Occultation Newsletter

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Joan Bixby Dunham, Editor

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FROM THE PUBLISHER

For subscription purposes, this is the third issuee of 1993. It is the first issue of Volume 6. IOTA annual membership dues, including **ON** and supplements for

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Local circumstance (asteroidal appulse) predictions	1.00
Graze limit and profile predictions (per graze)	1.50
Papers explaining the use of the predictions	2.50

Asteroidal occultation supplements will be available at extra cost: for South America via Orlando A. Naranjo (Universidad de los Andes; Dept. de Fisica; Merida, Venezuela), for Europe via Roland Boninsegna (Rue de Mariembourg, 33; B-6381 DOURBES; Belgium) or IOTA/ES (see below), for southern Africa via M. D. Overbeek (Box 212; Edenvale 1610; Republic of South Africa), for Australia and New Zealand via Graham Blow (P.O. Box 2241; Wellington, New Zealand), and for Japan via Toshio Hirose (1-13 Shimomaruko 1-chome; Ota-ku, Tokyo 146, Japan). Supplements for all other areas will be available from Jim Stamm (11781 N. Joi Drive; Tucson, AZ 85737; U.S.A.) for $2.50.

Observers from Europe and the British isles should join IOTA/ES, sending DM 40.-- to the account IOTA/ES; Bartold-Knaust Strasse 8; D-30459 Hannover, Germany; Postgiro Hannover 555 829 - 303; bank-code-number (Bankleitzahl) 250 100 30.

IOTA NEWS

David W. Dunham

Total Lunar Eclipse: The most important feature of this issue is the article on occultations during the November 29th total lunar eclipse, the best one for occultations throughout North America in many years; see the following pages.

IOTA/ES Business Meeting: The European Section of IOTA will hold their annual business meeting in Hannover, Germany, on Saturday, November 20, starting at 10:30 am. Contact Hans-Joachim Bode (see the back page) for more information.

ESOP XII: The 12th European Symposium on Occultation Projects was held in Roden, the Netherlands, on August 27-31. Claudio Costa's PC Evans program, along with numerous auxiliary programs and datasets for calculating and distributing detailed (formerly U. S. Naval Observatory, or USNO) lunar total occultations, was distributed to several national coordinators for the first time. At the meeting, I was able to just discuss what needed to be done with the coordinators who were there. Afterwards, I wrote the procedures and updated other documentation to create a consistent and understandable package, a job that took much more effort than I expected and which delayed this issue of **ON** for over a month. See the article on lunar occultation prediction news on p. 17 for more about the "PC Evans package". Many very interesting presentations were given during the main part of the ESOP meeting over the weekend. More about this enjoyable symposium will be published in a future issue. ESOP XIII will be held in late August, 1994, in Cracow, Poland, while ESOP XIV will be held in the Czech Republic in Plzen in 1995, the city's 700th anniversary.

IOTA Annual Meetings: The 11th annual meeting of IOTA was held Saturday, September 11, near Houston, TX; see Rocky Harper's article about it on p. 11. We tentatively plan to hold the 1994 IOTA meeting in western Texas just before the annular solar eclipse that will occur on Tuesday, May 10. The date would be either Saturday, May 7 or Sunday, May 8, with the location probably either Midland-Odessa or El Paso. Monday, May 9th would be devoted to testing equipment for, and deploying to, the annular eclipse. By selecting a western Texas location, those who also want to attend the Texas Star Party at Prude Ranch near Ft. Davis (and the other meetings that will be held there) could do so, but I think that we want to hold the IOTA meeting at a more accessible location for the benefit of those who are more interested in the eclipse. Let me know your ideas about this (1-301-474-4722 or E-Mail david_dunham@jhuapl.edu or see the roster for an address) soon since we want to make a decision by mid-December and include it in the next issue.

IOTA Manual: We plan to produce 100 copies of Wayne Warren's current "Script" version of the IOTA Manual before the end of this year for new observers and for current members who request a copy from the McManuses, to replace the difficult-to-read POM that has been distributed during the last several years. This version still needs some work that I have not had time to do. The "final" version that will be distributed to all members will also need to include revisions to describe the new graze predictions (a small change, since they are so similar to the current ones) and considerably more work to incorporate the "USNO" occultation papers that we have inherited and which are largely out of date.

E-mail: The October 9th occultation by 27 Euterpe was quite successfully observed in the southwestern USA, based on a good astrometric update obtained at Lowell Observatory four days before the event. Electronic mail (specifically, Internet) was valuable for distributing updated predictions quickly to dozens of observers. I mailed (regular postal service) the same information to a couple of dozen other ON subscribers in or near the path for whom I did not have E-mail addresses, but I think at best 25% of those may have arrived in time. In the USA and many other countries, Internet is available at most universities, colleges, government agencies, and large businesses. If you don't have access at work, Internet can be reached for reasonable prices via Compuserve, MCIMail, GEnie, and other vendors in the USA and in other countries; a few IOTA members have already purchased access. Local and regional coordinators are encouraged to gain Internet access to facilitate communication about last-minute updates. Those with E-mail also have a duty to try to inform other IOTA members without E-mail in their areas of local time-critical events.

This Issue and a Correction: This issue marks the first issue of volume 6. With volume 5 issue 12, we exceeded 300 pages by 20 pages, so we decided it was time to start a new volume. We apparently got ahead of ourselves last March, since the cover of issue No. 11 said Vol. 6 when it should have been Vol. 5. The first page of the issue (p. 275) correctly stated "Volume 5".

1994 North American Asteroidal Occultation Supplement: The 1994 N.A.A.O.S., giving Edwin Goffin's predictions, world maps, and finder charts, is being distributed with this issue, and others should have already received similar predictions for their areas from their national or regional coordinator.

The Next Issue: The main purpose of the next issue will be to describe IOTA's planetary occultation predictions for 1994. It will also include several articles, such as Tony Murray's article on new double stars, that could not be included in this issue due to lack of time. We also hope to include Richard Wilds' paper on Watts' lunar limb correction charts, a separate IOTA publication, with that mailing. We should receive your contribution for **ON 6** (2) by December 13. We want to produce the issue before the end of 1993, but it might not actually appear until the first or second week of January 1994.

OCCULTATIONS DURING THE TOTAL LUNAR ECLIPSE OF 1993 NOVEMBER 29

David W. Dunham

This eclipse is the best-placed for North America since 1982; the Moon will be in the zenith at mid-eclipse near Mexico City. But unlike other total lunar eclipses well-seen from the continent during the previous 30 years, several relatively bright stars in the northern part of the Hyades will be occulted. Occultations might be seen during this eclipse from northern and western Europe, northwestern Africa, South America, Japan, eastern Siberia, northern New Zealand, and most of the Arctic, Atlantic, and Pacific Oceans. This eclipse will probably be only slightly darker than usual due to the lingering effects of material still in the atmosphere from the eruptions of Mt. Pinatubo in 1991. Nevertheless, the November eclipse should be very good for occultations due to the brightness of the stars that will be occulted. With large telescopes, occultations of stars as faint as 13th magnitude might be observed in the dark center of the umbra that will be traversed by the northern parts of the Moon. Observers of this eclipse should certainly include the timing of occultations in their program.

<u>Value:</u> Only during a total lunar eclipse can occultation disappearances and reappearances be observed equally well around the entire circumference of the Moon's disk. This gives a rare oppotunity to accurately link the eastern and western hemispheres of the Moon. Dr. Chester Watts found this job to be extremely difficult when he constructed his epic charts of the marginal zone of the Moon from photographic plates where in general only either the eastern or western hemisphere were sunlit. Improving information about the lunar profile from lunar eclipse occultation timings is important for all lunar occultation analyses. But this especially benefits analysis of solar eclipse Bailey's bead timings made near the edges of the path of annularity or of totality that are used for measuring small variations in the solar diameter. For the solar eclipse analyses, where the most accurate data involve the lunar polar regions, lunar eclipse grazing and near-grazing occultation timings have special value. Since the Moon is near the ecliptic during both lunar and solar eclipses, the latitude libration is always near zero in both cases.

<u>Observing Strategy:</u> The eclipse occurs late Sunday evening-early Monday morning at the end of the Thanksgiving Day weekend for Americans. So if you are travelling during this holiday period, plan to return in time to get ready to observe the eclipse (and possibly to travel further if clouds threaten your main observing location). Try to gain access to the largest telescope possible and concentrate on timing occultations around the entire Moon's limb. Also, try to observe reappearances, as they are often under-observed during eclipses.

If you have a portable telescope, allow youself enough time to travel to view the eclipse. Most parts of North America and Europe are quite cloudy in late November. Mobility could mean the difference between seeing and not seeing this rare event. Remember that Sunday evening traffic will be heavier than usual so allow more time for travelling. If the largest telescope available to you is portable, it would be best to take it to the nearest grazing occultation path. Observations of southern-limit grazes will be more difficult than northern limit since the southern part of the Moon is in the umbra for a shorter time than the northern part, If a southern-limit graze path of a relatively bright star (necessary since the southern part of the Moon will be in the brighter outer portions of the umbra throughout totality) is near you, its observation should have top priority.

<u>Other Publications:</u> Basic information (such as contact times) about this eclipse are given, or can be inferred, from this article. Additional general information about the November eclipse is given on pages 66-68 of the November issue of **Sky and Telescope (S&T)**. The 1993 occultation highlights article on pages 74-76 of the January issue of **S&T** gives a map showing 5 eclipse graze paths, double star, and other eclipse occultation information. A reference to this article probably will be given somewhere in the December issue, which will reach (or has reached) virtually all North Americans before the eclipse. I was not able to prepare an article in time for either **S&T** or **Astronomy**, because I did not have the software working on my PC to generate the necessary plot for that article until mid-August. This is part of the slow resolution of the problems caused by the loss of my access to two mainframe computers in 1992 September. **Astronomy** did publish a letter from me on p. 13 of their December issue pointing out the good eclipse occultation opportunity and refering readers to IOTA for more information.

Fortunately, several thousand people who do not get **ON** will get a chart showing stars to 11th magnitude and other information about eclipse occultations. An article that I prepared will be published in the November issues of the Astronomical Society of the Pacific's **Mercury** magazine and in the Astronomical League's **Reflector**. The **Mercury** article also includes basic information about timing occultations.

<u>The Star Field:</u> The eclipse star field, shown in two charts, is in Taurus about 5° northwest of Aldebaran. The brightest star in the field is 4.4-mag. κ Tauri = ZC 656, near the upper-left corner of the chart. It will be occulted during the final partial phases in the Pacific Ocean southeast of New Zealand. Some points in the northern limit calculated with the OCCULT program are below; since the region of visibility of this occultation is only in the ocean, I presume that nobody will attempt to observe it.

West Long.	Lat.		Moon alt.	Sun alt.	umbral dist.	% sunlit
160°	-59°	32′	1°	-2°	90U	66E
150	-53	44	9	-10	94U	72E
145	-51	00	14		99U	78E
142	-49	29	16		103U	86E

No significant clusters or nebulae are in the star field which does contain several outlying members of the Hyades open cluster.

One plot shows only the stars, down to magnitude 14.0 from the Q-catalog based on the USNO XZ and the Space Telescope Guide Star (GS) Catalogs, the data from the latter which were sent to me via Wayne Warren by Doug Mink at the Center for Astrophysics in Cambridge, Massachusetts. Underlined stars are, or may be, double. The Q-catalog equinox 1950 bounds, which are close to those determined by David Herald, are 4^h 12.0^m to 4^h 24.0^m in right ascension (R.A.) and $+19.^\circ8$ to $+22.^\circ3$ in declination (Dec.). The equinox 1950 stars-only chart cuts off some stars at the top (which will be traversed by the Moon only as seen at low altitude from the far southern Pacific Ocean where there are no islands), where the declination is $+22.^\circ2$, and there is a blank strip at the left because the high R.A. needed to end at 4^h 25.0^m. David Herald's equinox J2000 boundaries are 4^h 15.4^m to 4^h 27.3^m in R.A. and -21° 04′ to -23° 34′ in Dec. The "topocentric paths" chart on the page after the "stars only" chart, with apparent-place coordinates so that it can be used with the "USNO" (now IOTA) detailed Q-catalog total occultation predictions, includes the stars that were left out at the top of the 1950 chart, plus a blank strip, but it cuts out a few stars at the bottom (that will be traversed by the Moon only as seen from the Arctic) and at the right (which is shown on the 1950 chart), and leaves a blank strip nearly 1 minute wide at the left (where the Moon will be out of the umbra as seen from anywhere on the Earth's surface).

Topocentric Paths: The other chart shows the same star field, but also includes numbers of the brighter stars, a figure of the Moon generated by Bob Bolster with John Westfall's Moonview program, and topocentric tracks for the Moon's center for 25 locations while the Moon's center is on the chart and is above the local horizon. Apparent place coordinates (with precession, nutation, and aberration applied to 1993 November 29) are used. The Moon's figure is drawn for the right size and orientation during the eclipse. The position angle of the Moon's North Pole (0° of Watts Angle, or WA on IOTA predictions) will be 349°, to help locate reappearing stars with lunar features. In many cases, the pattern of the star field will give a better idea of the point of emersion.

A copy of the Moon figure can be moved with its center along the path, keeping its orientation the same as shown on the chart, to estimate the times and locations of disappearing and reappearing stars. The name of the location, for which a topocentric curve of the Moon's center is plotted, is given along the path. Labels are written near the right (lower R.A.) end of the tracks; if they are not legible, I have also typed them near an uncluttered part of the curve. A list of the coordinates used for calculation of the paths is given in Table 1.

Time increases from right to left (the Moon's R.A. is always increasing) along the curves. If the Moon is above the horizon both times, the paths start at first umbral contact and end at last umbral contact. Tick marks at 1-hour intervals, from 5h U.T. to 8h U.T., extend north from the path. Shorter tick marks extending south of the paths mark the four eclipse contacts, which will occur at the following times:

UT h m	
4 40.4	First umbral contact (First Contact)
6 02.2	Start of totality (Second Contact)
6 50.1	End of totality (Third Contact)
8 11.9	Last umbral contact (Fourth Contact)

Not shown is mid-eclipse, which will occur at 6^h 26.1^m UT. For stations where the early part of the eclipse occurs before moonrise, the paths end at the following times: Auckland and Khabarovsk, at fourth contact; and Tokyo, at 8^h U.T. For paths near the right side of the chart, often the paths start to the right of the chart and end near moonset. These paths can be extended to the right off the chart, but these parts of the paths are shortly after first contact when only the eastern part of the Moon's limb, which is generally then on the chart, is in the umbra. The start and end times for these tracks are as follows: Recife, 5:00 UT to 7:45 UT; La Palma, 5:15 to 7:45; San Fernando, 5:15 to 7:15; Rome, 5:15 to mid-eclipse; Herstmonceux, 5:00 to 7:30; and Moscow, 1st contact to 5:30 UT. For locations not shown on the chart, interpolate.

Table 1. Stations

Location	Latitude	E.Long.
AUCKLAND, New Zealand	-36°908	174°777
TOKYO, Japan	35.660	139.770
KHABAROVSK, Siberia	48.450	135.100
MOSCOW, Russia	55.755	37.570
ROME, Italy	41.924	12.453
HERSTMONCEUX, U.K.	50.871	0.338
SAN FERNANDO, Spain	36.462	-6.200
LA PALMA, Canary Is.	28.758	-17.880
RECIFE, Brazil	-8.051	-34.958
RIO DE JANEIRO,Brazil	-22.898	-43.186
ST. JOHN'S, Newfoundld.	47.537	-52.753
BUENOS AIRES,Argentina	-34.605	-58.434
CARACAS, Venezuela	10.507	-66.928
SANTIAGO, Chile	-33.418	-70.630
MONTREAL, Quebec	45.500	-73.600
BOGOTA, Colombia	4.599	-74.081
LIMA, Peru	-12.100	-77.050
MIAMI, Florida	25.750	-80.250
KANSAS CITY, Missouri	38.964	-94.497
MEXICO CITY, Mexico	19.250	-99.100
LOS ANGELES, California	34.113	-118.302
VANCOUVER, Brit. Col.	49.500	-123.100
ANCHORAGE, Alaska	61.210	-149.870
HONOLULU, Hawaii	21.300	-157.850
NORTH POLE, Arctic Oc.	90.000	----

The Stars and their Numbers: Apparent positions were plotted so that the RA and Dec. given in the detailed IOTA predictions could be used to locate stars whose occultations are listed. The RA bound was increased by 3^m due to the increase in RA since 1950.

The numbers of stars of magnitude (mag.) 11.0 and brighter have been plotted on the apparent-place chart. The number of each star starts about 3.5 mm to the right of the center of the star; keep this distance in mind when examining the chart, since fainter stars often appear between the star and its number. All star numbers increase with R.A. from right to left across the chart. If available, a three-digit ZC number, ranging from 628 (4.8-mag. ω Tauri, the 2nd-brightest star in the lower right part of the chart) to 657, is plotted. The next preference, if available, is a USNO XZ (or X) number in the 5000's. If neither ZC nor X numbers are available, the star's Q-catalog number, ranging from 93 to 1415 on the chart, are given. Around R.A. 4h 20m, the Q numbers overlap the ZC number range; for example, Q 633 is about 2 cm north of the typed "SANTIAGO" while ZC 633 = 53 Tauri is just above the words "MEXICO CITY". The Bayer Greek letters of the two stars mentioned above, and the Flamsteed numbers of four stars (51, 53, 56, and 67 Tauri) have in addition been typed with larger, darker characters near these bright stars.

Variable Star: The only XZ variable star on the chart is ZC 634 = 56 Tauri = V724 Tauri = Q 536 = SAO 76551, a rotating variable that has an insignificant mag. range for occultation work. The mag. of this "ACV variable" varies from 5.36 to 5.40 in a 1.569-day period. The star will be occulted for observers in southern South America. I have not checked to see if any fainter non-XZ known variables are on the charts.

Double Stars: Known double stars are underlined on the charts. Data about most of them are given in the lists of European and North American grazes given later in this article, while the rest of the visual doubles are listed below. Spectroscopic binaries possibly resolvable by high-speed photoelectric occultation recordings, that are not in the graze lists, include X 5728 (SAO 76609) and ZC 665 (SAO 76618).

