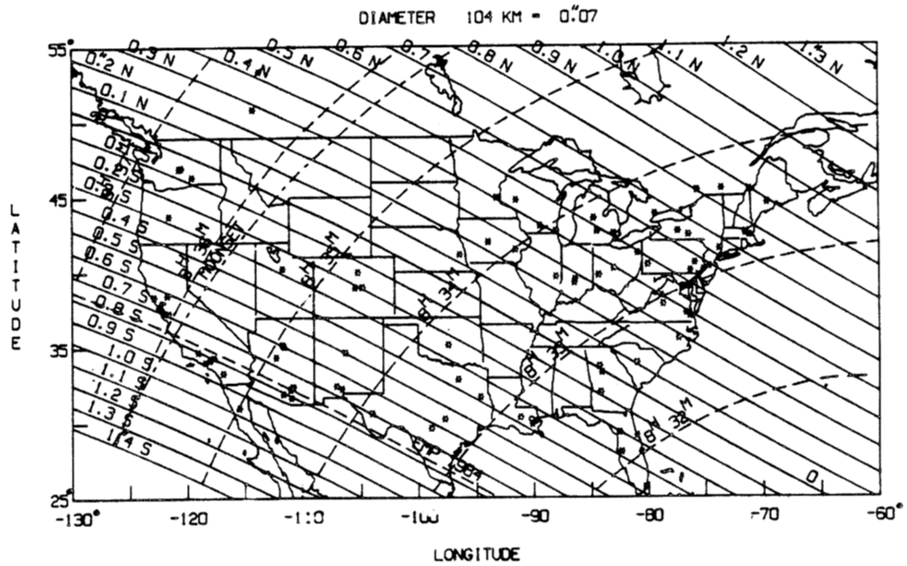
1985 3 25 (51) NEMAUSA
DIAMETER 153 KM = 0.″12



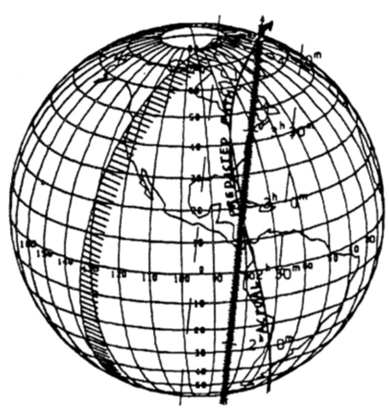
EPHEMERIS SOURCE = KRSTNN77

SAO 158545 by Io 1985 Apr 2

1985 3 28 (42) ISIS BD +18° 2490
DIAMETER 104 KM = 0.″07

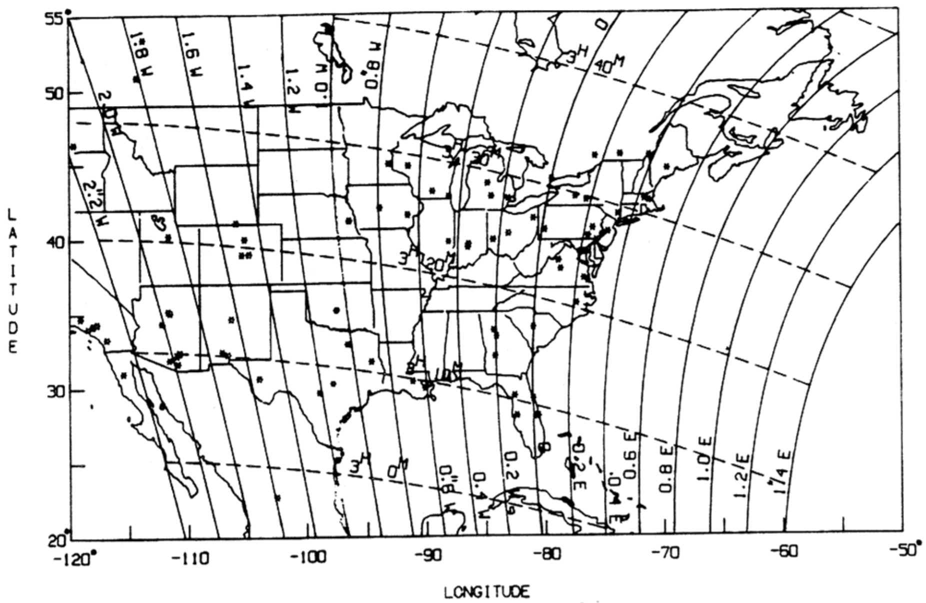


EPHEMERIS SOURCE = HERGET77

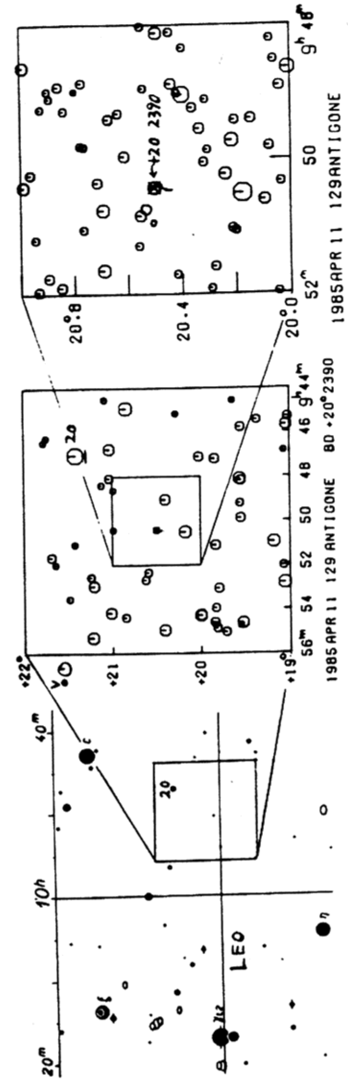


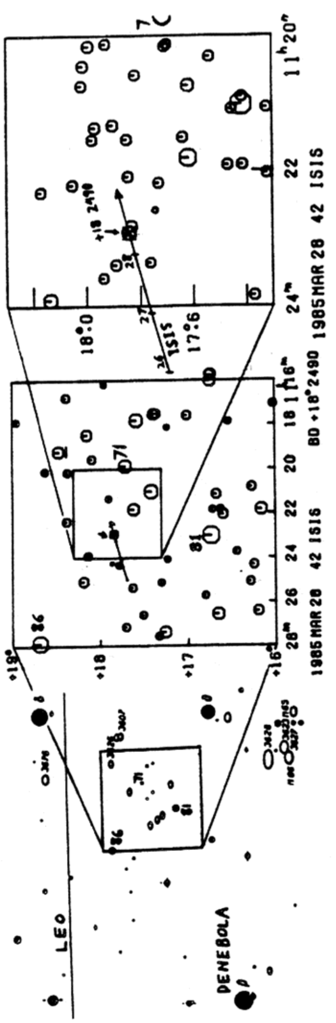
+20°2390 by Antigone 1985 Apr 11

1985 4 11 (129) ANTIGONE BD +20°2390
DIAMETER 113 KM = 0".08



EPHEMERIS SOURCE = EMP 1980





SAO 139564 by Sapientia '85 Apr 15