Occultation Newsletter

Volume II. Number 4 August, 1979

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IOTA NEWS

David W. Dunham

Hans-Joachim Bode reports that postal rate increases in the German Federal Republic make it necessary to raise annual IOTA/European Section dues to DM 12.--. Unfortunately, this change was not made in the notice to observers which is being distributed with USNO's regular XZ predictions for 1980.

Using Kukarkin's most recent catalogs, David Herald has prepared a comprehensive list of variable star data in the zodiacal region. After it is crossreferenced with the XZ catalog, it will be published by IOTA. It also will be put into machine-readable form so that at some later date, fairly complete variable star data might be printed directly on predictions of total and grazing occultations.

FROM THE PUBLISHER

For subscription purposes, this is the second issue of 1979.

Coupons for reporting counts of occultation timings in 1978 probably will be included in the next issue.

O.N.'s price is $1/issue, or $4/year (4 issues) including first class surface mailing, and air mail to Mexico. Air mail is extra outside the U.S.A., Canada, and Mexico: $1.20/year in the Americas as far south as Colombia; $1.68/year elsewhere. Back issues also are priced at $1/issue. Please see the masthead for the correct ordering address.

IOTA membership, subscription included, is $7/year for residents of North America (including Mexico) and $9/year for others, to cover costs of overseas air mail. European (excluding Spain and Portugal) and U. K. observers should join IOTA/ES, sending DM 12.-- to Hans J. Bode, Bartold-Knaust Str. 5, 3000 Hannover 91, German Federal Republic. Spanish, Portuguese, and Latin American occultation observers may have free membership in IOTA/LAS, including *Occultation Newsletter en Español*; contact Sr. Francisco Diego Q., Ixpantenco 26-bis, Real de los Reyes, Coyoacán, Mexico, D.F., Mexico.

HYADES GRAZE EXPEDITIONS

David W. Dunham

If clear skies prevail over most of North America during the morning of September 12th, some records seem bound to be broken. There are several grazes by the 59% sunlit waning moon as it makes its favorable passage across the Hyades cluster, culminating in one of the best Aldebaran grazes of the series. Some information about known expeditions for grazes of the brighter stars is listed below. [Dated 8 Aug 79]

Approximate Location	Organizer	Telephone
Aldebaran (mag. 1.1)		
Arvin, CA	David Hale	805,871-7116
	James Van Nuland	408,371-1307
China Lake, CA	James McMahon	714,446-3237
southern Nevada	Ed Grayzeck	702,739-3563
Colorado	Paul Asmus	303,978-0321
Stockton, MN	James H. Fox	612,436-5843
Black River Falls, WI	John D. Phelps	312,532-2968
Vanderbilt, MI	Homer F. DaBoll	312,584-1162
north of Ottawa	Brian Burke	
north of Montreal	David Brown	514,481-4153
Drummondville, Quebec	Andre Coulombe	819,472-2828
Theta^1 Tauri (mag. 3.6)		
southeast Manitoba	Richard Bochonko	204,474-9501
Theta^2 Tauri (mag. 4.0)		
British Columbia	Rich. Linkletter	206,479-1191
near Edmonton, Alta.	John Howell	403,252-6360
Z.C. 677 (mag. 4.8)		
near Phoenix, AZ	Frank Reed	602,945-4860
near Albuquerque, NM	James Theiler	
n. of St. Joseph, MO	Robert Sandy	816,763-4606
Milwaukee, WI	Raymond Zit	414,342-4037
Roscommon, MI	Homer F. DaBoll	312,584-1162
Z.C. 659 (mag. 6.4, SAO 93925)		
Frederick, MD	Wayne Warren	301,474-0814
northern New Jersey	Roger Tuthill	201,232-1786
Stamford, CT	Charles Scovil	
northwest Rhode Island	Wm. Penhallow	401,322-7186
Boston, MA area	Dennis DiCicco	617,926-2678
Philadelphia, PA area	Emil Volcheck	215,388-1581
New Haven, CT area	Edward Wetherbee	203,389-1198
northeast Texas	Don Stockbauer	713,488-6197
Z.C. 672 (mag. 6.6, SAO 93961)		
south of Dallas, TX	Paul Newman	214,494-3973
northeast Texas	Don Stockbauer	713,488-6197
Pittsburgh, PA area	Robert Clyde	216,274-8882
115 Tauri (mag. 5.3, close double, Sept. 13 a.m.)		
betw. Dallas & Houston	Don Stockbauer	713,488-6197
Mississippi	Ben Hudgens	601,924-4705
s. of Washington, DC	Wayne Warren	301,474-0814

MORE OCCULTATIONS OF STARS BY CERES AND VESTA

David W. Dunham

Some occultations of faint stars, not included in the list of 1979 planetary occultations on p. 17 of the February issue, are given in the list below. The format of the list is similar to that of the list in the February issue. Since the change in magnitude in case of an occultation is less than 0.5 for all of the new events, visual observations are precluded; photoelectric observation will be needed for effective monitoring. Since Ceres and Vesta are the two largest asteroids, the occultation paths will be relatively wide, and observations will be especially valuable.