Visual Doubles not in Graze Tables

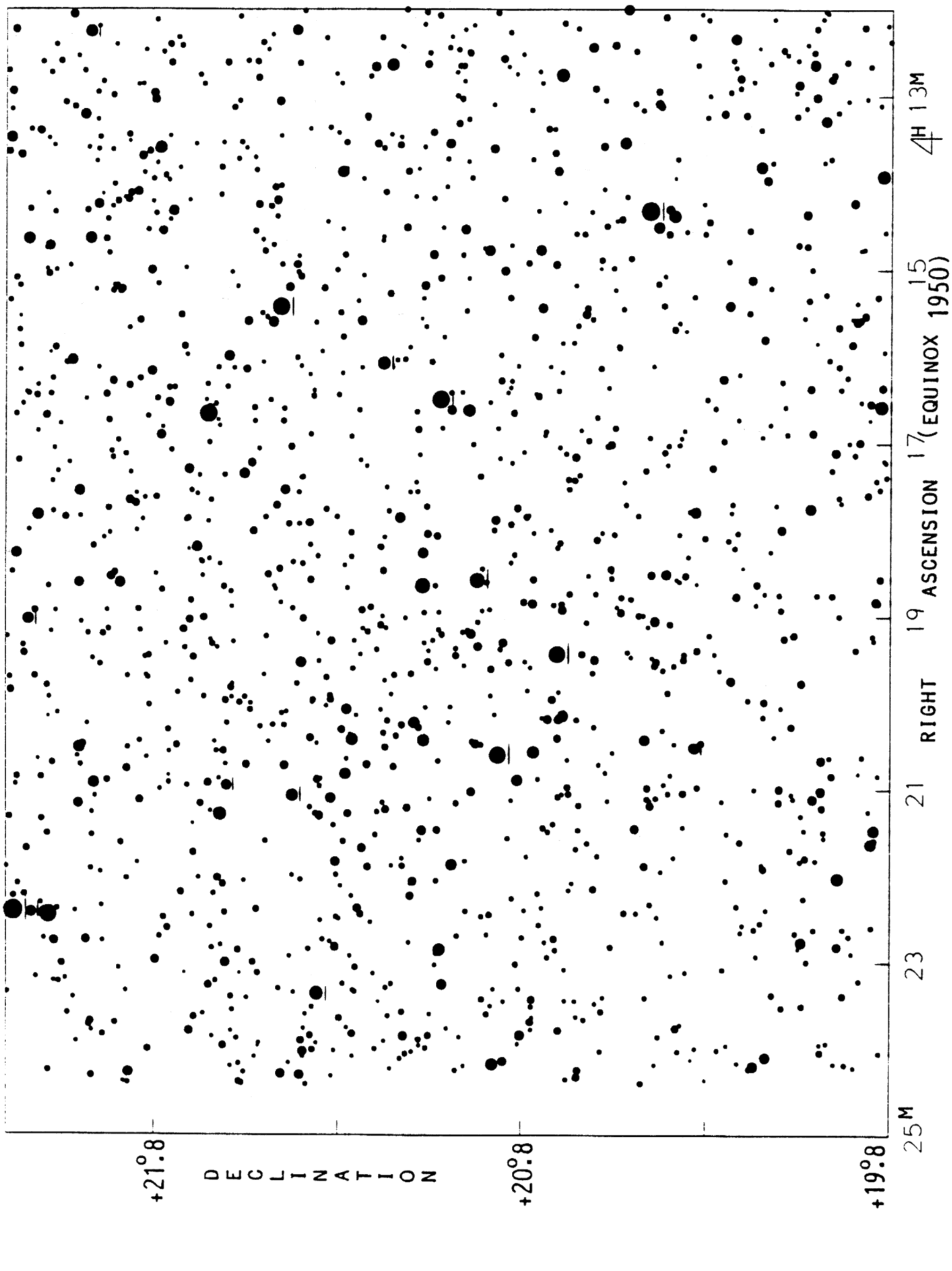
USNO#	D	SAO/BD	Desig.	Mag1	Mag2	Sep.	P.A.	N
ZC 631	O	76541	CL750	5.9	7.9	0"13	197°	
X05583	A	+20°731	ADS3118	8.2	12.7	1.8	206	1
X05633	K	76568	SI74328	10.0	10.0	0.2	90	
X05682	M	76592	ADS3180	8.8	12.3	2.2	199	
ZC 656	V	76601	HP74425	5.2	5.2	0.1	110	
Q01204	A	---	ADS3201	10.2	10.5	5	333	2

Mag1 is the magnitude of the primary, Mag2 is that of the secondary, Sep. is the separation in arc seconds, and P.A. is the position angle. The star's double-star code is given after the USNO#, under D. Under SAO/BD, 5-digit numbers are SAO numbers; one of the stars is a BD star that is not in the SAO. Under Desig. (designation), ADS is Aitken's Double Star, CL is C. Lynns, who discovered the star with speckle interferometric observations at Kitt Peak Nat. Obs. in 1975 October, SI is B. Sincheskul, Poltava, Ukraine, who saw a gradual fade when the star disappeared on 1974 March 28, and HP is Harold Povenmire, Florida, a confirming observation of occultation duplicity obtained on 1974 April 25 (the star is κ Tauri). Note 1: X05583's northern limit crossing the Bahamas is shown as track #1 on the North American graze map, but since the secondary is fainter than mag. 12.5, duplicity information was not included in the XZ catalog, so it has no double star code (blank) in the IOTA-USNO total occultation and graze predictions. Note 2: I did not know about Q 1204's duplicity, so its code is also blank in the Q-catalog prediction input file for calculating detailed total occultation predictions with the Evans program. Like nearby κ Tauri, the star will be occulted in the umbra only for part of the far southern Pacific Ocean.

Minor Planets: Using data in Ephemerides of Minor Planets for 1993, I found only one asteroid that will appear on the charts at the time of the eclipse. It is 15.5-mag. (2003) Harding, which is labelled on the topographic paths chart to the right of "AUCKLAND". Its occultation will be visible in the umbra only from part of the Pacific Ocean east of New Zealand.

November Version of the USNO Q-catalog: The first edition of the Q-catalog was described in **ON 5**, 208, and updates made for last June 4th's eclipse were described on pp. 302-303 of the last issue. The range of Q-numbers for the November 1993 lunar eclipse field is 5 to 1427.

I recently manually compared a B1950-version of the appropriate part of the Bonner Durchmusterung (BD) with the Q-catalog to determine the BD numbers for many of the non-XZ Q-catalog stars. These BD numbers are not in the predictions because the database (Besselian elements file, or befile) used by the prediction program had to be created over a year ago at USNO before thier IBM mainframe computer was taken away. These BD numbers are listed in Table 2.


+21°.8
+20°.8
+19°.8
DECLINATION
25M
23
21
19
RIGHT ASCENSION
17
(EQUINOX 1950)
15
4H 13M

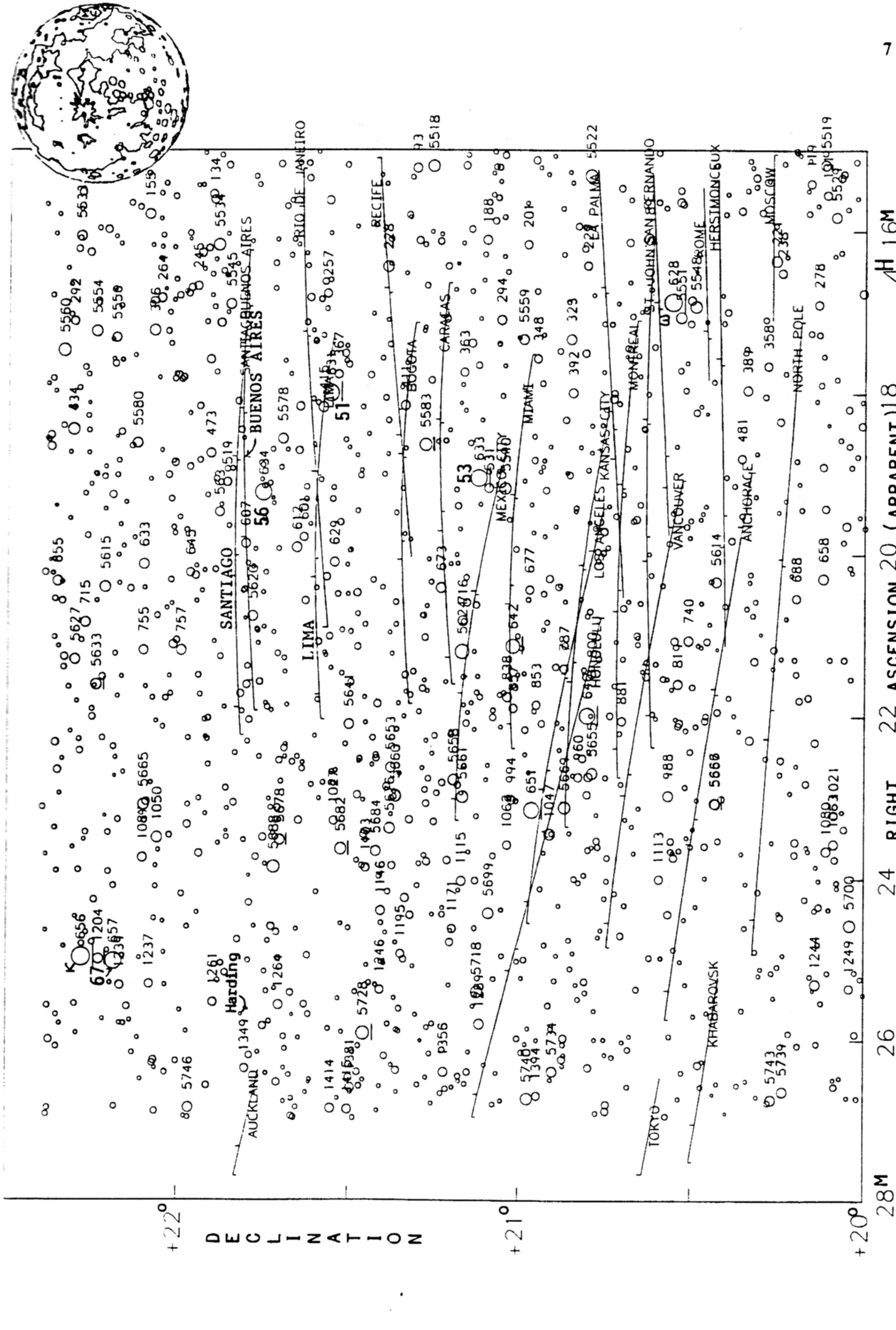

RIGHT ASCENSION (APPARENT)
4H 16M
18
20
22
24
26
28M
DECLINATION
+22°
+21°
+20°
AUCKLAND
Harding
SANTIAGO
BUENOS AIRES
LIMA
RIO DE JANEIRO
RECIFE
BOGOTA
CARACAS
MIAMI
MEXICO CITY
HONOLULU
LOS ANGELES
KANSAS CITY
LA PALMA
MONTREAL
ST JOHNS
SAN FERNANDO
VANCOUVER
ANCHORAGE
ROME
HERSTMONCEUX
MOSCOW
NORTH POLE
TOKYO
KHABAROVSK

Table 2. BD Stars in the Q Catalog

Q No.	B.D. No.	GSC No.	Q No.	B.D. No.	GSC No.
Q 5	+20° 718	12630981	Q 658	+19° 702	12720345
Q 55	+20 719	12631027	Q 673	+20 737	12760325
Q 109	+19 683	12590195	Q 688	+19 703	12720683
Q 141	+20 722	12720234	Q 715	+21 627	12761368
Q 198	+20 723	12760341	Q 716	+20 738	12760246
Q 221	+19 686	12720711	Q 740	+20 739	12720572
Q 228	+21 613	12760254	Q 745	+21 628	12761438
Q 238	+19 688	12720260	Q 755	+21 629	12760840
Q 294	+20 726	12760375	Q 819	+20 742	12720728
Q 306	+21 615	12760940	Q 881	+20 743	12761556
Q 323	+20 728	12760399	Q 988	+20 747	12720945
Q 389	+19 693	12720180	Q1047	+20 752	12761505
Q 392	+20 730	12760222	Q1050	+21 638	12761284
Q 415	+21 619	12761221	Q1063	+19 711	12720767
Q 434	+21 620	12761074	Q1080	+19 712	12730688
Q 481	+20 732	12720527	Q1117	+19 714	12730760
Q 531	+20 734	12760280	Q1134	+19 715	12730379
Q 633	+21 624	12761322	Q1244	+19 719	12730747
Q 655	+22 677	12761439	Q1415	+21 646	12770282

The star +21° 634 was noted as "doubtful" in the BD, and no star brighter than mag. 12.7 was found near its position, so no Q-catalog star has been given that BD number. The double star code of X 5678 = Q 1054 was incorrectly given as "D" in the earlier versions of the Q-catalog. X 5678's correct BD number is +21° 638a; BD +21° 638 = 9.4-mag. Q 1050, which is more than 20′ north of X 5678.

I found five duplicates in this part of the Q-catalog, all apparently caused by problems with matching when I computer-merged the XZ with the Q-catalog over a year ago. In each case, the XZ data should supercede the unmatched Q-catalog data, as shown in the table below. Unfortunately, the five now-rejected stars were included in the Q-catalog befile mentioned above, and therefore continue to be included in the Q-catalog detailed occultation predictions.

Action on Q-Catalog Duplicate Stars

Rejected Star	mag.	Retained Q No.	ZC/XZ	mag.
Q 88	9.5	Q 87	X 5519	10.0
Q 106	7.7	Q 105	X 5522	8.1
Q 198	8.4	Q 197	X 5534	8.9
Q 753	6.5	Q 751	ZC 642	6.9
Q1004	8.3	Q1003	X 5666	9.6

Predictions: The Q-catalog predictions and their distribution were described in **ON 5** (8), p. 20 and (9), p. 240. More detailed information is in the verification form explanation that was distributed with those predictions. For those without predictions, use the star field charts here to locate both disappearing and reappearing stars, and try to mark the ones without an identifying number. Accurate Q-catalog predictions can be computed to identify the stars after the observations are made. If time permits, they might also be generated before the eclipse upon request to a regional coordinator who has the PC-Evans program; see the "Lunar Occultation Prediction and Software News" article later in this issue.

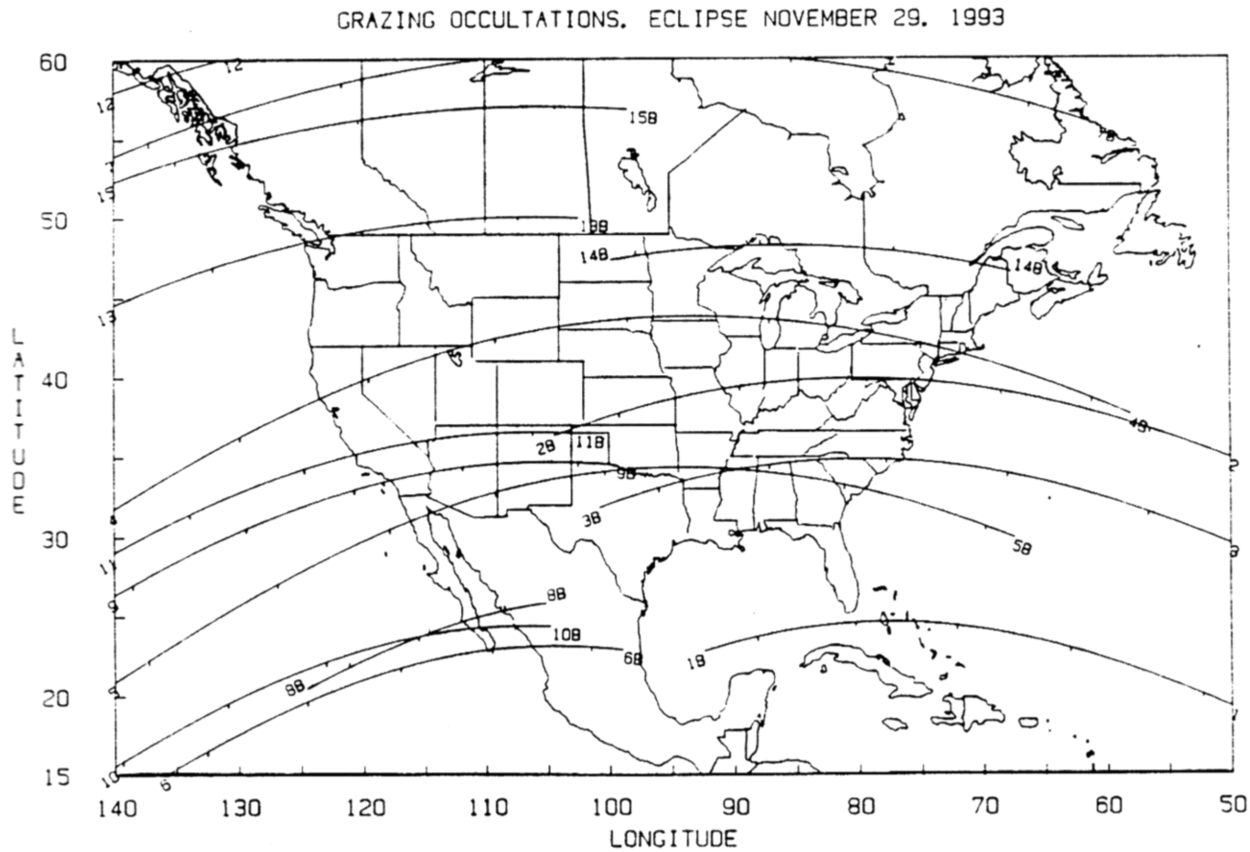
Reporting Observations: Occultation timings during this eclipse should be reported on the International Lunar Occultation Centre (ILOC) lunar occultation report forms, or the equivalent IOTA/ILOC graze report forms, or in an ASCII file on MS-DOS-compatible diskette [for the latter, see **ON 4** (10), p. 237 and **ON 4** (5), pp 92-97]. For all occultations that occur during lunar eclipses, please also send a copy of your report to David Herald; P.O. Box 254; Woden, ACT 2606; Australia. He will analyze all timings made during the eclipse and publish his results in **ON**. For the star number, use the ZC number and catalog code (column 16) "R". If the star is not in the ZC, give its SAO number and put "S" in col. 16. If it is in neither the ZC nor the SAO, give its X number with "X" in col. 16. If the star is in neither of these catalogs, give the star's Q-catalog number, if you have Q-catalog predictions, and put "Q" in col. 16. If you don't know any of these numbers for an observed occultation, include a copy of the star chart with your report marking these fainter stars whose occultations you time.

Grazing Occultations: Eberhard Riedel, Munich, Germany, prepared maps and tables of all grazes of XZ stars that will occur against the umbra during this eclipse. He prepared these maps in the same style as those in the hemispheric grazing occultation supplements for 1993 distributed earlier. But rather than prepare maps covering large parts of each hemisphere, like those published on pages 304 and 305 of the last issue, Riedel produced more legible maps only covering the more populated parts of North America and Europe that are included, along with their associated tables, on the following pages. Another map (and associated table) was prepared for South America and is being send only to **ON** subscribers there. Paths end in a "B" when they occur at the edge of the umbral shadow. Points along the paths where totality begins and ends are not indicated, but you can tell whether the eclipse occurs during totality or during a partial phase from the time of the event in your area. On the map of Europe, the altitude limits are too lenient.

Lunar Polar Diameter: Two occultations offer reasonable possibilities for observation at both the northern and southern limits for an accurate lunar polar diameter measurement. Preliminary information was given about them on p. 306 of the last issue. That information is reviewed and updated here.

ω Tauri, N. Limit: At mag. 4.8, ω is the 2nd-brightest (not the brightest, as stated last time) star that will be occulted during the eclipse, around 5:30 UT, during the early partial phases in Europe. The northern limit passes 5 km n. of Alesund and 70 km n. of Oslo, Norway; 35 km n. of Motala, Sweden (Alt. 11°); 10 km s. of Vilnius, Latvia (Moon alt. 5°); and near Minsk, Belorus (but Moon alt. only 2°). Eberhard Bredner hopes to travel to Scandinavia to help local efforts to observe this graze.