79-80 DATE	UNIVERSAL TIME	PLANET NAME	PLANET m_v	PLANET Δ,AU	STAR SAO No	STAR m_v	STAR Sp	STAR R.A.(1950)Dec.		OCCULTATION Δm	OCCULTATION Dur	OCCULTATION df	OCCULTATION P	Possible Area	El Sun	MOON El	MOON %Snl	MOON Up
Jul 31	1h24m-32s	Ceres	8.7	2.48		10.6		1h27m.1	-4°20'	.12	131s	40	4	Europe	108°	170°	38+	none
Aug 25	22 30-62	Ceres	8.3	2.18		11.6		1 30.7	-5 33	0.04	194	55	3	e.Europe, Mideast, Africa	131	163	9+	none
Nov 23	2 18-33	Vesta	6.9	1.62	110541	8.7	A2	2 25.2	+4 13	0.18	55	25	4	w.Europe; Canada; n.USA?s	154	115	13+	w110°W
Nov 27	4 20-54	Ceres	8.4	2.28		13.1		0 36.4	-8 38	0.01	174	51	3	Patagonia, w. N. America	120	29	54+	w 80 E
Jan 3	7 40	Ceres	8.9	2.75	128975	9.2	F8	0 47.4	-4 17	0.46	57	18	4	n. w. Pacific; n. Japan?n	88	103	99-	e145 E

The predictions for the occultations by Ceres were published in an article by Edward Bowell and Lawrence Wasserman on p. 661 of the May, 1979, issue of *Astronomical Journal, Vol. 84*. To find the occultations, all but one of the stars not being listed in any astrometric catalog, the Lowell astronomers produced computer-generated plots of the asteroid's ephemeris on transparencies which could be overlaid on Palomar Sky Survey prints. The positions of stars near the plotted path were refined from measurements of plates of the area taken with Lowell Observatory's 33-cm astrograph on 1979 January 1. Besides the occultations of July 31st, Aug. 25th, and 1980 Jan. 3, several occultations of 13th and 14th-mag. stars with Δm's of 0.02 or less were found. Considering scintillation and instrumental noise sources, it is felt that there is no hope of obtaining useful observations of these very difficult events, but the one on Nov. 27, of Lowell star No. 15, has been included since the event probably will occur in the western U.S.A. The Lowell astronomers consider the August 25th event (the date is incorrectly given as Aug. 24 in their article) to be only marginally observable with good atmospheric conditions and sensitive photoelectric equipment.

DATE	MINOR PLANET No.	Name	km-diam-"	RSOI	MOTION PA	°/Day	"/D,RA	STAR SAO No	DM No.	D	STELLAR DIAMETER m"	m	Time	df	Lowell Num.	APPARENT R.A.	Dec.
1979 Jul 31	1	Ceres	1020 0.57	12409	102°	0.104	0.102		-04° 217		0.18	316	41	1.0	6	1h28m.6	-4°11'
1979 Aug 25	1	Ceres	1020 0.64	12368	207	0.080	-0.037								8	1 32.2	-5 24
1979 Nov 23	4	Vesta	549 0.47	4210	268	0.203	-0.204	110541	+03° 340							2 26.8	+4 21
1979 Nov 27	1	Ceres	1020 0.62	12173	343	0.085	-0.025								15	0 37.9	-8 28
1980 Jan 3	1	Ceres	1020 0.51	12075	48	0.216	0.162	128975	-04° 102		0.14	287	16	0.9	15	0 48.9	-4 08

Certainly the most promising Ceres event is the one on July 31st, which probably will occur from parts of Europe where there are several photoelectric observers. An updated astrometric prediction might be obtained from Gordon Taylor, Royal Greenwich Observatory (phone: 032-181 3171) one or two days before the event, but all European photoelectric observers are encouraged to monitor the event in any case; possible satellites could occult the star at any location shown on the regional map.

My calculations of the 1980 Jan. 3rd occultation utilized the measured Lowell position of the star. If the star's SAO data are used, the path crosses northern Japan (in bright evening twilight) and the Kamchatka Peninsula (in a relatively dark sky). The event is not included in Gordon Taylor's list of 1980 occultations given in his Bulletin 15 of 1979 April 27.

The occultation by Vesta on November 23rd was noted in a very general bulletin issued by Taylor in 1977, but he did not include it in his list of 1979 asteroidal occultations issued during 1978 August. More details of the event will appear in a future issue of *O.N.* Also in future issues will be information about 1980 events which, as noted above, are now available. Of special interest early in the year will be an occultation of a 7.4-mag. star by (48) Doris on January 4 U.T. The path is expected to cross southeastern, central, and western Europe, and part of eastern Canada and/or the eastern USA.

Preprints of this article, including a finder chart prepared by Don Stockbauer, were sent to some photoelectric observers in the region of visibility of the July 31st event before it occurred. Several other known photoelectric observers had been sent preprints of the *Astronomical Journal* article.

ERRATA

Noted by David Dunham:

O.N., 1 (13), 139: Footnote to Table 4 should refer to AGK2 rather than AGK3.

O.N., 2 (3), 28: The 1978 July 29 graze of 0618 was observed in PA, not IA.

Noted by Luiz Augusto L. Silva:

O.N., 2 (3), 25: λ Virginis and ρ Sagittarii both are identified as SAO 158489. ρ Sagittarii actually is SAO 162512.