ω Tauri, S. Limit: During totality around 6:15 UT, the southern limit passes 20 km south of Villa Cisneros, Southern Sahara, and north of Atar, Mauretania (Moon alt. 12°). Hans Bode is looking into the possibilities for an IOTA/ES expedition to these areas, but he does not expect to go there himself; he will probably go instead to the Canary Islands to observe the occultation of a star by Jupiter that happens to occur during this eclipse (however, the Canary Islands are well-placed for a valuable southern-limit graze of 8.7-mag. X 5548 = SAO 76533, track 9, whose northern limit, track 8, is far north in Scandinavia). Nevertheless, an expedition to the Villa Cisneros or Atar area for the spectacular graze of ω Tauri would be very interesting and valuable, as well as a good escape from the cold and likely cloudy weather in Europe.



North American Grazing Occultations during the Lunar Eclipse of 1993 November 29

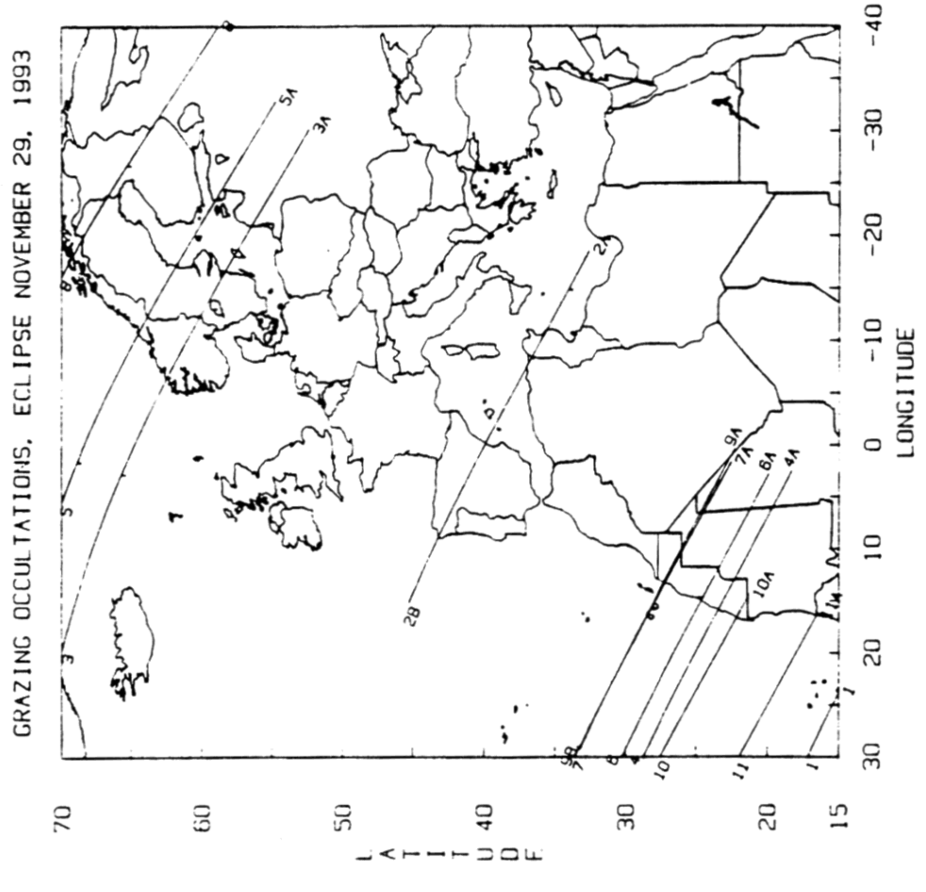
No.	Year	Mo	Day		USNO	SAO D	Mag	%Snl	L	W.U.T. h m	Long	Lat	Star Name	Mag1	Mag2	Sep	PA
1	1993	Nov	29	X	5583	76546	8.2	62E	N	5 8.7	92°	23°					
2	1993	Nov	29	X	5590	76550	8.7	62E	N	5 9.0	104	36					
3	1993	Nov	29		633	76548V	5.4	61E	N	5 9.1	101	32	53 Tauri	Spectroscopic			
4	1993	Nov	29		642	76564K	6.9	59E	N	5 22.5	140	32	219 B. Tauri	7.7	7.7	0".10	353°
5	1993	Nov	29	X	5624	76565	7.1	58E	N	5 15.5	140	21					
6	1993	Nov	29	X	5653		10.0	30E	N	6 12.5	136	15					
7	1993	Nov	29		646	76571M	6.1	30E	N	6 16.2	140	54	224 B. Tauri	6.2	9.3	1.90	170
8	1993	Nov	29		646	76571M	6.1	10E	S	5 51.1	124	21	224 B. Tauri	6.2	9.3	1.90	170
9	1993	Nov	29	X	5658	76579	9.1	24E	N	6 17.2	140	26					
10	1993	Nov	29	X	5660	76580	8.8	19E	N	6 18.8	140	16					
11	1993	Nov	29	X	5661	76581	8.6	17E	N	6 27.0	140	29					
12	1993	Nov	29	X	5655	76578	9.1	6E	N	6 44.4	140	58					
13	1993	Nov	29		651	76585X	5.9	6E	N	6 46.5	140	45	227 B. Tauri	6.7	6.7	0.15	55
14	1993	Nov	29	X	5614		10.0	6E	S	5 56.1	100	47					
15	1993	Nov	29	X	5669	76584	8.6	2E	N	6 52.8	140	52					

ZC 646, N. Limit: The northern limit for 6.1-mag. ZC 646 passes 65 miles n. of Ketchikan, AK; 20 mi. s. of Ft. Nelson, Brit. Col.; 7 mi. n. of Meander River and over Ft. Fitzgerald (where totality ends at central graze), Alberta; 40 mi. s. of Ft. Chimo, Quebec; and 25 mi. s. of Nain, Labrador.

Members of the Edmonton center of the Royal Astronomical Society of Canada are making extensive preparations to observe the graze. Russ Sampson is leading the effort, with help from IOTA member Doug Hube. The observers would travel by bus to Ft. Nelson, and rent winterized vehicles to reach the graze zone, where special precautions will be needed to cope with temperatures that may be below -20°. There is about a 40% chance that the sky will be clear or have scattered clouds, and not too windy to prevent observation. The effort is expected to cost $2000, 10% of which IOTA has agreed to cover (and half of that a private donation); the organizers are optimistic about getting the remainder covered by a Scientific Research Council grant. An article about these preparations was published in a recent RASC bulletin.

ZC 646, S. Limit: During totality, this passes about 150 km northwest of La Paz, Baja California, north of where Don Stockbauer and I observed a graze of Atlas during the 1991 July 8th Pleiades passage. Southern Baja California is a free-trade zone with no customs inspections, facilitating the temporary inport of telescopes and other equipment. Paul Maley plans to observe this graze with at least one other observer; contact him (1-713-488-6871 or see the roster for an address) if you might be interested in helping this effort. The path crosses Highway 1 on the west side of Baja, where marine cloud may be a problem. There will likely be no clouds where the path crosses the east coast of Baja, but that seems to be accessible only by boat. The expedition for this graze also expects to get some GPS measurements to resolve a large map discrepancy that was found at the Atlas graze sites.

Joe Senne calculated details of these grazes.



European Grazing Occultations during the Lunar Eclipse of 1993 November 29

No.	Year	Mo	Day	USNO	SAO D	Mag	%Snl	L	W.U.T. h m	Long	Lat	Star Name	Duplicity
1	1993	Nov	29	X 5518	76524	8.9	72E	N	5 8.9	30°	17°		
2	1993	Nov	29	X 5522	76525	8.1	72E	N	5 1.0	15	45		
3	1993	Nov	29	628	76532K	4.8	68E	N	5 9.2	20	70	Omega Tauri	Spectroscopic
4	1993	Nov	29	628	76532K	4.8	2E	S	6 2.4	30	29	Omega Tauri	Spectroscopic
5	1993	Nov	29	X 5551	76534	9.3	68E	N	5 17.7	6	70		
6	1993	Nov	29	X 5551	76534	9.3	2E	S	6 7.0	30	30		
7	1993	Nov	29	X 5559		10.0	67E	N	6 8.2	30	34		
8	1993	Nov	29	X 5548	76533	8.7	68E	N	5 14.7	-16	70		
9	1993	Nov	29	X 5548	76533	8.7	2E	S	6 0.2	29	33		
10	1993	Nov	29	X 5590	76550	8.7	62E	N	7 9.8	30	28		
11	1993	Nov	29	633	76548V	5.4	61E	N	7 10.4	30	22	53 Tauri	Spectroscopic

Other Graze Expeditions: Probably the most spectacular graze in the USA will be seen near the northern limit of the occultation of 5th-mag. 53 Tauri, especially in North Carolina, where the graze occurs shortly after totality begins. But the southern limit crosses remote and dangerous parts of Colombia and the Amazon basin. There are similar problems with the other limit for all grazes in the contiguous USA. Bob Stewart, Norfolk, VA, is planning an expedition to the vicinity of Jacksonville, NC, and there will probably also be an expedition for 53 Tauri near St. Pauls, close to highway I-95 south of Fayetteville, NC. Harold Povenmire plans to observe this graze near Water Valley or Courtland, MS, where another northern-limit graze, of 7th-mag. SAO 76565, can also be seen. The RASC Edmonton Centre, as part of their training for the ZC 646 graze, observed a northern-limit graze of 53 Tauri near Edmonton on September 8th. An analysis of those observations should improve the prediction for the November 29th occultation of that star, and will probably improve the predictions for other northern-limit grazes as well. The results of this work will be put on the IOTA occultation line answering machine at 1-301-474-4945, along with weather updates and plans for other expeditions; please give me the latter information if you are planning a graze expedition, preferably by telephoning me at 1-301-474-4722.

THE 11th ANNUAL IOTA MEETING

Rocky Harper

The 1993 annual meeting of the International Occultation Timing Association was held on September 11, 1993 at the Lunar and Planetary Institute, Houston, Tx. The meeting began at 9:00am with the call to order by president David Dunham. Nine members were present, including the Dunhams from Greenbelt, MD.; Dan Falla from San Diego, CA; Rick Frankenberger and Gary Dowdle from San Antonio, TX; the others were all from the Houston, TX, area. Visitors from the Houston Astronomical Society and the JSC Astronomical Society also attended.

The first order of business was the financial report which showed IOTA to be healthy. The largest costs are printing and mailing the **ON**. No increase in membership dues is seen at this time. Work on the IOTA Observer's Manual has continued with a release hopefully in 6 months. Next David mentioned that he thought that IOTA should reincorporate in Maryland or Kansas. IOTA first incorporated in Texas on August 19, 1983 which meant that the organization had by-laws and a charter. It obtained tax-exempt status from the IRS. as long as there was an annual meeting in the state of incorporation. After 10 years in Texas, David feels it's time to consider moving the meetings to another area.

Next was a discussion of total lunar occultation prediction software. David talked about the PC EVANS program and David Herald's OCCULT program. See the May 1993 **ON** for more details. A crude version of the Evans program (it just applied linear **a** and **b** factors to standard station data that were keypunched) was originally written for a mainframe computer by Carroll Evans of China Lake, California back in 1962. The current sophisticated version was written by Tom Van Flandern at USNO in 1970, and updated several times to add new features since then. It was converted to PC use by Claudio Costa in Rome a year ago. David brought his PC which had the PC EVANS and OCCULT programs on hard disk which some members copied. The improved coverage of lunar graze predictions and maps by Eberhard Riedel was also discussed. The mention of the observation of unpredicted events brought on a good talk about the future improvement of predictions. Star position errors should be virtually eliminated as well as better magnitudes derived when data from the Hipparcos space mission are reduced. David also showed how the $0''.25$ error in the Watts data should be reduced to $0''.1$ using information from the upcoming Clementine Moon/asteroid mission scheduled for launch in early 1994. David is personally involved in this mission so it should be exciting. David next gave a very interesting talk about the 12th European Symposium on Occultation Projects that was held in Roden, the Netherlands, on August 27-31. Then we broke for lunch to a local cafeteria where we continued our discussions.

The meeting resumed around 1:00pm with the highlight on video developments. A lot of talk focused on Tom Cambell's VTACT system and the European Cuno video time inserter. Image intensifiers were also discussed. Gary Dowdle mentioned that relatively inexpensive video couplers for image intensifiers are advertised in law enforcement, but not astronomical, publications. He was going to do some research on this and write something about it for **ON**.

The next item concerned lunar and solar eclipses. Much was said about the November 29, 1993 total lunar eclipse at which time it passes through the Hyades star cluster producing some excellent occultations. Future expeditions were mentioned including those to the May 10, 1994 annular solar eclipse here in the United States. The next total solar eclipse occurs November 3, 1994 in South America where several expeditions are planned.

At 3:15pm David talked about upcoming asteroidal occultations and major grazing events. The last part of the meeting was used to plan for a southern-limit graze of 4.3-magnitude Alpha Cancri (Acubens = ZC 1341) by a 10% sunlit waning Moon the morning of September 13th. Unfortunately, it was too cloudy to observe that event and the expedition was cancelled.

As always the meeting was very interesting and exciting. There was the usual enthusiasm and a lot of great stories told.

[Ed. We thank Rocky for this report, written in spite of a personal disaster that occurred the ill-fated morning of Sept. 13: A gas explosion destroyed half of his house and burned his arms and face! Fortunately, Rocky had insurance, made a good recovery, and none of the other members of the household were hurt. He wrote this report as soon as his PC was replaced.]

1994 LUNAR OCCULTATIONS OF PLANETS

The maps showing the regions of visibility of lunar occultations of major and bright minor planets are reprinted by permission from the **Japanese Ephemeris** for 1994, published by the Hydrographic Department (which also includes the International Occultation Centre, ILOC) of the Maritime Safety Agency of Japan. On the maps, in region 1, only the reappearance will be visible; in region 2, the entire occultation will be visible; and in region 3, only the disappearance may be seen. Reappearances occur at sunset along a dashed curve, while disappearance is at sunrise along a curve of alternating dots and dashes. We have added the lunar percent sunlit to each map. Some of the maps are given below, while others are in convenient locations on later pages of this issue. Consult these maps especially for occultations of minor planets, which are not included in the detailed IOTA total occultation predictions (occultations of major planets are included).

Those interested in observing partial occultations, which occur within a few kilometers of the northern and southern limits of these occultations, should request predictions preferably three months in advance from Joseph Senne; P.O. Box 643; Rolla, MO 65401; USA; telephone 1-314-3646233; Internet c0458@umrvmb.umr.edu.

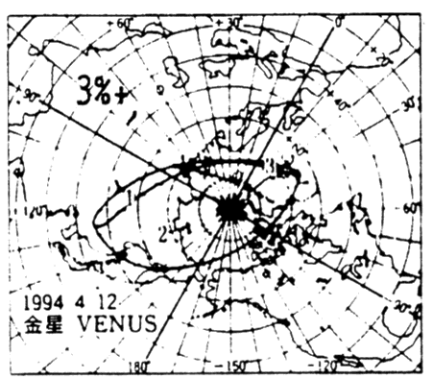
TREASURERS' REPORT

Craig and Terri McManus

Our report for the period September 1, 1992 to August 31, 1993 is as follows:

INCOME	
Full Memberships	$5,765.00
Gifts from Members	13.50
Interest on Checking	93.74
Non-member Predictions	7.50
ON Subscription Only	1,020.00
ON Back Issues	25.00
Prelim Occultation Manual	7.50
Sale of IOTA Items	36.01
Other	3.84
TOTAL INCOME	$6,972.09
EXPENSES	
Ast. and Graze Supplements	$860.06
Credit Card Costs	33.46
Mailing Costs (all)	3,489.09
ON Costs	2,452.25
Office Expenses	168.04
Other Expenses	343.38
USNO Total Occ Expenses	234.07
Other	203.24
TOTAL EXPENSES	$7,784.49
OVERALL TOTAL	-$812.40

Our current balance is $3,447.91. The expenses and incomes look a little skewed to the negative due to the fact that we produced five (5) **ON**'s this last fiscal year as opposed to the normal four.



1994 SOLAR ECLIPSE PUBLICATIONS

Since 1949, USNO published a special series of free circulars containing detailed information about important upcoming solar eclipses. Funding cutbacks forced USNO to discontinue these circulars in 1991; the last of these circulars described the 1992 January and June eclipses.

Fortunately, a similar series has been started by Fred Espenak and Jay Anderson. NASA Reference Publication 1301 (April 1993) gives information about the 1994 May 10th annular eclipse and NASA Reference Publication 1318 (October 1993) does this for the 1994 November 3rd eclipse. The format of these publications is similar to that of the USNO eclipse circulars, but some additional information is included, including (of special interest to **ON** readers) tables of corrections to the northern and southern limits to define "graze zones" based on Watts' profile data. A drawback is that the table of mapping coordinates for the umbral path is given at only 1°-intervals of longitude, making quadratic interpolation necessary for accurate work, and the maps are at 1:5,000,000-scale, 2.5 times less detailed than those in the recent USNO circulars. On p. 16 of Publ. 16, an old address is given for the USGS (the Arlington, VA office was closed a few years ago) and no address is given for Canada. The correct addresses are:

Branch of Distribution
U. S. Geological Survey
Box 25286, Bldg. 810 Federal Center
Denver, CO 80225
USA (or telephone 1-800-USA-MAPS)

and

Canada Map Office
615 Booth Street
Ottawa, Ontario, K1A 0E9
Canada

On that same page, the old address for IOTA in Topeka is given (see the top of p. 1 of this issue for the current address) and it failed to give Dr. Fiala's address at USNO for receiving observations (that oversight was corrected on p. 18 of Publ. 1318).

Robert Victor at Abrams Planetarium, E. Lansing, MI, points out a discrepancy in Table 6 of Publ. 1301: The interior and exterior corrections, for both the N. and S. Limits, seem to have been reversed. Robert will communicate with Fred Espenak to try to resolve this discrepancy, and we will mention the result in the next **ON**. The similar data in Table 6 of Publ. 1318 seem to be correct.

Those planning expeditions to the limits of annularity or totality are encouraged to obtain these publications; it will probably be a few months before Alan Fiala at USNO and I can calculate more detailed limit data for eclipse planners. Free copies of these publications can be obtained from

Jay Anderson
Prairie Weather Centre
900-266 Graham Avenue
Winnipeg, Manitoba, R3C 3V4
Canada

Internet: janders@ccm.umanitoba.ca

Requests should include the following information: Name, size, type, and activities of organization; name of contact person; complete postal address; and whether publications are wanted for a) specific eclipse (give date), b) eclipses with local interest only, or c) all eclipses.

Additional useful information about the 1994 November 3rd eclipse is given in good articles in this month's issues of **S&T** and **Astronomy**, and more information on the 1994 May 10th event is expected in the 1994 January issue of **S&T**.