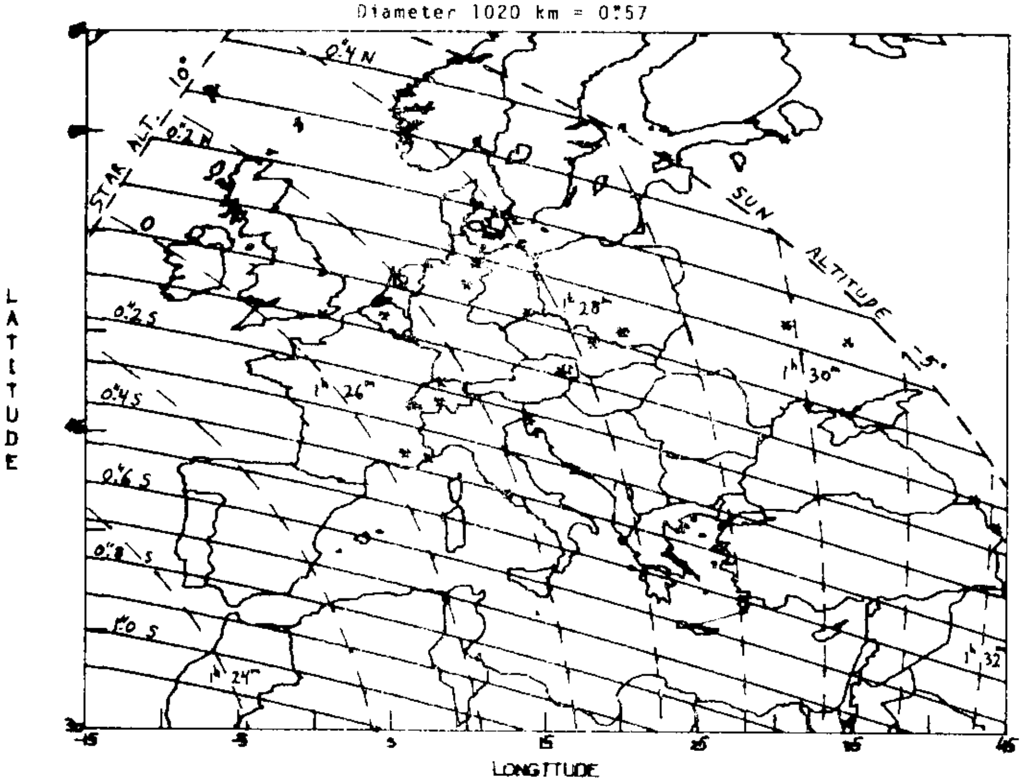
PUBLICATION RECEIVED

IOTA has received a reprint of the *Supplement to the Japanese Ephemeris, 1980, Solar Eclipses in 1981-1985*. Preliminary predictions of solar eclipses (4 total, 3 annular, 5 partial) in the years from 1981 to 1985 are presented in both map and tabular form. Similar data for 1986 to 2000 will be successively released in the volumes for 1981, 1982, and 1983 of the Japanese Ephemeris.

Address inquiries to: Astronomical Division, Hydrographic Department, Tsukiji-5, Chuo-ku, Tokyo, 104 Japan.

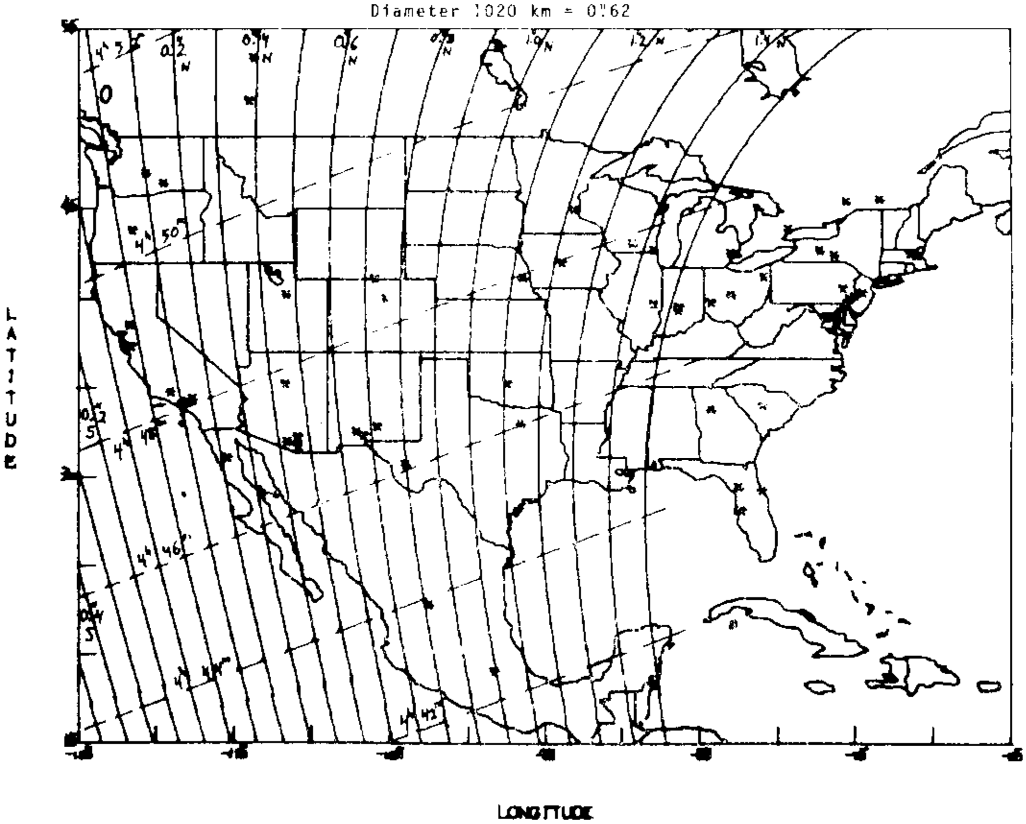
Occultation of BD -4° 217 by (1) Ceres, 1979 July 31

Diameter 1020 km = 0".57



Occultation of Lowell #15 by (1) Ceres, 1979 November 27

Diameter 1020 km = 0".62



DETERMINATION OF THE SUN'S RADIUS FROM TOTAL SOLAR AND TOTAL LUNAR ECLIPSES

David W. Dunham

A preliminary report of the successful observations of last February's solar eclipse from several locations near the edges of the path of totality was given in the last issue, p. 21. A study of the 2nd and 3rd contact timings indicates a north shift from our predictions of 0".3 and a correction to the solar radius with respect to the lunar radius, of +0".14. The latter result is in almost exact agreement with David Herald's value determined from Australian observations near both edges of the path of totality of the 1976 October 23rd solar eclipse. Workers at USNO and I plan to examine less extensive data obtained near both edges of the total solar eclipses of 1970, 1972, and 1973. We also are working with Paul Muller in England to analyze data from the solar eclipse of 1715 May 3rd which, thanks to the efforts of Sir Edmund Halley, was successfully observed from near both edges of the path of totality in England. From a comprehensive analysis of these observations, we should be able to examine possible small variations in the solar radius during much of a sunspot cycle and over a time span of 264 years. Since the intensity drops rapidly by several orders of magnitude at the onset of a total solar eclipse, these results are affected by irradiation and atmospheric seeing to a much smaller extent than direct transit circle observations of the sun.

During all total solar eclipses, the latitude libration is always near zero, while the longitude libration can have a wide range of values. Hence, virtually the same lunar features determine the contacts for observers near the path edges for every eclipse, while this is not the case for observers near the center of the path. Consequently, determination of the solar radius from timings of the contacts near the center of a solar eclipse path is more subject to individual and libration-dependent errors in Watts' lunar limb correction data than when edge observations are used.

Analysis of solar eclipse observations can determine the sun's radius with respect to that of the moon to an accuracy of about 0".05. It would be useful to calibrate the results in an absolute sense for comparison with other techniques, such as transit observations. This would be possible from an accurate determination of the lunar radius at librations similar to those during solar eclipses. The librations are similar during total lunar eclipses, which also provide virtually the only times when emersions can be timed about as easily as immersions, and when grazes can be observed at both the north and south limbs. Consequently, observers should make a special effort to obtain occultation timings, including reappearances, during lunar eclipses. Lunar eclipse grazes are especially valuable for defining the lunar limb in the areas where solar eclipse contacts occur when observed near the edges of the path of totality, which give the best results for the solar radius, as noted above. Information about this September's lunar eclipse is given on p. 37. The moon's position in the sky, and its librations, during the September lunar eclipse will be similar to those during last February's total solar eclipse.

Of utmost value would be observations of grazes of the same star at both limits during a lunar eclipse. The lunar polar radii needed for absolute calibration of solar eclipse edge observations could be determined to an accuracy of perhaps 0".02 from such simultaneous graze data. During the September lunar eclipse, the moon will pass south of the center of the umbral shadow, so that northern-limit grazes of faint stars during totality will be relatively easy to observe. Four or five northern-limit grazes of SAO stars might be seen from the U.S.A. But at central eclipse, the southern limb of the moon will have an umbral distance of 92", so that a star at least as bright as 8th magnitude probably will be needed for reliable southern-limb observations. I computed the southern limits for the north-limb grazes which occur in the U.S.A. to see if there were any possibilities during the September eclipse. The best prospect was 6th-magnitude 78 Aquarii = Z.C. 3360 = SAO 146382, but its southern limit crosses the Pacific Ocean, entering northern Peru at a time when the south limb will be a short distance outside the umbral shadow, making reliable observations impossible. After September, there won't be another total lunar eclipse until 1982.

The following expeditions probably will be undertaken for grazes during the eclipse in the U.S.A.: λ Aquarii (mag. 3.8, in penumbra), near Norfolk, VA, led by David Dunham (phone 301,585-0989) and east Texas, Don Stockbauer (713,488-6197); 78 Aquarii (mag. 6.3), Boca Raton, Fl, contact Tom Campbell (813,985-1842); SAO 146387 (mag. 8.4), Fresno, CA, contact James Van Nuland (408,371-1307) or Garret Wimer (209,264-9771); and SAO 146395 (mag. 9.2), Pomona, CA, Robert Fischer (714,598-3476) and south of Colorado Springs, CO, Paul Asmus (303,978-0321).