SOLAR ECLIPSE NEWS

David W. Dunham

Annular Eclipse, 1994 May 10: See the previous article and the "IOTA Annual Meetings" subsection of IOTA NEWS on p. 1.

Total Eclipse, 1994 November 3: Paul Maley informs me that his expedition to Tacna, Peru, described on p. 294 of the last issue, is sold out. Unfortunately, everyone in his expedition wants to observe near the center line near Tacna, with nobody willing to stay behind at Arequipa to observe a short distance inside the northern limit of totality. However, if anyone wants to try that, they should contact Paul (1-713-488-6871), who felt that suitable arrangements to observe near the northern limit in the Arequipa area could probably be arranged. However, travel to and from Arequipa would need to be arranged independently of his expedition.

Tom Van Flandern has issued "Eclipse Edge Expedition '94 Bulletin #1 -- July, 1993" giving preliminary information about his planned expedition to a location about 5 km north of the southern limit in the Atacama

Desert near Arica, Chile. The expedition will last from Oct. 28 to Nov. 4 and will include astronomical lectures, night observing sessions of the southern sky, and recreational side trips. The cost from Miami will be $1700, or somewhat less per person for 2 or 3 sharing a hotel room. A final commitment date of 1994 July 15th has been set. The bulletin, besides giving further details about these arrangements, also has a good explanation of the advantages of locations just inside the path edges over locations near the central line. To get a copy of the Bulletin write to Eclipse Edge Expeditions; PO Box 15186; Chevy Chase, MD 20825-5186. Eclipse Edge Expeditions is also selling, for $20, a video tape of the successful 1991 July 11th 1st Eclipse Edge expedition in Mexico, including some of my footage of that event.

Hans-Joachim Bode is organizing an IOTA/ES expedition to Bolivia to videorecord and time Bailey's bead phenomena near both limits of this eclipse.

VTACT

Tom Campbell, Jr.

I am now building copies of the VCR Time signal Audio conditioner and Clock Trigger (VTACT), discussed in **ON 5** (8), p. 216. It does the following useful jobs:

1. Eliminates microphone and preamp mixer combination.
2. Includes a speach filter to enhance voice recording.
3. Includes a 1000-Hertz and 1200-Hertz tone filter to greatly enhance the WWV or WWVH minute tone, especially valuable for reliably triggering a video time inserter; as long as you can hear the tone at all, it will trigger properly.

The unit is very stable, with a delay jitter of only ± 2 msec. The unit weighs 1.5 lbs. or 680 grams and fits in a 6 x 5 x 3-inch box. I have one unit, which has 3 printed circuit boards, for sale for $250. Future units will cost somewhat less since they will use an easier-to-construct single-board design. For more information, contact me at 5405 98th Ave.; Temple Terrace, FL 33617; phone 1-813-985-1842.

GRAZING OCCULTATION OBSERVATIONS

Richard P. Wilds

This quarter's article starts out with a little personal information. I have been transferred. I will still be teaching in the same complex as Craig McManus, but I will have a different office with a different work phone - (913)296-4343. One advantage is that callers can now leave messages with the receptionist, if they cannot contact me directly.

The graze report starts with two reports sent in by Henk Bulder from the Netherlands. The 08/24/92 graze was discussed in detail in the March 1993 **ON 5**, #11, pages 277-280. The 12/05/92 graze was in the Cassini Region among the polar mountains M4 and M5. Since you will have received your copy of The Marginal Zone of the Moon, I hope the reader will have little difficulty in locating the regions in which the reported grazes were observed [Ed. Unfortunately, distribution of this will be delayed to the next **ON**].

The first graze of 1993 reported for this quarter was the only graze from H.A.R.T. This graze was also in the Cassini Region. Another early graze was reported from Germany. This was a difficult marginal graze which was not included in Mr. Buttner's regular graze predictions. We also received a report of a well observed graze from Pierre Vingerhoets, president of the Occultation Group of the Belgian Association for Astronomy. The graze was observed in an area south of the crater Sylvester.

The same weather conditions which have given H.A.R.T. difficult, and even dangerous, flooding conditions in the plains have helped observers in the east. Mike Kazmierczak reported a graze observed from Georgia on 02/02/93 - the first of four in the list. All his grazes were very successful, but his best was on 07/10/93. He set up next to a railroad crossing. He reports observing 18 events! This alone would get the heart going, but a train came moments after the last event! That would be a tape to save.

Two midwestern observers also had fine grazes to report. Robert J. Modic had a miss around the crater Brianchon, but he finished with two very good grazes around the crater de Sitter. Wayne Hutchinson also had a graze around Brianchon. These two gentlemen were joined by Robert H. Hays Jr. who reported two more grazes in the Brianchon area. Mr. Hays reported that his 5/27/93 observation of Alpha Cancri was quite an eyeful. He reports several extremely interesting events of a gradual nature which gave the impression of viewing the graze in "slow motion." Other observers have reported such observations and all are left with a feeling of awe at what they have seen.

John Centala must be commended for leading a graze in the middle of "Lake Iowa." He reports that the graze would have been even better if clouds had not been involved.

Perhaps the best report of the quarter also came from a most interesting area of the astronomical world. Poland has a long and proud history of greatness in astronomy. The latest representatives of this tradition are Marek Zawilski and Janusz Slusarczyk of the Section of Observations of Positions and Occultations of the Polish Amateur Astronomers Society. Mr. Zawilski writes that the team he works with has had many cases of lost grazes due to clouds and site failures for various reasons. They struggle with more problems than the average graze team due to difficulties such as poor map coverage. He reports that the current effort was actually carried out by two teams -- one from Lodz and Warszawa led by Mr. Zawilski and the other from Krakow led by Mr. Slusarczyk. For many of the observers this was their first viewing of a graze. They were very satisfied! This is a tribute to years of perseverance and to overcoming great difficulties in the practice of good science. They correctly identified their graze area as falling between the craters Merril and Rozhdestvenskiy.

Two Florida observers make a return this quarter. Tom Campbell reported a video of a graze in the same area observed by his Polish colleagues. Hal Povenmire also reported observations in this area.

Joaquim Garcia made another report of a graze too difficult for his current IOTA predictions. He reports, though, that he is working on obtaining the software he needs to make his work more valuable to the program. He also reports Rui Goncalves has been helping him with the graze effort for years and had an important part in the current results. It is interesting that these two gentlemen from Portugal joined Mr. Zawilski from Poland to assist Mr. Costa and Mr. Bulder in the first graze on our current list.

HISTORICAL FLASHBACK. A new feature to appear from time to time is a look back at some of historical moments in the observations of occultations. I would be interested in any thoughts and ideas for this section.

For this flashback we return to Westchester, Connecticut on 30 May 1966. Graze leader David Dunham arrived at a secluded site to observe the graze of 6.8 mag. SAO 139072 (ZC 1864). He reports: "The owners of the house figured that we could have found them only with the aid of photographic satellites! While setting up my telescope near a farm house, a small boy from the house said, 'Can I observe it, too?' I turned around to see that he had set up a telescope of his own!" Dave, you can certainly build graze teams in the strangest ways.

Graze List

UTDate YYMMDD	V P	Star #	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap Cm	Organizer	Sh N S	WA	B
1992														
920824	V	78297	2.8	22-	1.0N	Minturno, Italy	20	166	1	5	C.Costa/H.J.J.Bulder	0.4N	0°	1.3
921205		92395	7.0	82+	7.0S	Wieringerwerf, Neth.	3	8	1	20	Henk J.J. Bulder	0.0	177	-5.3
1993														
930130		92600	9.0	41+	3.3S	Burlington, Kansas	4	8	1	20	H.A.R.T. C.McManus	0.0	177	-4.9
930201		76430	4.5	68+	0.0N	Stollberg, Germany	4	3	1	6	D.Buttner/A.Viertel	?	2	-1.4
930202		76608	4.3	71+	10.0N	McDonough, Georgia	2	12	1	20	Mike Kazmierczak	0.1S	12	-1.2
930227	V	93237	8.0	32+	10.0N	Tisselt, Belgium	5	26	1	15	Pierre Vingerhoets	0.1S	11	-2.7
930301		76430	4.5	44+	11.0N	Barnesville, Georgia	1	8	1	25	Mike Kazmierczak	0.4S	13	-1.4
930331		78632	8.1	49+	13.2N	Highland Heights, OH	1	0	1	20	Robert J. Modic	>0.5S	15	3.3
930427		78391	8.4	25+	4.2N	Clodine, Texas	1	2	1	20	Wayne Hutchinson	0.0	16	3.2
930427		78394	8.0	25+	10.3N	Schneider, Indiana	1	2	1	13	Robert H. Hays Jr.	0.3S	14	3.3
930427		78395	6.6	25+	10.6N	Cascade, Iowa	2	14	2	44	John Centala	0.7S	14	3.3
930428		97087	6.8	37+	15.0N	Bundaberg,Qld,Austra.	1	0	1	20	Phill Kearney	>0.3S	18	3.8
930429		98267	4.3	53+	9.4N	Bolimow, Poland	8	32	1	5	Marek Zawilski	0.0	10	6.6
930429		98267	4.3	53+	9.4N	Lubaczow, Poland	7	24	1	7	Janusz Slusarczyk	0.0	10	6.6
930502	V	118634	6.2	79+	13.0N	Bradenton, Florida	2	3	1	20	Tom Campbell	0.5S	09	7.3
930510		187498	5.1	80-	4.7N	Richmond Hts., Ohio	1	6	2	20	Robert J. Modic	0.4S	352	-2.7
930514		145965	8.2	41-	6.7N	Richmond Hts., Ohio	1	6	2	20	Robert J. Modic	0.1N	354	-6.0
930515		146415	6.4	32-	4.0N	Conyers, Georgia	1	6	1	25	Mike Kazmierczak	0.2S	357	-6.1
930527		98267	4.3	31+	8.2N	Grand Ridge, Illinois	1	3	1	13	Robert H. Hays Jr.	0.1N	11	6.7
930527		98267	4.3	31+	7.4N	King, North Carolina	2	8	1	15	Hal Povenmire	0.7S	10	6.7
930613		128538	8.7	42-	5.6N	Quebradas, Portugal	2	8	2	20	J.Garcia/R.Goncalves	?	356	-5.7
930710		128487	6.9	65-	10.0N	Acworth, Georgia	1	18	1	25	Mike Kazmierczak	0.2N	349	-5.9

REMEMBER to apply the following shifts:

1. Northern limit, waxing-phase, dark-limb grazes tend to have a 0".3 south shift from your predicted graze path. One should spread out, however, since star errors could increase this shift or reduce it to a 0" shift.

2. Southern limit, waxing-phase, dark-limb Cassini region grazes tend to have a 0".4 - 0".5 second of arc south shift from your predicted graze path. Cassini region grazes have profile points from 3 to 7. Southern-limit Cassini grazes will also have large negative latitude librations. This correction should continue into waning-phase grazes to Watts angle 187°.

Please report all grazes to:

Richard P. Wilds
3630 S.W. Belle Ave
Topeka, KS 66614-4542
USA

and to the:

International Lunar Occultation Centre (ILOC)
Geodesy and Geophysics Division
Hydrographic Department
Tsukiji-5, Chou-ku
Tokyo, 104 Japan

Stellar cross reference:

SAO #	ZC #	other
78297	976	μ Gem
92395	197	
92600		X2420
76430	599	37 Tau
76608	660	69 Tau
93237	446	
78632		X9576
78391		X9083
78394		X9100
78395	989	15 Gem
97087	1151	
98267	1341	α Cnc
118634	1605	62 Leo
187498	2757	36 Sgr
145965		X30506
146415	3371	
128538		X32200
128487	3524	

LUNAR OCCULTATION PREDICTION NEWS

David W. Dunham and Walter I. Nissen, Jr.

Detailed Total Occultation Predictions: The International Lunar Occultation Centre (ILOC) in Tokyo has computed most of the total occultation predictions for 1994 using their own program, and they will mail the predictions early this month. For their main prediction run, they used the station and prediction options data updated by us over a year ago for the 1993 predictions, which we ran with the EVANS program mainly at USNO before their IBM mainframe computer was taken out of service on 1992 October 1. We have finally updated these input datasets for the 1994 predictions, using information supplied by observers on their 1994 prediction verification forms, and sent them by E-mail (via Mitsuru Sôma at the Japanese National Astronomical Observatory, Mitaka, Japan, since ILOC does not have E-mail) late the first week of this month. At their request, we provided ILOC with the 1993 prediction address list in electronic form (again via Sôma) at the end of October; a version including the 1994 updates was sent late the first week of November. We have asked ILOC to provide 1994 predictions for the new observers, and for new and updated stations, that are in our new datasets but that were not in the 1993 prediction datasets that they have had for almost a year.

According to Dr. Yoshio Kubo of the Japanese Hydrographic Office (of which ILOC is a part), ILOC's prediction program "is the same as the one by the EVANS program and the predicted times differ by only one or two seconds at most". ILOC's program probably produces comprehensive predictions of observable occultations of XZ stars, which is almost 99% of what the EVANS program does. But we are not sure that ILOC's program has all of the features of the EVANS program, including observability code rejection based on IOTA's modification of B. Schaefer's MAGLIM subroutine (or another observability-code scheme), "graze nearby" messages, photoelectric-option output, occultations of K-catalog stars and galactic-nebular objects, occultations of major planets, terminator-distance messages when appropriate, and events during umbral lunar eclipses (in 1994, there is only a shallow eclipse centered over southern Brazil on May 25). We will report on this in the next issue.

If your ILOC predictions lack some of the features that were in the EVANS predictions, you can request predictions that will at least have those features from your closest national or regional coordinator who has the PC version of the EVANS program (see below).

These predictions will be supplied free upon request for one station to IOTA members. Costs for extra stations, and for non-IOTA members, will be determined in a few weeks and announced in the next issue. If there are a large number of these requests, we may write the EVANS predictions to a magnetic tape and send it to ILOC for printing and distribution (as we did for many of the 1993 predictions), which would lower the cost for those from whom we received requests before finally writing the tape and sending it.

Overall, response to the 1993 prediction mailing was good, with we believe a higher percentage of returned forms than in other recent years. We have included in the updated datasets all of the verification forms that we received (and did not lose) before November 4. A second mailing, to those from whom we have no form, has not yet been made, but probably will be done later this month. Any responses to that mailing will be treated as updates, since they have been left out of the main run. However, for those requiring no changes, ILOC probably did generate the predictions (since they used the 1993 prediction dataset updates of a year ago for their main run), and ILOC can send them if we simply inform them of the address code.

PC Evans total occultation prediction software: The PC version of the EVANS program is working very well; the only problem is that a few relatively faint K-catalog stars near the equator, involving less than 0.1% of the occultations, are treated as planets with unknown results in the predictions. Claudio Costa, from Rome, provided David with diskettes containing the executible program, Fortran source code, datasets, and some documentation at a small IOTA meeting held on Saturday, June 19, in Belgirate, Italy, just after the IAU Symposium, "Asteroids, Comets, Meteors 1993" (we thank Marco Cavagna for making arrangements for that meeting). Much of David's time since then has been devoted to documenting use of the program and its datasets, and managing the overall prediction process along the lines developed at USNO for their predictions generated with the mainframe EVANS program.

The first version of the "Evans package" was distributed at the ESOP-XII meeting in late August; see IOTA NEWS on p. 1. The documentation was finally completed in late October. The "Evans package" consists of much more than that program; it also includes the whole system of datasets, several small utility programs to manage them on a PC, and rather extensive documentation. Also included is a PC version of the LOCM program for generating local circumstances of asteroidal and planetary occultations, and software with documentation by Wolfgang Zimmermann for predicting the paths of occultations by major and minor planets (a PC version of an early, but enhanced, version of David's MPOCC mainframe program). David Herald's OCCULT software, described on pages 306-307 of the last issue, is included [an important note for those with OCCULT: the install.bat file with that program creates the 2-megabyte Watts file as a read-only file, so if you want to delete it later to make room for something else, you need to type the command "attrib watts.dat -r". We have deleted the "attrib" command at the end of install.bat that makes watts.dat read-only, and suggest that the other coordinators do the same, for future distribution]. The Evans package consists of 27 diskettes, most containing compact ZIPPED files. At least 60 megabytes of disk space are needed to use the software to generate predictions. The national and regional coordinators who now have, or who soon will have, the Evans package are listed below; addresses are in the IOTA-IOTA/ES Roster distributed with the last issue:

Graham Blow, New Zealand
Reinhold Buechner, Germany (IOTA/ES) *
Henk Bulder, the Netherlands
Claudio Costa, Italy *
David Dunham, Maryland *
Andrew Elliott, U.K.
Rick Frankenberger, Texas
Joaquim Garcia, Portugal *
Rocky Harper, Texas
Craig and Terri McManus, Kansas
Walter Morgan, California
Ton Schoenmaker, the Netherlands
Mitsuru Sôma, Japan
Matti Suhonen, Finland
Pierre Vingerhoets, Belgium

An asterisk (*) indicates that we have heard that the PC EVANS program has been installed and is ready to produce predictions. For operational use, subregions of the USNO super standard station regions have been defined and assigned to individual coordinators, so that the same station code is not used for different stations by different coordinators. Subregions will be assigned by David as he learns that individual coordinators get the PC EVANS program to work on their PC. If you have 60 megabytes to donate to the cause (at least on a temporary basis; the files can be backed up to diskettes, tape cartridge, Bernoulli disk, or other medium when the program is not in use) and are willing to provide predictions to IOTA members in your nation or region (IOTA can reimburse mailing costs for predictions sent to IOTA members), please contact David Dunham for a package. The only cost that we impose on receipients of the EVANS package is that they be willing to copy it and send it to one or two other coordinators whom we specify. In this way, Dunham and the other IOTA centers will not be spending all of their time copying and packaging diskettes. If you give a copy of the package to someone else, we want to know that, for distribution of new and updated datasets. With the widespread distribution of this software, IOTA can provide a prediction service that is locally more responsive than the previous centralized system has been, and we hope to get these predictions to all IOTA members who want them.

1994 Grazing Occultation Predictions: As you have seen in this issue and in other IOTA publications during the past year, Eberhard Riedel in Munich, Germany, has been preparing maps of grazing occultation paths for various purposes. Along with these maps, he also produces files of detailed graze limit predictions, an example of which is given at the bottom of this page. These predictions give essentially the same information as the current IOTA graze program. Riedel plans to provide packages to the IOTA graze computors that will include datasets of paths of grazes of stars to mag. 8.5 (also the USNO limit) for each of the super standard station (SSS) regions [see the 1993 hemispheric graze supplement for their definition], and software that will read one of these datasets and the corresponding IOTA station file for the SSS region to generate detailed predictions of all grazes within each observer's favorable travel radius. For the rare (and usually spectacular) grazes of stars of mag. 4.5 and brighter (except in some cases near full moon when moonlight interference is too strong), every observer in the region will get a prediction, regardless of their distance from the path. Riedel also plans to provide profiles for each graze, although this job could be done by the ACLPPP program. In any case, we plan to construct an interface with ACLPPP, so that we can maintain a consistent link with Mitsuru Sôma's OCCRED program that will be used also to analyze the observations. If Riedel's efforts to achieve the most accurate predictions (they already agree with the IOTA predictions to within about 200 m, usually smaller than the stellar and lunar limb errors involved) and the profiles delay too long the delivery of his packages to the graze computors, we may have difficulty getting predictions for January events to observers in time. For those few observers wanting predictions of 1994 "unfavorable" grazes not in Riedel's predictions (generally for stars fainter than mag. 8.5), David can use the OCC program following the same proceedures used for 1993 and earlier years.