Observers interested in timing the 1980 February 16th solar eclipse from near the path edges should coordinate plans with Hans-Joachim Bode, 3 Hannover, Bartold-Knaust Str. 6, German Federal Republic. He plans to observe near the southern edge, near Mombasa, Kenya. I hope that some observers in India, where weather prospects are quite favorable, also will attempt timings near the edges of the path of totality.

SATELLITES OF (9) METIS?

David W. Dunham and Toshio Hirose

IOTA Special Bulletin #5 gave prediction information for two asteroidal occultations. Besides the now famous occultation by Herculina, data were given for the occultation of SAO 165132 by Metis on 1978 July 12. Metis was near a stationary point, so that the occultation shadow swept more from north to south than from east to west, just off the east coast of Asia. Penhallow obtained a plate on July 6 when, due to the slow motion, Metis was only about ¼" from the star. Dunham's predicted path using these data shifted west, so that Korea and/or western Japan, and the northern Philippines, would likely have an occultation. Brian Marsden relayed the prediction to Dr. Sinzi, who notified Hirose and others. IOTA sent a telegram to the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) urging observation. Gordon Taylor also made astrometric observations and computed a similar prediction. He notified potential observers in Japan, PAGASA, and Boscha Observatory, Indonesia. Ernesto Calpo of PAGASA made plans to observe from Manila and from another site 140 km to the southwest, but rain foiled this effort.

Hirose coordinated attempts by Japanese amateurs, canceling an expedition to Hokkaido (favored by the nominal prediction) and encouraging observers in western Japan upon learning about the newly predicted path 14^h before the event. Unfortunately, rain and clouds prevented observation from Tokyo and farther west, but six observers north of Tokyo did have clear skies at the critical time. Yoshihiro Musashi, Kawasaki City, found Metis' visual magnitude to be about 0.6 mag. brighter than the predicted V mag., so the drop in case of an occultation would be only a little more than 1 mag. Haruhiko Ono saw such a drop, of only 0.2 duration. Other possible dimmings were seen by two others, but they were uncertain; atmospheric scintillation was reported. Apparently, an occultation by Metis itself was not observed.

UNSUCCESSFUL ATTEMPTS FOR OTHER 1978 JULY-AUGUST OCCULTATIONS

David W. Dunham

On July 29, Penhallow made astrometric observations to try to improve the prediction for the occultation of SAO 93064 by (65) Cybele on August 1. My analysis of his results indicated that the path would be 0.8 south of the nominal prediction, so that the event might be observed from the north central United States (see map on page 158 of *O.N. 1*, #15). Observers near St. Paul, MN; Denver, CO; Sioux City and Marion, IA; and St. Charles and Lemont, IL, effectively bracketing the predicted path, all reported no occultation. Unfortunately, this spread of observers was too small to catch the event; the occultation would have been missed if the shift from the 0.8 south line was as small as 0.2 in either direction. Lemont was at 0.90 south; many attempts by observers farther south and/or east were foiled by clouds. In this case, the minor planet was 5 magnitudes fainter than the star, so that a magnitude equation might have resulted in astrometric error. Penhallow feels that this very well could have been as large as 0.2. He is looking into the possibility of using diffraction gratings to produce secondary images to circumvent magnitude errors for future events. Due to Cybele's relatively fast motion, the asteroid was rather far from the star on Penhallow's July 29th plate, which could cause further error.

J. Derral Mulholland, University of Texas, and Edward Bowell, Lowell Observatory, provided astrometric updates on AGK3 +13° 203, the star which (2060) Chiron passed on July 24. These recent positions were in good agreement with the AGK3 data, indicating that the path would miss the earth's surface.

The relatively small elongation from the sun made an astrometric update for the occultation of SAO 93624 by (18) Melpomene on July 17 virtually impossible. Observations would be hampered for the same reason. The western Canadian Maritime Provinces had the only reasonable hope for observations, and then only if there were a sizeable south shift. I have received no reports about this event, probably due to unfavorable weather.

Penhallow's astrometry for the occultation of SAO 140167 by (45) Eugenia on July 19 indicated that the path would shift about 4" south (the largest path shift from astrometric data of which I am aware), just off the earth's surface above Antarctica.