XZ Catalog: Both B1950 and J2000 versions of the USNO-IOTA prediction catalog of 32221 Zodiacal stars, XZ80N (last updated in mid-1992), are now available from the Astronomical Data Center (ADC), National Space Science Data Center, Code 633, NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA; telephone 1-301-286-8310 (Gail Schneider); fax 1-301-286-1771; Internet gail@ndadsa.gsfc.nasa.gov. Six other USNO catalogs that have been used for occultation predictions, including J, K, and L, are also now available from the ADC. Wolfgang Zimmermann is preparing a new version of the J2000 XZ catalog that will replace the positional data for most of the stars with more accurate data from the PPM catalog. I thank Wayne Warren for helping prepare the documentation for these catalogs.

```
# 39: JAN.   3, 1994   STAR: 87 LEONIS                    MOON: 67% SUNLIT, WANING
 SOUTHERN LIMIT GRAZE              SAO 138238, MAG.  6.4        PHASE-ANGLE: 250.8
  DELTAT:   60.29 SEC.             USNO:   1670, SPEC. K2       POS-AN.CUSP: 205.2
```

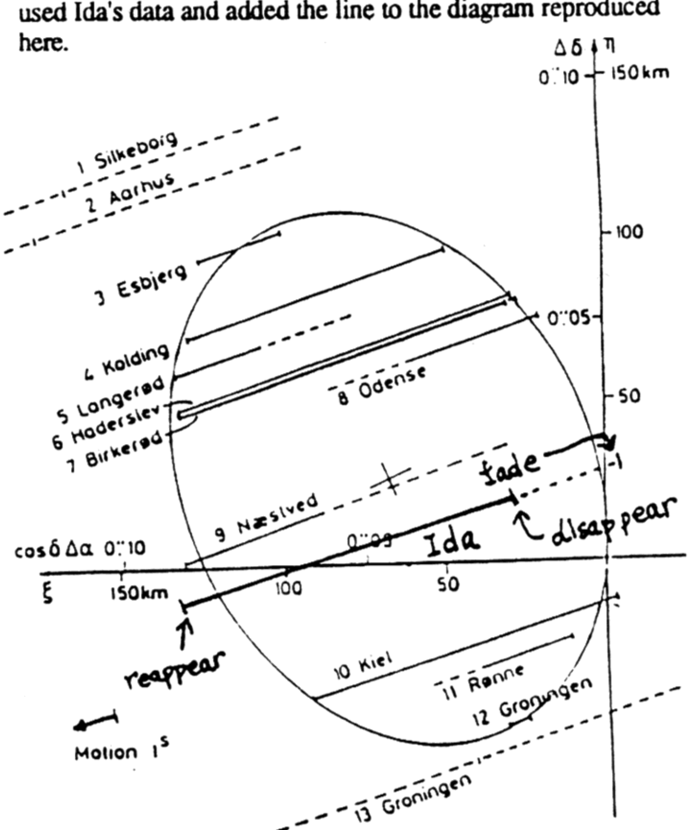
WEST LONG.	NORTH LATITUDE DEG. MIN.	UT	MOON ALT.	MOON AZI.	TANZ	SUN ALT.	POWI GRAZE	CUSP ANGLE
125.0000	37 36.30'	13h 40m 0.4s	48.3	195.8	0.89	-22.2	211.66	6.5 DA
124.0000	36 55.02'	13h 42m 36.2s	48.6	198.4	0.88	-20.7	211.67	6.5 DA
123.0000	36 13.65'	13h 45m 13.9s	48.8	201.1	0.88	-19.3	211.67	6.5 DA
122.0000	35 32.27'	13h 47m 53.0s	48.9	203.8	0.87	-17.8	211.65	6.5 DA
121.0000	34 50.99'	13h 50m 33.0s	48.9	206.5	0.87	-16.3	211.60	6.4 DA
120.0000	34 9.91'	13h 53m 13.7s	48.9	209.2	0.87	-14.8	211.55	6.4 DA
119.0000	33 29.15'	13h 55m 54.5s	48.8	211.9	0.88	-13.3	211.47	6.3 DA
118.0000	32 48.80'	13h 58m 35.0s	48.6	214.6	0.88	-11.7	211.37	6.2 DA
117.0000	32 8.96'	14h 1m 14.7s	48.3	217.2	0.89	-10.2	211.26	6.1 DA
116.0000	31 29.74'	14h 3m 53.1s	47.9	219.8	0.90	-8.6	211.12	5.9 DA
115.0000	30 51.22'	14h 6m 29.9s	47.4	222.3	0.92	-7.1	210.98	5.8 DA
114.0000	30 13.49'	14h 9m 4.7s	46.9	224.7	0.93	-5.5	210.81	5.6 DA
113.0000	29 36.63'	14h 11m 37.0s	46.3	227.0	0.95	-4.0	210.63	5.5 DA
112.0000	29 0.71'	14h 14m 6.6s	45.7	229.2	0.98	-2.4	210.44	5.3 DA

REPORTS OF ASTEROIDAL APPULSES AND OCCULTATIONS

Jim Stamm

If you do not have a regional coordinator who forwards your reports, they should be sent to me at: 11781 N. Joi Dr. Tucson, AZ 85737 USA. Names and addresses of regional coordinators are given in "From the Publisher" on *Occultation Newsletter's* front page. All times in this report are UTC.

Isao Sato has forwarded an observation that he recently came across: Miyoshi Ida reported an occultation of BD +25°1937 by (106) Dione on January 19, 1983 from Yokaichi, Japan. His report was made soon after the observation, but since there were no confirming observations made in Japan, the report was not accepted. Sato, recalling a 1984 article (Kristensen, L.K., **Astron. Nachr. 305**, p.207) about the event reported in Europe, used Ida's data and added the line to the diagram reproduced here.



I have summarized all of the reports that I have received for the first half of 1991 in the following two tables and section of notes. Table 1 lists the 1991 date, minor planet, occulted star, IDs of successful observers, and references to any notes. Table 2 lists the observer's ID, name, nearest town to location of observation, country (includes state or province for North America and Australia), and the total number of observations made in the period. The notes section details those events that included positive observations, or other significant information that could not be reported in the tables. I am not including notes on those observations that may have been spurious unless there is some sort of confirmation, or the fact that something may have happened is relevant to another observation. Instead, I will place an asterisk (*) in the Notes column to indicate that I have received a report with more than a "no event...." in it.

Table 1. Asteroidal appulses and occultations: Jan.-June 1991.

1991	Minor Planet		Cat	Star	Observers	Notes
Jan 02	179	Klytaemnestra	AC	21180	Hon	
Jan 04	4	Vesta	AGK3	+10° 0317		1
Jan 09	185	Eunike	PPM	155732	MolBlkSmcAnd	
Jan 10	11	Parthenope	LickV	6202	Dss	
Jan 11	184	Dejopeja	PPM	97666	SmcAndMol	
Jan 13	381	Myrrha	SAO	95912		2
Jan 13	1512	Oulu	PPM	93530		3
Jan 17	11	Parthenope	LickV	1712	Dnz	
Jan 19	532	Herculina	Lick1	0954	DnzSta	
Jan 19	216	Kleopatra	PPM	152432		4
Jan 19	17	Thetis	AGK3	+91° 0500	Mol	
Jan 21	230	Athamantis	SAO	156876	AzaCanDflGezGrcKkn MosMtiScbTrlTrr	5
Jan 26	34	Circe	LickV	30296	GrcFltChsHozStwVie HelDwdDomBolBzlMcbGat	
Jan 30	27	Euterpe	PPM	126000	Sta	
Feb 01	664	Judith	PPM	125047	LapDikBlkNesPaj AndSmc	
Feb 02	5	Astraea	SAO	96089	SmcAndHawBlkPri BemByrDik	6
Feb 04	201	Penelope	PPM	125971	DnzDebSmi	
Feb 15	187	Lamberta	SAO	158961	Sta	
Feb 22	360	Carlova	PPM	120671	AzaBglBrtFauGrc IacMrxNelOhpWtt	
Mar 01	627	Charis	PPM	126389	BdwGeyMrxRth	
Mar 04	535	Montague	LickV	8021	Mol	
Mar 06	245	Vera	LickV	2005	LapBlk	
Mar 10	318	Magdalena	PPM	120542	BffBglCvgEwlFoo GenHffKhlMrxSzk	*
Mar 16	369	Aeria	AGK3	+26° 1145	Mrx	
Mar 17	334	Chicago	SAO	162723	Thn	
Mar 17	60	Echo	AC	20206	AndSmcHut	
Mar 20	121	Hermione	FAC	167316	Thn	
Mar 21	968	Petunia	PPM	177977	Smc	
Mar 21	726	Joella	SAO	136589	Smc	
Mar 26	747	Winchester	PPM	128799	Hon	
Mar 27	187	Lamberta	SAO	183474	LapBlkKruNesAnd	
Mar 27	508	Princetonia	PPM	93204	BgsBlmBulDssFglHff KrtMrxRthShtThoTvh	
Mar 29	846	Lipperta	SAO	159344	Ccp	
Mar 30	2	Pallas	SAO	118404	Wel	
Mar 31	96	Aegle	SAO	156875	Khl	
Apr 02	217	Eudora	PPM	179112	StgBlkAndHutDik	7
Apr 02	624	Hektor	SAO	181911	CopLeaOveSmi	
Apr 04	683	Lanzia	SAO	186127	And	
Apr 05	17	Thetis	LickV	23742	Wrr	
Apr 07	532	Herculina	FAC	250938	Grh	
Apr 08	184	Dejopeja	AC	5827	HonHoz	
Apr 08	532	Herculina	FAC	255192	BblDssJun	
Apr 11	4	Vesta	AGK3	+20° 0416	Sta	
Apr 11	121	Hermione	FAC	199379	NesBlkHutAndGem	
Apr 13	19	Fortuna	AC	4776	GkoMeuScfZwk	
Apr 15	177	Irma	SAO	184383	HilBomOveDebJooDae ProSmiGadThn	
Apr 15	270	Anahita	LickV	972	Sta	
Apr 18	121	Hermione	FAC	211278	DebSmiOveThn	
Apr 19	103	Hera	LickV	12536	DikStgAndBlk	
Apr 20	115	Thyra	Yale	9594	BlkGemHilGibLoa	
Apr 23	186	Celuta	SAO	208561	Blk	
May 05	15	Eunomia	FAC	368210	MolMiaHutKeaBemSmcAnd	
May 07	207	Hedda	SAO	79868	MiaAnd	

Table 1 (Cont.). Asteroidal appulses/occultations: Jan.-June 1991.

1991	Minor Planet	Cat	Star	Observers	Notes
May 08	462 Eriphyla	SAO	158878	Diz	
May 08	1345 Potomac	SAO	164518	StgBlkDal	
May 10	181 Eucharis	SAO	144646	StgSmcAndLoa	
May 11	102 Miriam	AC	23399	Sta	
May 11	1655 Comas Sola	PPM	128119	DizSta	
May 24	1404 Ajax	SAO	181037	NesSmc	
May 27	674 Rachele	SAO	184425	EnkFleOveDebThn BrrFnzGez	•
Jun 08	585 Bilkis	PPM	174544	StgSmc	
Jun 09	146 Lucina	FAC	447154	And	
Jun 11	694 Ekard	SAO	158489	Ega	
Jun 11	433 Eros	SAO	226005	SmcHutAndSugTakIka	
Jun 13	423 Diotima	SAO	185272	DikAndLoa	8
Jun 15	356 Liguria	SAO	210543	LunDebSmiThn	9
Jun 16	130 Elektra	PPM	168528	Sta	
Jun 19	776 Berbericia	SAO	159636	SmiThn	
Jun 24	103 Hera	PPM	159359	CopOveSmi	
Jun 24	514 Armida	PPM	156789	CopOveSmi	
Jun 24	978 Aidamina	PPM	163619	Hon	
Jun 25	53 Kalypso	SAO	164279	Grc	
Jun 26	41 Daphne	AGK3	+06° 0115	OveSmiVnbThn	
Jun 29	897 Lysistrata	PPM	171718	SmcAnd	

Table 2. Observers and locations of events Jan.-June 1991.

ID	Observer	Town	Country	No.
Aik	Aikman, Chris	Victoria	Brit. Columbia - CAN	1
Aka	Akazawa, Hidehiko	Funaho	Japan	1
Aki	Akiyoshi, T.	Miyazaki	Japan	1
Alw	Allis, Tanner	Midland	Michigan - USA	1
And	Anderson, Peter	The Gap	Queensland - AUS	18
Aza	Azema, J.-M.	Lamalou	France	2
Blg	Ballegoy, E.V.	Druten	Netherlands	1
Ban	Ban, Yoshihiko	Mastumoto	Japan	2
Bff	Baruffetti, Pietro	Massa	Italy	1
Bay	Bayus, Chris	Flint	Michigan - USA	1
Bem	Bembrick, Colin	Bathurst	N.S.W. - AUS	2
Bdw	Benedyktowicz, L.	Kracow	Poland	1
Bgl	Bertoglio, A	Torino	Italy	2
Brt	Bertoli, Oreste	Alpignano	Italy	1
Btv	Bettonvil, F.	Heesch	Netherlands	1
Bzl	Binzel, Richard	Lexington	Massachusetts - USA	1
Bis	Bishop, Roy	Avonport	Nova Scotia - CAN	1
Blk	Blanksby, Jim	Wandin	Victoria - AUS	12
Blm	Blommers, L.	Leiden	Netherlands	2
Bst	Bolster, Bob	Alexandria	Virginia - USA	1
Bom	Boltman, A. & M.		South Africa	1
Bol	Boltwood, Paul	Ottawa	Ontario - CAN	1
Brr	Borras, Vincente	Benicarlo	Spain	1
Bos	Boschat, Michael	Halifax	Nova Scotia - CAN	1
Bgs	Bourgeois, Jean	Ciney	Belgium	2
Bbl	Briet Blanes, T.	Castellon	Spain	1
Bri	Brisbin, Jack	Dryden	Michigan - USA	1
Bru	Bruce, Robert	Drouin	Victoria - AUS	1
Bul	Bulder, Henk	Zoetermeer	Netherlands	2
Bun	Burns, Tom	Stratford	Ohio - USA	2
Byr	Byron, Jeff	Sydney	N.S.W. - AUS	1
Can	Candela, Bernard	Sollies-Pont	France	1
Car	Carlson, Jim	Falmouth	Massachusetts - USA	1
Cas	Casas, Ricard	La Orotava	Spain	1
Cat	Castle, Paul	Colona	Illinois - USA	1
Cvg	Cavagna, Marco	Sormano	Italy	1
Chs	Chase, Rick	S. Waterford	Maine - USA	2
Cir	Cirker, Willkie	Lucas	Ohio - USA	1
Coo	Cooper, Tim	Benoni	South Africa	5
Cos	Cosentine, Martin	Coal Valley	Illinois - USA	1
Cun	Cunningham, M.	Whittier	California - USA	1
Dal	Daalder, Peter	Launceton	Tasmania	1
Dfl	Daiffallah, Khalil	Alger	Algeria	1
Dae	Dale, S.	Pietermaritzburg	South Africa	1
Deb	de Beer, G.	Ladysmith	South Africa	5
Dnz	Denzau, Helmut	Essen	Germany	4
Dik	Dickie, Ross	Gore	New Zealand	5
Did	Didick, Richard	Norton	Massachusetts - USA	1
Diz	Dietz, Richard	Greeley	Colorado - USA	2
Dod	Dodson, Steve	Sudbury	Ontario - CAN	1
Dom	Dombrowski, Phil	Glastonbury	Connecticut - USA	1
Dow	Dow, Donaldson	Ramrod Key	Florida - USA	1
Dwd	Dunham, David W.	Greenbelt	Maryland - USA	1
Dw2	Dunham, David W.	Maryland	New Jersey - USA	1
Dw3	Dunham, David W.	Detroit Air.	Michigan - USA	1
Dss	Dusser, Raymond	Kalaa Sghira	Tunisia	5
Ega	Egawa, Humiharu	Kumatori	Japan	1
Eir	Eiraku, M.	Uchinoura	Japan	1
Ell	Elliott, A.J.	Reading	United Kingdom	1
Emm	Emmons, Richard	North Canton	Ohio - USA	1
Enk	Enke, S.	Windhoek	South Africa	1
Ewl	Ewald, D.	Biesenthal	Germany	1
Fau	Faure, G.	Varces	France	1
Fnz	Fernandez B., D.	Barcelona	Spain	1
Fie	Field, R.	Durban	South Africa	1
Flt	Fletcher, Murray	Victoria	Brit. Columbia - CAN	2
Foo	Fodor, L.	Kunadacs	Hungary	1
Fgl	Foglia, Sergio	Lacona	Italy	1
Fxj	Fox, Jim	Afton	Minnesota - USA	1
Frs	Frasca, Michael	Peoria	Illinois - USA	1
Fry	Frey, Gary	W Bloomfield	Michigan - USA	1
Fuj	Fujiwara, Y.	Osaka	Japan	1
Fuk	Fukushima, S.	Machida	Japan	1
Grc	Garcia, Joaquim	Lisboa	Portugal	5
Gad	Garde, T.	Shurugwe	South Africa	1
Gat	Garrett, Lawrence	Burlington	Vermont - USA	2
Gen	Genovese, Marco	Torino	Italy	1
Gem	George, Martin	Launceton	Tasmania	2
Ger	Gerry, Karen	Jones Beach	New York - USA	1
Gib	Giles, Barry	Hobart	Tasmania	1
Gil	Gill, David	Massilon	Ohio - USA	1
Gqr	Gomez de Quiroga	Madrid	Spain	1
Gez	Gomez, F.J.	Mollet	Spain	2
Gcv	Goncalves, Rui	Lisboa	Portugal	1
Gko	Gorko, M	Lodz	Poland	1
Grh	Graham, Frances	E. Pittsburg	Pennsylvania - USA	1
Gro	Grainger Obs.	Exeter	New Hampshire - USA	1
Grs	Grieser, Dan	Columbus	Ohio - USA	2
Gur	Guerber, Jeff	Greenbelt	Maryland - USA	1
Gey	Guyer, E.H.	Daun	Germany	2
Has	Hasegawa, Takashi	Tochigi	Japan	1
Hsh	Hashimoto, Akie	Chichibu	Japan	1
Hat	Hattori, Y.	Miyazaki	Japan	1
Haa	Hayashi, H.	Zushi	Japan	1
Tvh	Haymes, Tim V.	Reading	United Kingdom	2
Hay	Hays, Robert	Worth	Illinois - USA	1
Haw	Hayward, Steve	Madang	Papua New Guinea	1
Hel	Heil, Christopher	Andover	Massachusetts - USA	1
Hnn	Henn, Allan	Brooklyn	Wisconsin - USA	1
Hey	Henry, Michael	Canton	Ohio - USA	1
Hed	Heydon, Alex	Toronto	Ontario - CAN	1
Hil	Hill, Kym	Hobart	Tasmania	2
Hir	Hirose, T.	Ota	Japan	1
His	Hirose, Y.	Chigasaki	Japan	1
Hff	Hoffman, Martin	Weidenbach	Germany	2
Hoz	Holtz, John	Russellton	Pennsylvania - USA	3
Hom	Homma, T.	Fuchu	Japan	1
Hon	Honkus, Edward	Carnegie	Pennsylvania - USA	5
Hor	Horiuchi, J.	Ohito	Japan	1
Hos	Hosoi, S.	Soka	Japan	1
Hut	Hutcheon, Steve	Sheldon	Queensland - AUS	6
Iac	Iacovone, N.	Torino	Italy	1
Ika	Ikari, Yasukazu	Taga	Japan	1
Ima	Imai, Y.	Toshima	Japan	1
Joo	Jooste, J.	Reitz	South Africa	1
Kac	Kachelmeyer, R.	Roseville	Minnesota - USA	1
Kai	Kaiser, Daniel	Columbus	Indiana - USA	1
Kak	Kakei, W.	Shizuoka	Japan	1
Kan	Kaneko, Sakae	Sakura	Japan	1
Kar	Karasaki, H.	Nerima	Japan	1
Kea	Kearney, Phillip	Bundaberg	Queensland - AUS	1
Kei	Keith, Lee	Milwaukee	Wisconsin - USA	1

Table 2 (Cont.). Observers/locations of events: Jan-June '91.