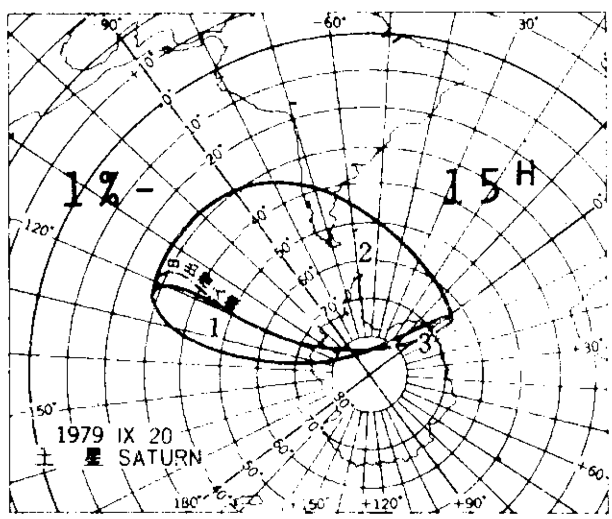
AUREOLE AROUND (224) OCEANA

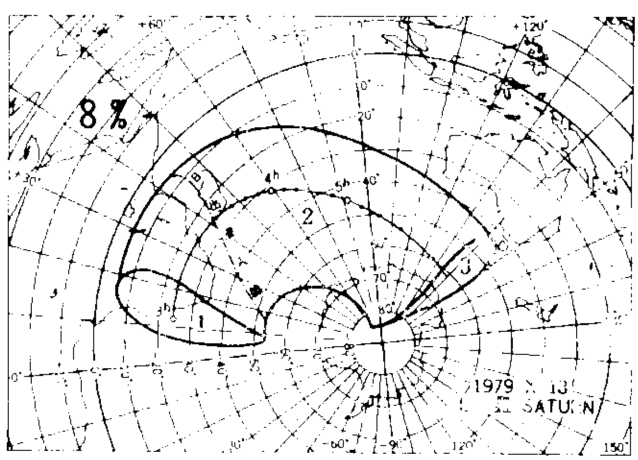
Eduardo V. Przybyl and David W. Dunham

In his Spanish-language book, *Astronomía*, Editorial Ramón Sopena, Barcelona, Spain, 1957, José Comas Sola states on p. 340 (translated into English): "In some cases, for example Oceana, the minor planet appears to be enveloped in an aureole when photographed." Could this effect be related to the "turbid image" or "somewhat diffuse" observations of stars around the times of recently observed asteroidal occultations, caused by a cloud or small orbiting satellites? (224) Oceana is an M-type asteroid expected to have a diameter of 59 km. Unfortunately, orbital elements accurate enough for comparison with star catalogs to predict possible occultations are not currently available for this minor planet. Elizabeth Roemer reports that observers sometimes claim to see aureoles when guiding for photographs of asteroids.

LUNAR OCCULTATIONS OF PLANETS

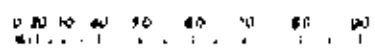
The maps showing the regions of visibility of lunar occultations of planets are reprinted by permission from the Japanese Ephemeris for 1979, published by the Hydrographic Department of Japan. Region 1, only R visible; Region 3, only D visible.



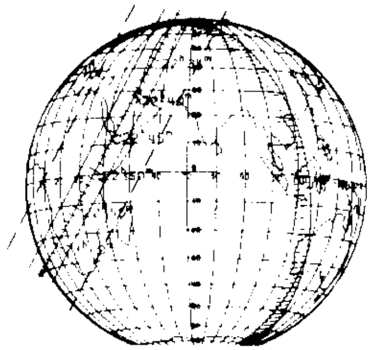


PLANETARY OCCULTATIONS

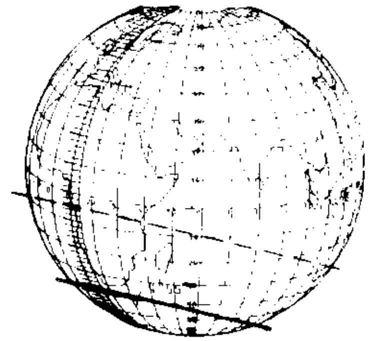
The world maps are produced by Mitsuru Sôma, the regional maps by David Dunham.



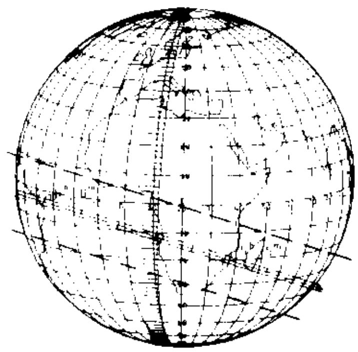
Use a tracing of the cosine scale above to estimate star altitude from the world maps: place the 90° mark at the center of the circular arc, and read the star altitude at the observing site.