ID	Observer	Town	Country	No.
Kel	Kelly, Patrick	Halifax	Nova Scotia - CAN	1
Kit	Kitazaki, K.	Musashino	Japan	1
Kiy	Kiyokawa, T.	Zama	Japan	1
Khl	Kohl, Mike	Wald	Switzerland	2
Kom	Komuro, M.	Sakado	Japan	1
Kkn	Kosa-Kiss, Attila	Salonta	Romania	1
Koy	Koyama, H.	Hachioji	Japan	1
Krt	Kretlow, Mike	Siegen	Germany	1
Kru	Kruijshoop, Alfred	Mt. Waverly	Victoria - AUS	2
Kuj	Kube, Jim	West Allis	Wisconsin - USA	1
Kum	Kumamoto Civ. Obs.	Kumamoto	Japan	1
Lae	Lane, David	Halifax	Nova Scotia - CAN	1
Lap	Larkin, Patricia	The Basin	Victoria - AUS	4
Lgn	Le Guern, Vincent	Villeneuve	France	1
Lea	Learmonth, R.	East Rand	South Africa	1
Jlx	Lecacheux, Jean	Meudon	France	1
Lez	Lenz, George	Wilton	Connecticut - USA	1
Lhd	Lindhard, L.	Esbjerg	Denmark	1
Loa	Loader, Brian	Christchurch	New Zealand	3
Low	Lowe, Andraw	Calgary	Alberta - CAN	1
Lun	Lund, H.	Johannesburg	South Africa	1
Lur	Lurcott, Edwin	West Chester	Pennsylvania - USA	1
Mcb	MacRobert, Alan	Bedford	Massachusetts - USA	2
Mae	Maeda, K.	Kiyotake	Japan	1
Mal	Maley, Paul	Metamora	Michigan - USA	1
Man	Manly, Peter	Tempe	Arizona - USA	1
Mas	Manske, Bob	Brooklyn	Wisconsin - USA	1
Mrc	Marche', Jordan	Bloomington	Indiana - USA	1
Mlt	Marlot, C.	Guines	France	1
Mti	Marti, Josep	Mataro	Spain	2
Mrx	Marx, Harald	Stuttgart	Germany	5
Mto	Mato, K.	Oita	Japan	1
Mat	Matsuda, Hideki	Tenri	Japan	1
Mcm	McManus, Barbara	Falmouth	Massachusetts - USA	1
Mcw	McWatters, Richard	Toronto	Ontario - CAN	1
Mia	Miller, Anderson	Jarrahdale	W. Australia - AUS	2
Min	Minobe, J.	Takasaki	Japan	1
Miz	Miyazaki U. Ast Club	Kiyotake	Japan	1
Mod	Modic, Robert	Richmond Hts	Ohio - USA	2
Mol	Moller, Harry	Kingsley	W. Australia - AUS	5
Moy	Moriya, Y.	Yokohama	Japan	1
Mos	Mostefaoui, Toufik	Alger	Algeria	2
Mut	Muto, N.	Sakado	Japan	1
Nel	Neel, Regis	Venissieux	France	1
Nes	Nelson, Peter	Ellinbank	Victoria - AUS	4
Ohp	Obs Haute-Provence	St. Michel	France	1
Jun	Obs. Jungfraujoch	Jungfraujoch	Switzerland	1
Meu	Obs. De Meudon	Meudon	France	1
Oda	Odagiri, S.	Aomori	Japan	1
Ohk	Okura, Nobuo	Okayama	Japan	1
Olv	Oliver	Bronson	Florida - USA	1
Osb	Osborn, Wayne	Mt. Pleasant	Michigan - USA	1
Osh	Oshima, O.	Kurashiki	Japan	1
Ove	Overbeek, Danie	Edenvale	South Africa	8
Oya	Oya, K.	Chigasaki	Japan	1
Pal	Paller, Leroy	Central	Arizona - USA	1
Paj	Park, J.	Melbourne	Victoria - AUS	2
Upk	Peorink, U	Heesch	Netherlands	1
Per	Persha, G.	Lowell	Michigan - USA	1
Pej	Peterson, John	Falmouth	Massachusetts - USA	1
Pek	Petrasko, Michael	Chatham	Massachusetts - USA	1
Phl	Phillips, Jim	Grand Rapids	Minnesota - USA	1
Plu	Pluth, Bernard Jr.	Dublin	Ohio - USA	1
Poa	Poani, Ernie	Campbell's Is.	Illinois - USA	1
Pri	Priestley, John	Pukerua Bay	New Zealand	1
Pro	Prosser, G.	Pietermaritzburg	South Africa	1
Pry	Pryal, Jim	Seattle	Washington - USA	1
Ros	Ross, Bob	Florence	Kentucky - USA	1
Rth	Rothe, Wolfgang	Berlin	Germany	3
Sao	Sato, I.	Meguro	Japan	1
Sso	Sato, M.	Fuchu	Japan	1
Scf	Scarfi, G.	La Spezia	Italy	1
Shf	Schaaf, Elizabeth		Iowa - USA	1
Scb	Schnabel, Carles	Barcelona	Spain	1
Sht	Scholten, Alex	Eerbeek	Netherlands	1
Scm	Schumacher, Phil	Stratford	Ohio - USA	1
Shb	Shibuya, H.	Matsubarako	Japan	1
Shm	Shima, K.	Fujimi	Japan	1
Sml	Small, Craig	Jones Beach	New York - USA	1
Smi	Smit, J.	Pretoria	South Africa	9
Smc	Smith, Charlie	Woodridge	Queensland - AUS	14
Smg	Smith, Greg	Elyria	Ohio - USA	1
Som	Soma, M.	Mitaka	Japan	1
Stg	St. George, Lou	Auckland	New Zealand	5
Sta	Stamm, Jim	Tucson	Arizona - USA	8
Sth	Storch, Samuel	Jones Beach	New York - USA	1
Stw	Stowers, Clifford	Fairfield	Maine - USA	1
Sun	Suenaga, Y.	Fujinomiya	Japan	1
Sga	Sugai, M.	Aikawa	Japan	1
Sug	Sugie, J.	Taga	Japan	1
Suz	Suzuki, A.	Yamato	Japan	1
Suk	Suzuki, Y.	Kodaira	Japan	1
Szk	Szarka, Levente	Kecskemet	Hungary	1
Tak	Takahashi, S.	Taga	Japan	1
Tan	Tanaka, K.	Higashimatsuyama	Japan	1
Trr	Terrier, Pierre	Chamonix	France	1
Thn	Thompson, R.		South Africa	8
Ths	Thompson, Ray	Toronto	Ontario - CAN	1
Tho	Thooris, Bertrand	Wervik	Belgium	1
Thh	Thrush, Jeff	Taylor	Michigan - USA	1
Tky	Tokyo U. Ast Club	Meguro	Japan	1
Tom	Tomoda, T.	Kobayashi	Japan	1
Tor	Torihara, Y.	Miyazaki	Japan	1
Trl	Torrell, Sebastia	Barcelona	Spain	3
Ued	Ueda, Masayoshi	Habikino	Japan	1
Vnb	VanBlommestein, P.	Simon's Town	South Africa	1
Fvl	Van Loo, Francois	Genk	Belgium	1
Van	Vance, Norbert	Allen Park	Michigan - USA	1
Vff	VanEffen, Dick	Midland	Michigan - USA	1
Vit	Victor, Robert	E. Lansing	Michigan - USA	1
Vie	Viens, J.-F.	Quebec City	Quebec - CAN	2
Waa	Wagenaar, R.	Wateringen	Netherlands	1
Wku	Waku, S.	Katsushika	Japan	1
Wrr	Warren, Wayne	Maryland	New Jersey - USA	2
Wnb	Watanabe, O.	Sapporo	Japan	1
Wat	Watanabe, Shinobu	Suita	Japan	1
Wei	Weier, David	Brooklyn	Wisconsin - USA	1
Wel	Welch, Douglas	Hamilton	Ontario - CAN	1
Wld	Wild, Walter	Chicago	Illinois - USA	1
Wil	Wilds, Richard	Topeka	Kansas - USA	2
Wtt	Witt, U.	Berlin	Germany	1
Yam	Yamada, M.	Yokohama	Japan	1
Yur	Yurchesyn, Joe	Halifax	Nova Scotia - CAN	1
Zwk	Zawilski, Marek	Lodz	Poland	1

NOTES:

1 Jan 04 (4) Vesta. See [O.N. 5(12), p.315]. Also see Jan. '92 [**Sky & Telescope 83**(1), p.72]. Positive observations came from HedThsMcwDw3PovFryBri ModHozOsbMal PerPluSmgRosGllAlwVffEmmGrsDod VanThh. Negatives from DssMosMtiTrlMrcHonHay PhlBosKelLae YurDidFrsDowKacBun ScmWilWasWei HnnSamKujVitMaeDunOlv KaiKeiBayBzlVieBisCatPoa ShfCosWld.

2 Jan 13 (381) Myrrha. See [O.N. 5(12), p.315]. Isao Sato, Mitsuru Soma, and Toshio Hirose have authored *The Occultation of Gamma Geminorum By the Asteroid (381) Myrrha* in the Apr. '93 [**Astronomical Journal 105**(4), pp.1553-61]. Sato (in a communication to IOTA) reports three additional video events not included in the AJ. paper. One was an 8.35

second occultation beginning at approximately 11:59:54 from Kiyosato, Japan (Longitude: 138°24'28"E. Latitude: 35°55'59"N. Height: 1500 meters), by Akira Ogino. The companion of Gamma Geminorum can be seen throughout the event. Sato explains that this fact is inconsistent with the visual observation of its emersion after the disappearance of the primary by Shu Kaneko, who was nearby on the occultation track. One interpretation of this inconsistency is that the brightness of the primary delayed Kaneko's recognition of the companion. If so, the position of the companion should be modified. Another interpretation is the existence of a third body, fainter than the companion.
This was the brightest and best observed event ever seen in Japan of an asteroidal occultation. 32 chords from 54 observers were obtained. Myrrha was shown to be an ellipse of about 147 by 127 km. Gamma Geminorum was also shown to have an upper limit in diameter of .0026 arcsec. Its 7.5 magnitude companion is separated by .06 arcsec. Positive observations came from HasTanBanKomMutShbHshKanHosWkuKarShmImaKit TkySaoSom SsoHomKoyHirMoy FukSuzSgaYamKiy OyaHisHaaSunHorOgi. Negatives from WnbOdaSuk KakIdaWatFuj UedOhkAkaOshMto KumHatTorAkiTom MaeMizMinEir. There were 4 positive observations in China (along with about 3000 misses!) - not yet reported. The Royal Astronomical Society of New Zealand also reports negative observations from KruBruPajBlkLapAndSmcHut.

3 Jan 13 (1512) Oulu. Observers were BgsBlgBlmBtv BulCasDnz DssEllFvlGcv GeyGqrGrcJlxLgn LhdMltRth TrlTvhUpkWaa.

4 Jan 19 (216) Kleopatra. See [**O.N. 5**(12), p.315]. Also see Jan. '92 [**Sky & Telescope 83**(1), p. 72]. Positive observations came from Dw2WrrGurAikMod SthPryLurHey. Negatives from McbGrsGroCirBunChs CunFltCarPej MemPekGatBstGer SmlVieManPalMis LowLezFxj. A blink of less than a second duration was reported by Wil.

5 Jan 21 (230) Athamantis. See [**O.N. 5**(12), p.315], and a separate article in this issue. Positive events were reported by AzaDflGezMosMtiScbTrl. Negatives by CanGrcKknTrr

6 Feb 02 (5) Astraea. See [**O.N. 5**(12), p.315].

7 Apr 02 (217) Eudora. See [**O.N. 5**(12), p.315].

8 Jun 13 (423) Diotima. See [**O.N. 5**(12), p.315].

9 Jun 15 (356) Liguria. See [**O.N. 5**(12), p.315].

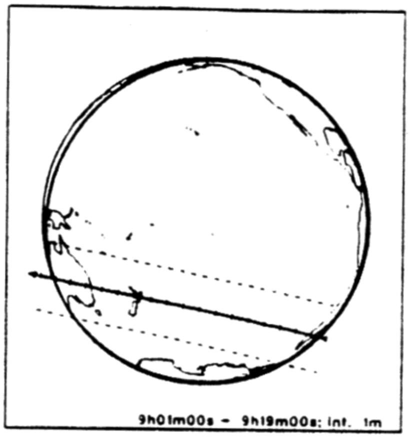
Several observers have indicated that the long time span between observation and publication tends to discourage making the observation and reporting it. I agree, and from now on I will publish summaries in a more timely fashion, from the reports that I have on hand. Reports received after my summary is written will be archived but not published. Of course this does not apply to positive observations that require the collection and reduction of data.

Edwin Goffin reports some changes to his 1994 asteroidal occultation predictions based on improved or erroneous elements. Some changes move the path a hundred or so miles, but errors generally shift the path that much anyway, so only the significant updates follow, including newer world maps from Goffin.

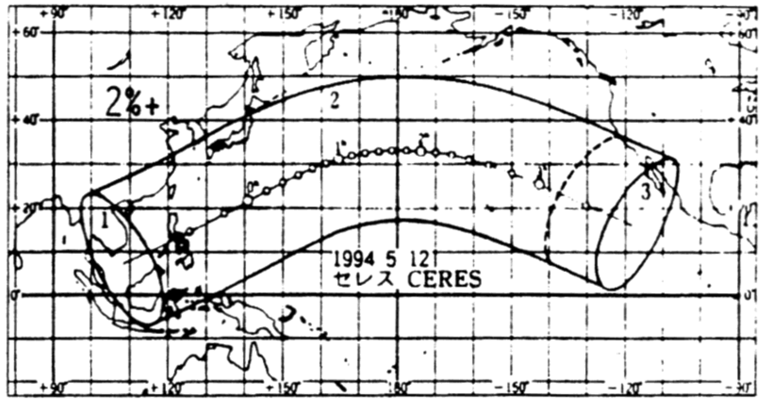
Discard predictions for (338) Budrosa, (399) Persephone, (611) Valeria, and (476) Hedwig. Add the events for Apr 17, Jun 17, and Oct 19. Note time and/or path changes for the events on Feb 04, Jun 28, Oct 30, and Nov 26.

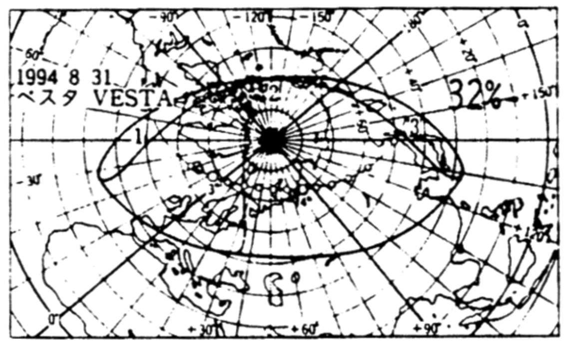
[Ed. The additional events will not be visible from populous parts of North American, so copies of them are being sent to the appropriate regional coordinators for distribution rathern than being published here. For the changed events, we include only Goffin's titles and world maps, since the other information on his chars is not changed.]
[Unfortunately, there is not enough time to include the article on the 1991 **January Athamantis** event mentioned in Jim's article. We plan to include it in the next issue, and some information about it will be given in the 1994 February issue of **Sky and Telescope**.]

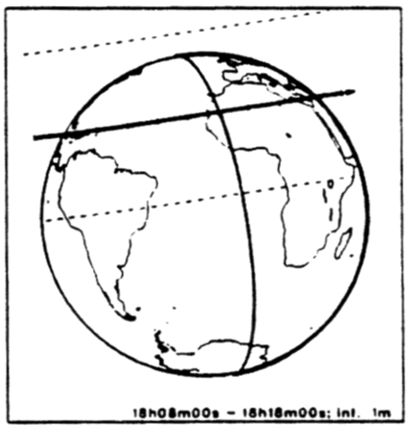
326 Tamara – PPM 52402
1994 feb 4 9h52.7m U.T. SAO 43724



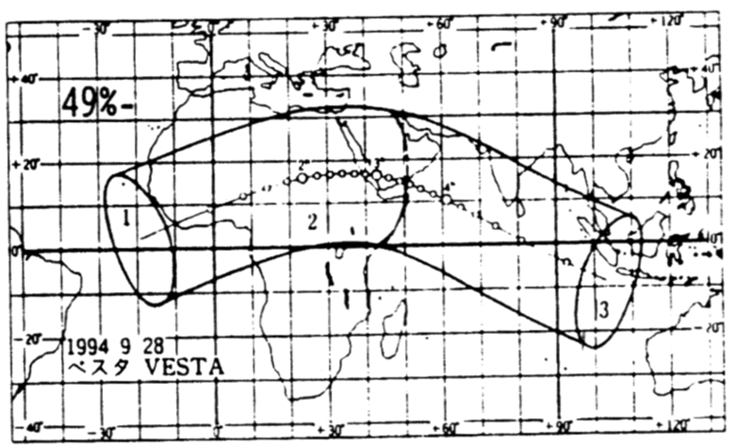
2393 Suzuki – PPM 233040
1994 jun 28 9h 9.9m U.T.



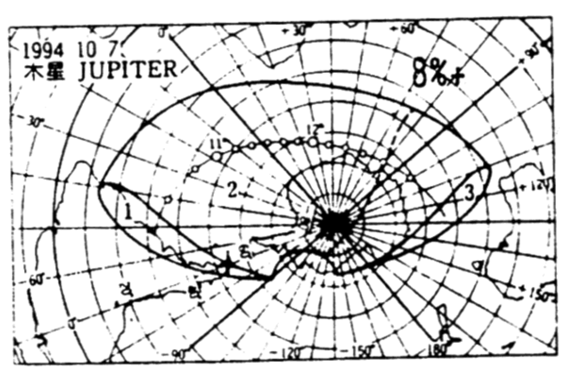




499 Venusia – PPM 270020
1994 oct 30 18h13.0m U.T.



514 Armida – PPM 117739
1994 nov 26 3h18.9m U.T.



SOLAR SYSTEM OCCULTATIONS IN 1993

David W. Dunham

This is a continuation of the article on pages 315-320 of the last issue, which in turn was started on p. 257 of **ON 5** (10). Regional maps showing asteroidal and planetary occultation paths for November and December, similar to those in **ON 5** (10) for February through May, are included in this issue. Unfortunately, there was not time to prepare finder charts for events that were not included in Edwin Goffin's predictions (with finder charts) that were distributed over a year ago.

There are many good events during the last two months of 1993, especially in North America and Europe. The usual world maps produced by Mitsuru Sôma (using my data for the occultation) are included for many of them. I have drawn Edwin Goffin's predicted paths on these if they differ from my prediction by more than 0".5. I have also put "PPMh" after "GOFFIN" on the label for these paths if Goffin has used positional data for the star from the especially accurate high-precision subset of the PPM catalog. If Goffin's time differs from my calculated time by more than 4 minutes, I have written the difference, Goffin's time minus my time, in minutes on the upper left or upper right side of the world figure. For example, "+9^m" means that Goffin predicts that the time of closest approach for any location will be 9 minutes later than the time of closest approach calculated with my data and given in the local circumstance predictions distributed by Joseph Carroll and by IOTA/ES.

Notes about Individual Events:

July 3: I distributed a catalog of relatively accurate positions of stars to about 11th magnitude from the Lick Voyager-Uranus (LU) catalog near the path of 24 Themis to potential astrometrists. Astrometry obtained at Climenhaga Observatory showed a small south shift of this path, so that it probably extended from Washington state and southern British Columbia across Montana, the Dakotas, and part of Minnesota, but known observers in this path were clouded out.

Aug. 18, Fortuna: SAO 163155 is in the Lick Voyager-Neptune catalog, so again I was able to distribute a subcatalog of fainter stars along the track to astrometrists. Alan Gilmore obtained plates on two nights at Mt. John Observatory in New Zealand. Analysis of measurements of these plates showed that the path shifted a small distance southward, still over Cuba and the Bahamas. J. Allyn Smith, Melbourne, FL, confirmed that the asteroid passed south of the star at the updated time, as expected from the astrometry.

Oct. 3, Pluto: Lick Observatory CCD astrometry of Pluto and the target star late in September showed that the path of this occultation missed the Earth's surface to the north. Based on this information, international expeditions to observe the occultation were cancelled. The astrometry showed that, within the uncertainties, an occultation by Charon was possible in either New Zealand or (less likely) eastern Australia. Graham Blow reports that the appulse was monitored photoelectrically at Mt. John Obs. through some cirrus at low altitude, and no occultation was detected.

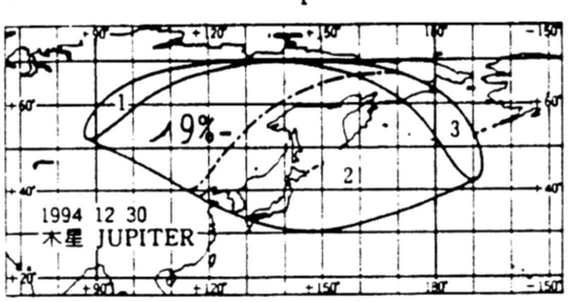
Oct. 9, Euterpe: Astrometry obtained at Lowell Observatory on Oct. 5 showed that the nominal path was quite accurate, although there was a sizeable correction to the time, 6 min. earlier than my prediction. Unfortunately, all observers in the path from Kansas eastward were clouded or fogged out. Some observers in Arizona also had problems with clouds, but several there, including Jim Stamm, timed the occultation. Observations were also made in New Mexico and by Paul Maley with an image-intensified video system at Dumas, in the Texas panhandle. Two other intensified video recordings were made, at Belen, Albuquerque and at Central Arizona College Observatory in Casa Grande, where a 2-second occultation near the northern limit occurred. Albert Vreeland, at his home in southern Tucson, AZ, had only a quick dimming during the correct second, marking the southern limit. I believe that three photoelectric records were obtained. Since the maximum durations were less than 11 seconds, Euterpe's outline may have been a little smaller than predicted. The actual occultation path is plotted on the Western Hemisphere regional map. More about this event will be given in a future issue.

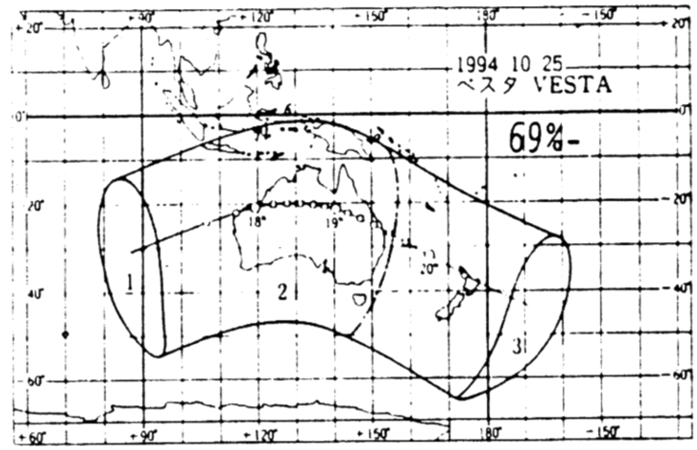
Nov. 7, Chiron: This event was first publicized only two months ago and has not appeared in previous **ON**'s. It was identified by S. Bus, L. Wasserman, and J. Elliot in a special search of occultations by this distant comet-like object during 1993-1996; a paper about them, including small finder charts, has been submitted to **Astron. J.** Around 13:20 UT of Nov. 7, Chiron was predicted to occult 14.3-mag. GSC 249-00971 along a path crossing the southwestern USA. It was the only event they found that had a reasonable chance of being visible from the contiguous USA. A special notice including part of the preprint giving information about this event was mailed to IOTA members in the possible region whom we thought might have access to large telescopes.

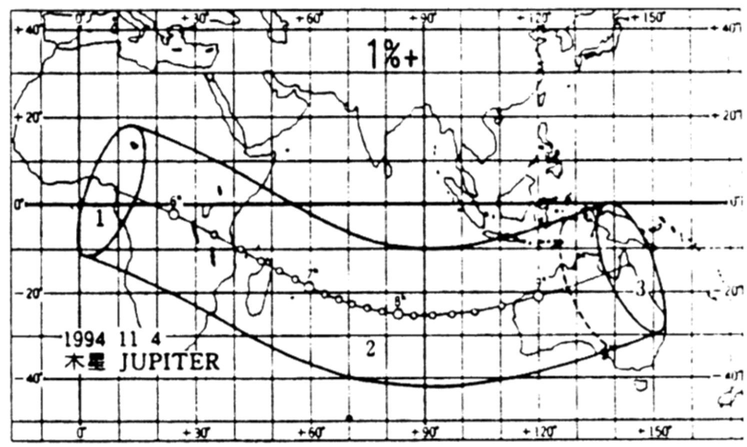
Nov. 13, Apollonia: The star is ZC 3286.

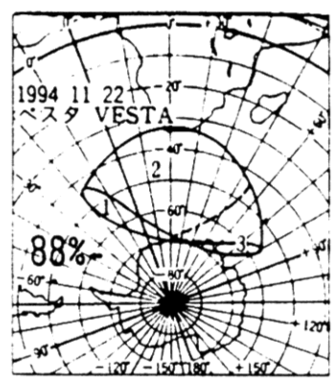
Nov. 20: 288 Glauke has a very long-period light curve, thought possibly due to precession caused by a satellite of the asteroid. But radar observations do not

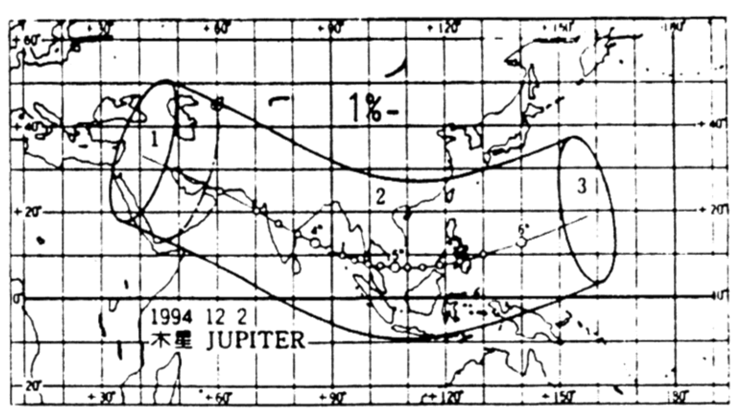
show two objects, only one very slowly rotating one.
Nov. 23, Fortuna: A major effort for this event is planned, similar to the one for Euterpe in early October. Observers in the southern and midwestern USA, especially in the region between (and slightly north and south of) my and Edwin Goffin's paths, are encouraged to provide me with longitudes, latitudes, and heights above sealevel, preferably accurate to a km or less, of all known sites where observations might be obtained. The computerized sort of stations relative to the updated path used for the Oct. Euterpe event can be used again for this event, and the results distributed by E-mail, for targeting of mobile observers to gaps in the fixed-site coverage of the event.
Nov. 23, Crocus: Like Glauke, 1220 Crocus has a very long-period light curve. A satellite may be responsible; there are no radar observations of Crocus.
Nov. 29: This event occurs during the total lunar eclipse discussed earlier in this issue. The star is ZC 2025. Wolfgang Beisker and Hans Bode plan to obtain a CCD record of the occultation from an observatory in the Canary Islands.
Dec. 11, Victoria: The star is ZC 466.
Dec. 20, P/Schwassmann-Wachmann-1: This giant comet beyond Jupiter's orbit may occult 13.1-mag. GSC 19150293 somewhere in eastern North America and Europe around 1:50 UT, according to new calculations by Edwin Goffin; the event, and two other occultations that he found, are not in any of IOTA's previously-distributed material. A copy of Goffin's chart for either of these events is available upon request to either the McManuses in Topeka (phone 1-913-232-3693, E-mail 570-0611@mcimail.com, address given at top of p. 1) or to Hans Bode (see back page). The 2nd event is of 13.3-mag. GSC 19150001 around 13:50 UT Dec. 23, possible area Siberia, Japan, and western North America; and the 3rd event is of 13.4-mag. GSC 19150481 around 7:00 UT Dec. 25, possible area North America, northwestern Africa, and Europe from Iberia to Scandinavia.
Dec. 21, Metis: Special efforts are planned to update the path prediction for this good event for Australia or New Zealand, possibly using observations of past occultations by Metis.
Dec. 31, Vibilia: The star is possibly a close double star, based on a "gradual" lunar occultation observed in South Africa on 1928 April 24.

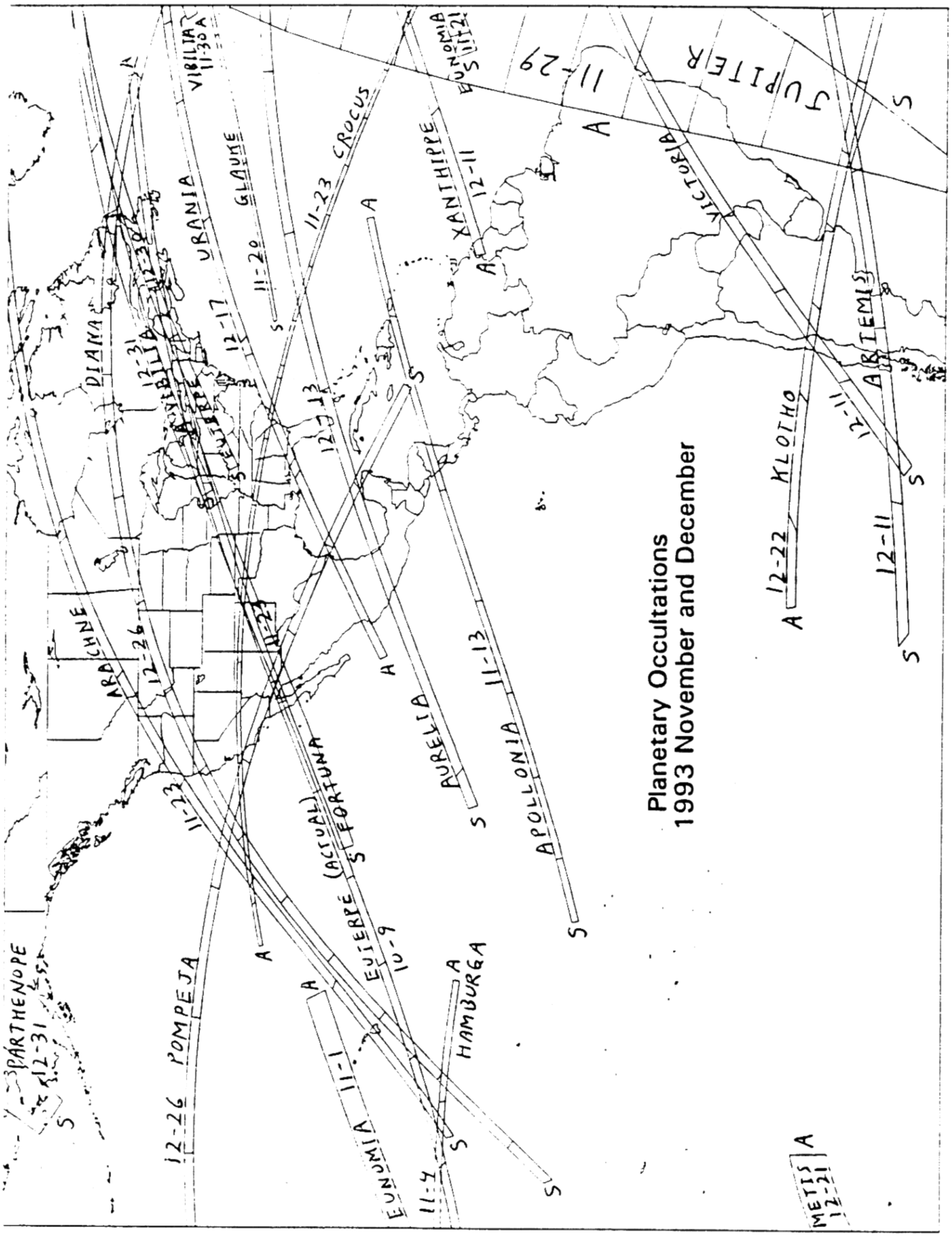


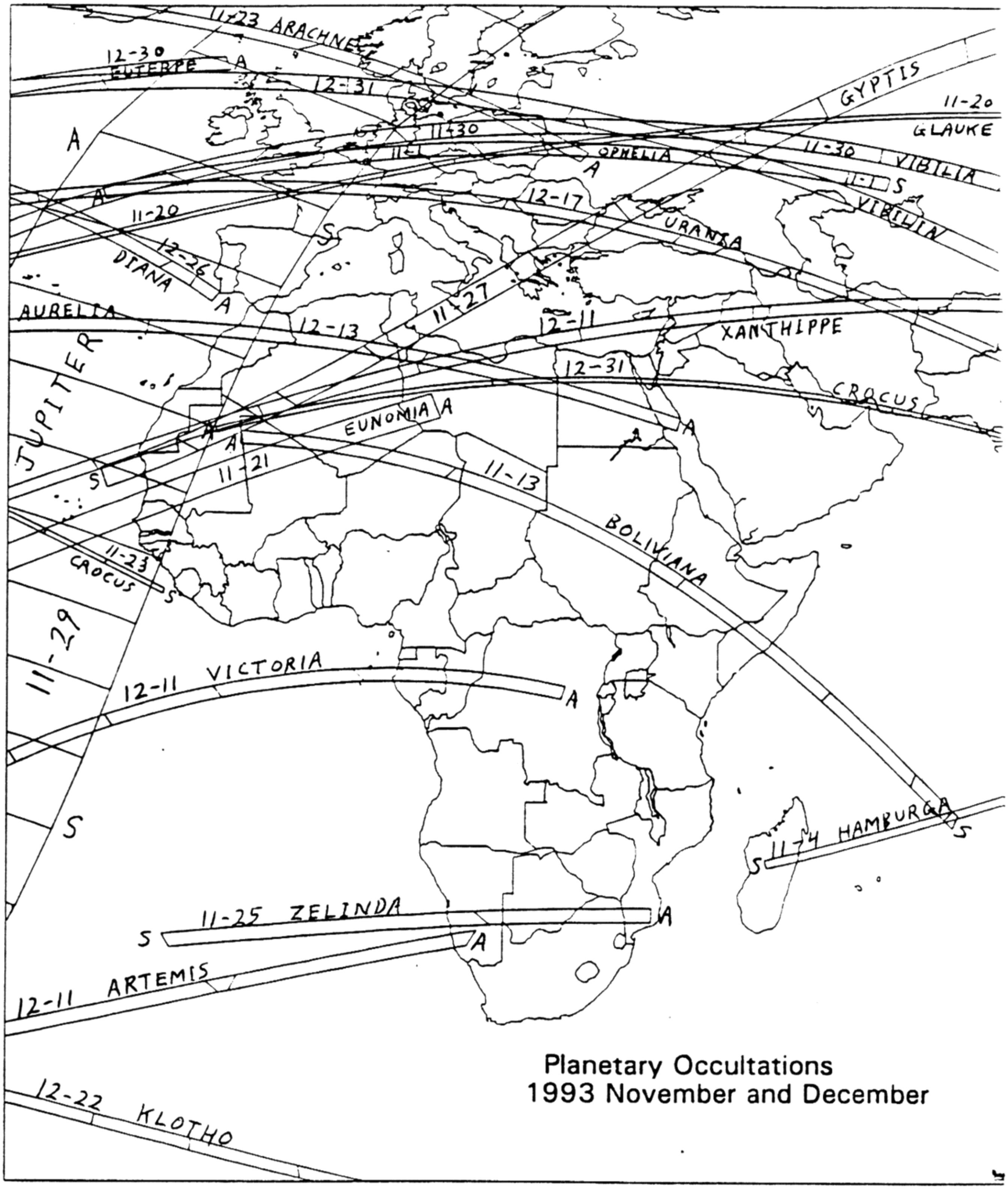




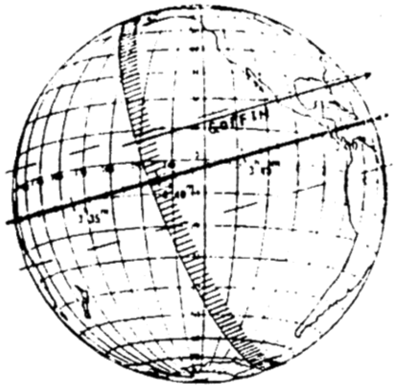





Planetary Occultations
1993 November and December
JUPITER
11-29
EUNOMIA 11-21
VIBILIA 11-30
XANTHIPPE 12-11
11-23 CROCUS
URANIA
GLAUME
11-20
VICTORIA
KLOTHO
12-22
ARTEMIS
12-11
DIANA
12-31
VIBILIA
EUTERPE
12-17
ARACHNE
12-26
AURELIA
APOLLONIA
11-13
FORTUNA
EUTERPE (ACTUAL)
10-9
11-23
POMPEJA
12-26
PARTHENOPE
12-31
EUNOMIA
11-1
11-4
HAMBURGA
METIS
12-21