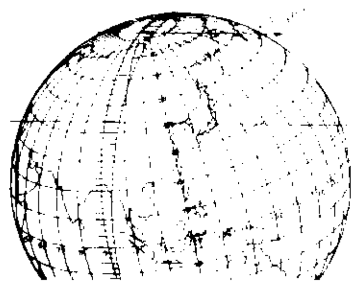
Lowell #8 by Ceres 1979 Aug 25



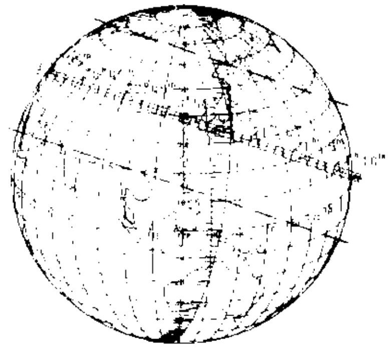
SAO 97988 by Antigone 1979 Sep 19



SAO 114497 by Juno 1979 Sep 27



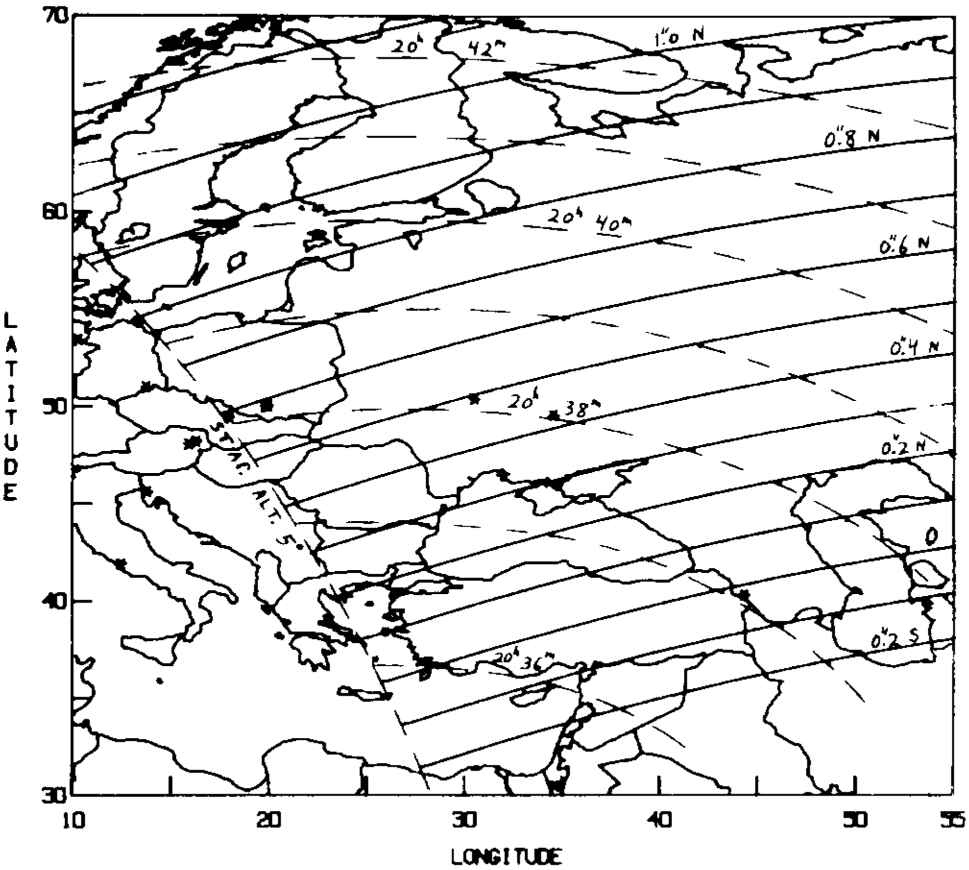
SAO 98024 by Mars 1979 Oct 6



+19°1399 by Cybele 1979 Oct 17

Occultation of BD +19° 1399 by (65) Cybele, 1979 October 17

Diameter 309 km = 0″12



EXTENDED-COVERAGE U.S.N.O. TOTAL OCCULTATION PREDICTIONS FOR 1979

David W. Dunham

Magnetic tapes have been prepared only recently to compute extended-coverage total occultation predictions for the remainder of 1979 similar to those distributed for 1978, described in *o.N.*, *1* (13), 138-140. The 1979 predictions are similar to those for 1978, with some differences explained below. Computer time is currently very limited at USNO, so that fewer observers will receive extended-coverage predictions for 1979 than for 1978. Observers might be able to increase their chances of receiving extended-coverage predictions for 1979 by requesting them from me at P.O. Box 488, Silver Spring, MD 20907. Many will have to be content with the more quickly produced but less accurate standard-coverage version of the predictions using standard station data quite distant from the desired location. The computer time situation is expected to worsen during the next several months, making it virtually certain that extended-coverage predictions will not be computed for 1980 until sometime after USNO receives the new computer which they've ordered, delaying distribution perhaps until about the middle of 1980.

The 1979 K-catalog predictions cover the interval from late August until late November and include only those stars which are not in the XZ catalog, about 1000 stars; details will be provided in an article, "Errors in USNO's XZ Catalog," in a forthcoming issue of *o.N.* Most of these are the Yale stars with no proper motions near 18^h right ascension; occultations of them will not be visible during December due to proximity of the sun. The K numbers for 1979 are the same as those for 1978.

No changes have been made to the J-catalog for the 1979 predictions. However, in order to save computer time, all occultations with the moon more than 70% sunlit were omitted from the final tape used for the predictions. This is because few occultations of non-XZ and non-K stars are observable at highly gibbous lunar phases. An error on a magnetic tape made it necessary to prepare the final 1979 J-catalog occultation tape from two tapes. The concatenation was not entirely successful, resulting in duplicates for most of the occultations during October 26th. The error was corrected, but only after predictions for several stations in North America and the western Pacific Ocean area had already been computed. Another error was uncovered by Keith Horne when he observed the 1978 September 22nd Hyades passage from Mt. Wilson Observatory, California. He noticed that the predictions for many of the fainter stars were off by several seconds. The reason for the error is that the positions for the non-SAO and non-AGK3 stars were taken from the A.C. with epoch near the turn of the century, and an average Hyades proper motion was applied to all of these stars. The current positions of these fainter stars which are *not* Hyades members, for which it would have been better to use no proper motions, are consequently about 8" from the positions which I have used, on the average, in P.A. 285°. This means that the actual occultations of these stars will occur about 20^s earlier than the times given in my predictions. Only a few of these fainter stars actually are Hyades members. I hope to identify them from published Hyades membership lists and correct the J-catalog accordingly, but I have not had time to do it yet this year. Hopefully, it can be done for the 1980 predictions. The affected stars in the Hyades region have J-numbers 4-389, 399, 404, 419, 426, 430, 441, and 454.