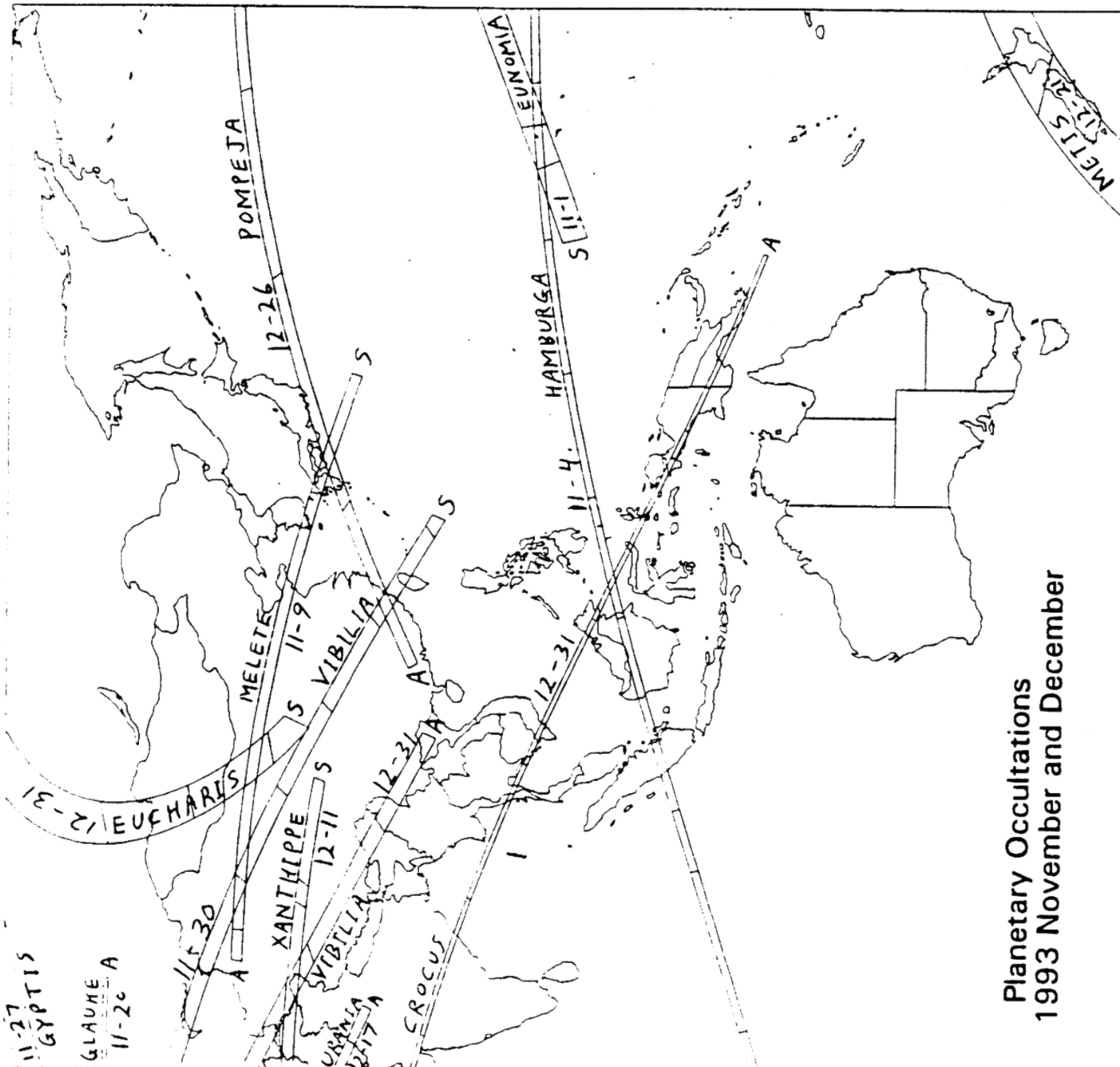
Planetary Occultations
1993 November and December



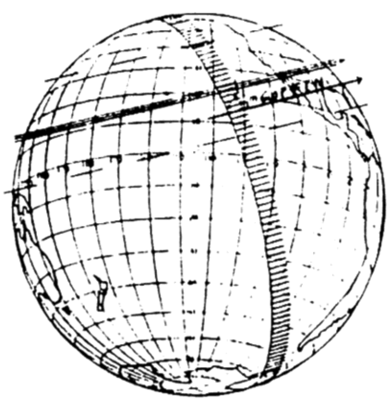
ZC 3286 by Apollonia 93 Nov 13

SAO 110007 by Glauke 93 Nov 20

SAO 163507 by Eunomia Nov 21



Planetary Occultations
1993 November and December

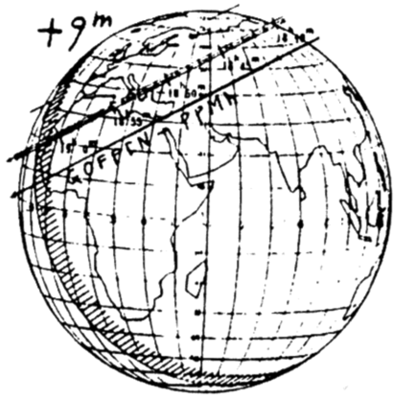


SAO 164056 by Fortuna 93 Nov 23

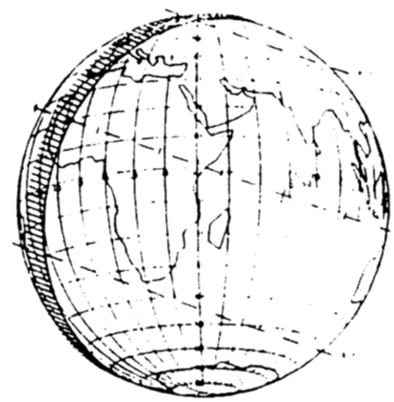
SAO 75811 by Arachne Nov 23

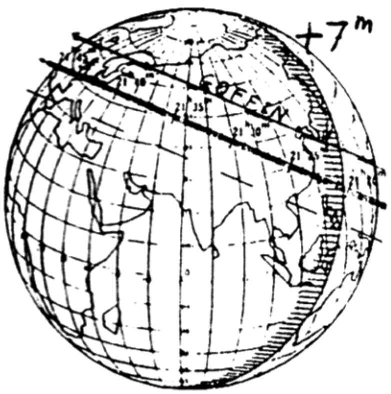

Anonymous by Crocus Nov 23

SAO 126605 by Zelinda 93 Nov 25



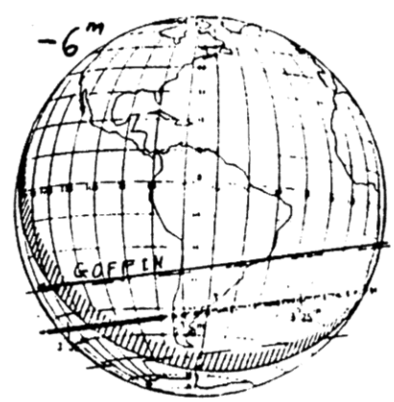
SAO 110612 by Gyptis Nov 27


ZC 2025 by Jupiter 93 Nov 29

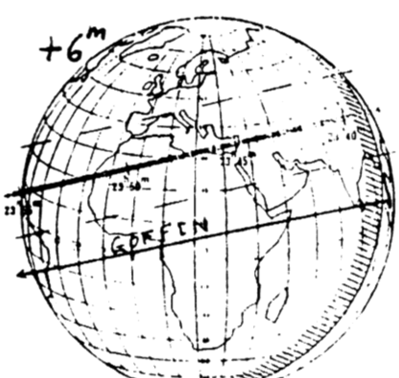


BD +24° 1499 by Vibilia Nov 30


ZC 466 by Victoria 93 Dec 11

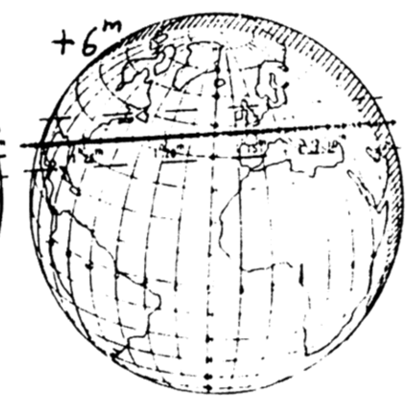


SAO 131238 by Artemis Dec 11



SAO 96091 by Xanthippe Dec 11

BD +19° 750 by Aurelia Dec 13



SAO 77562 by Urania 93 Dec 17

The International Occultation Timing Association was established to encourage and facilitate the observation of occultations and eclipses. It provides predictions for grazing occultations of stars by the Moon and predictions for occultations of stars by asteroids and planets, information on observing equipment and techniques, and reports to the members of observations made. IOTA is a tax-exempt organization under section 509(a)(2) of the (USA) Internal Revenue Code, and is incorporated in the state of Texas.

The **ON** is the IOTA newsletter and is published approximately four times a year. It is also available separately to non-members.

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Addresses, membership and subscription rates, and information on where to write for predictions are found on the front page.

The Dunhams maintain the occultation information line at 301-474-4945. Messages may also be left at that number. When updates become available for asteroidal occultations in the central U.S.A., the information can also be obtained from either 708-259-2376 (Chicago) or 713-488-6871 (Houston).

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Eberhard Bredner	Hans-Joachim Bode
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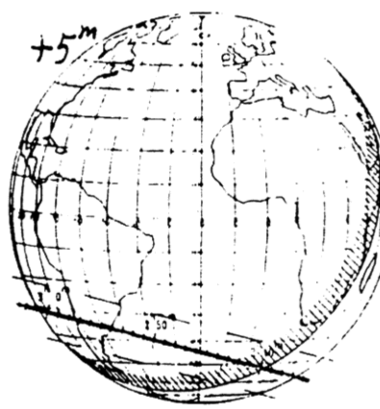
Germany	Germany

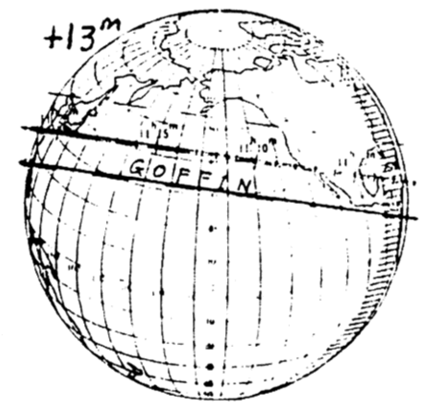
Telephones (49- for Germany, or 0- within Germany)

-2388-3658	-511-424696
Fax -2381-36770	-511-233112

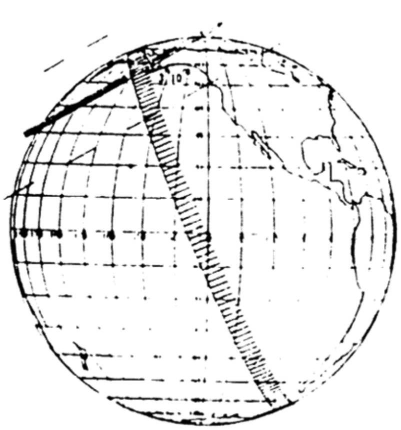
SAO 128628 by Metis 93 Dec 21



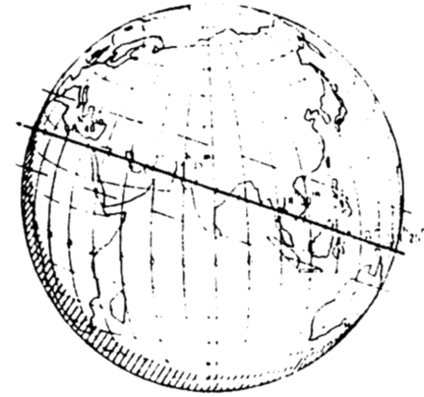
SAO115514 by Klotho 93 Dec 22



SAO 79240 by Pompeja Dec 26



SAO 109579 by Parthenope Dec 31



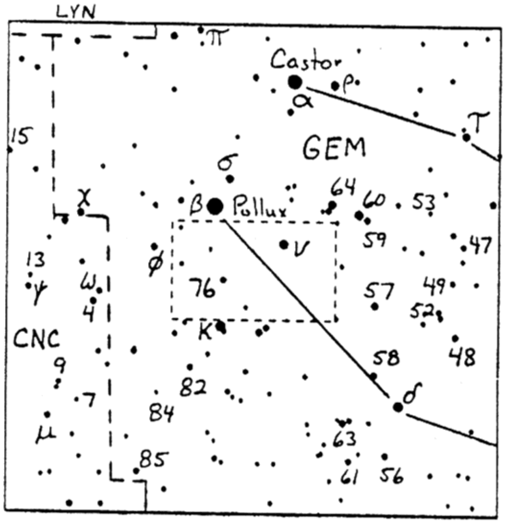
Anonymous by Crocus Dec 31

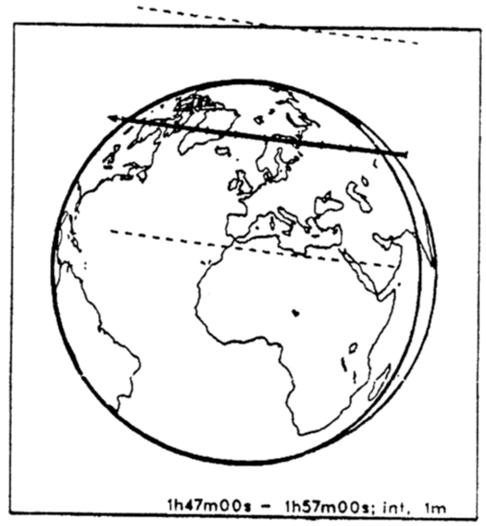
SAO 78468 by Vibilia 93 Dec 31

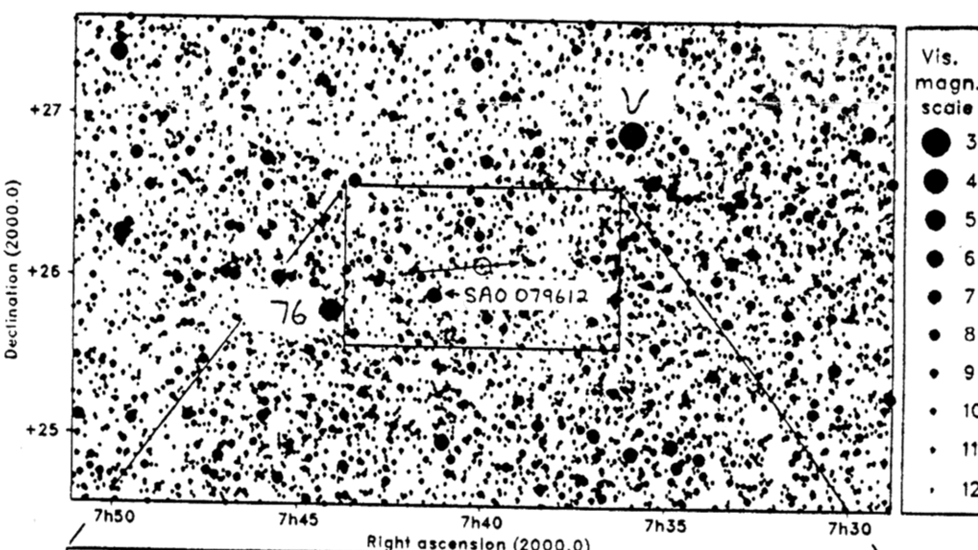
Comet Schw–Wch 1 – GSC 1915 00293

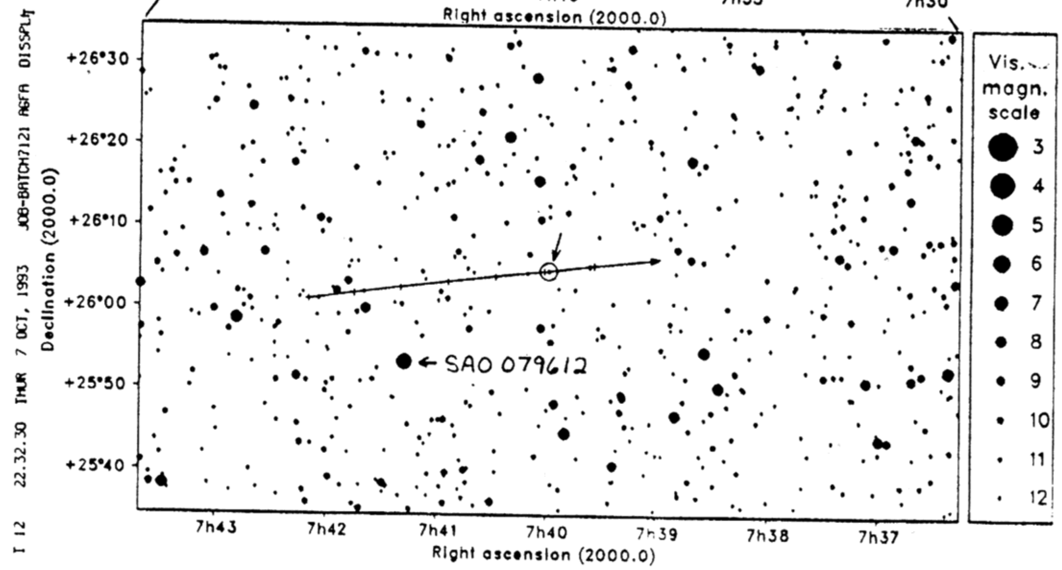
1993 dec 20 1h52.1m U.T.

Minor planet :			Star :	
V. mag. = 19.85	Diam. = 100.0 km = 0.03"		α = 7h39m58.730s	δ = +26°04'38.50"
μ = 15.25"/h	π = 1.70"	Ref. = EG93–nnn	V. mag. =	Ph. mag. = 13.08
Δm = 7.7	Max. dur. = 6.3 s		Sun : 155°	Moon : 123° , 42%









1993 Asteroidal Occultation Predictions by Edwin Goffin for North America.

DATE	Time UT	Minor Plant	Cat Star
Dec 20	01:52	Comet Schw-Wch 1	GSC 1915 00293
Dec 23	13:50	Comet Schw-Wch 1	GSC 1915 00001
Dec 25	07:06	Comet Schw-Wch 1	GSC 1915 00481