A new catalog (M) was created for the 1979 September 6th lunar eclipse star field from San Fernando A.C. data supplied by David Herald; see below. The A.C. data were merged with, and when appropriate, replaced by more accurate XZ data. In the DM field, Z.C. numbers are given for Z.C. stars and X-numbers are given for non-ZC SAO stars. B.D. numbers are given for non-SAO B.D. stars, whose magnitudes have been taken from the B.D. in many cases, the B.D. visual magnitudes being preferred to the photographic A.C. magnitudes. The DM zone identifies the A.C. zone with a letter B denoting southern declinations, as has been done for non-B.D. A.C. stars in the J-catalog. The first two digits of the DM number are the minutes of 1900 R.A. to be added to 22^h for the center of the A.C. plate, while the last three digits are the number on the plate. Hence, M103 = B 8 48172 is A.C. -8° 22^h48^m 172, and M378, whose DM is given as B 7 60058, is A.C. -7° 23^h00^m 58. Only predictions for September 6th, to give coverage for the lunar eclipse, were computed and merged with the 1979 J-catalog occultation tape.

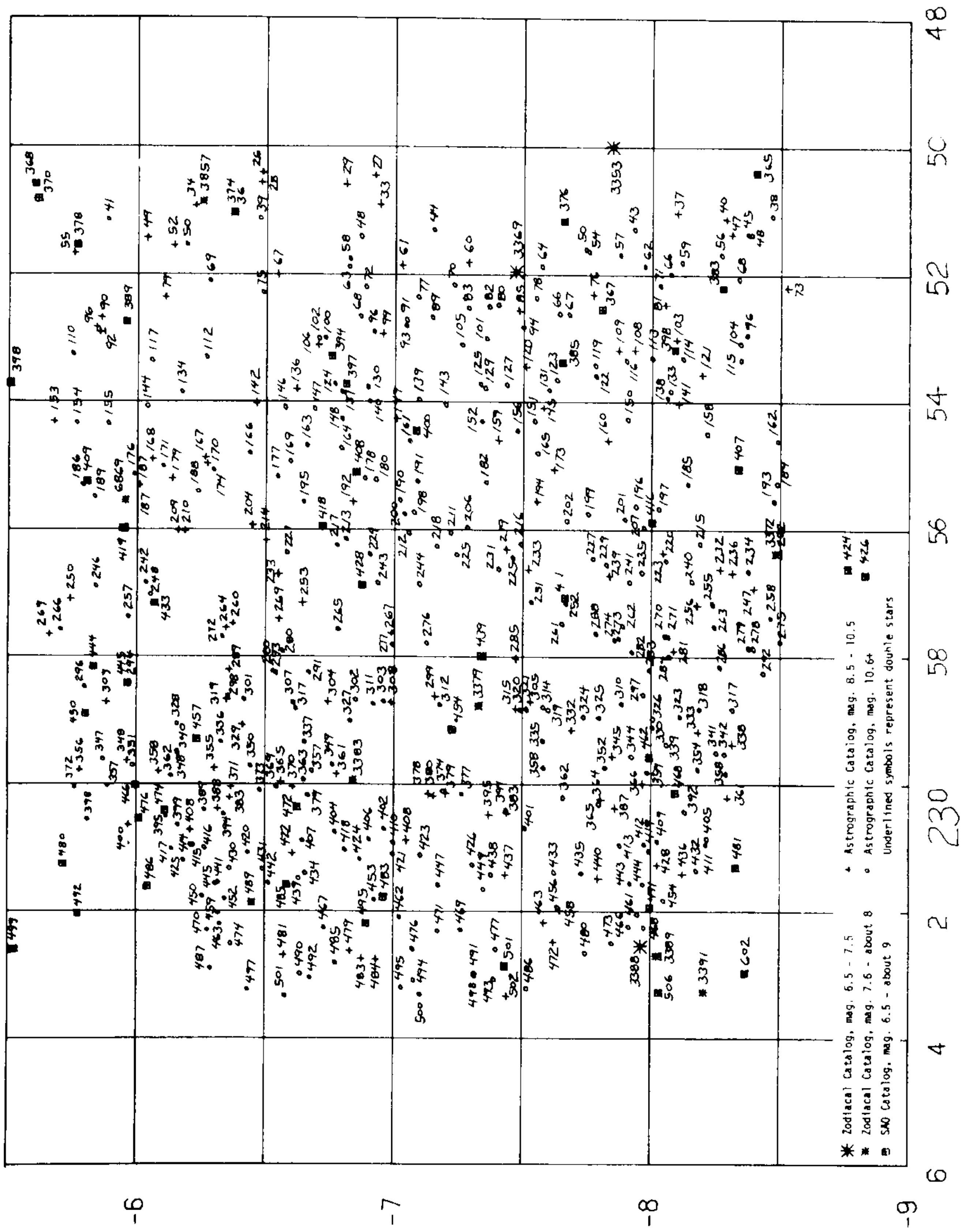
OCCULTATIONS DURING THE LUNAR ECLIPSE OF 1979 SEPT 6

David W. Dunham and David Herald

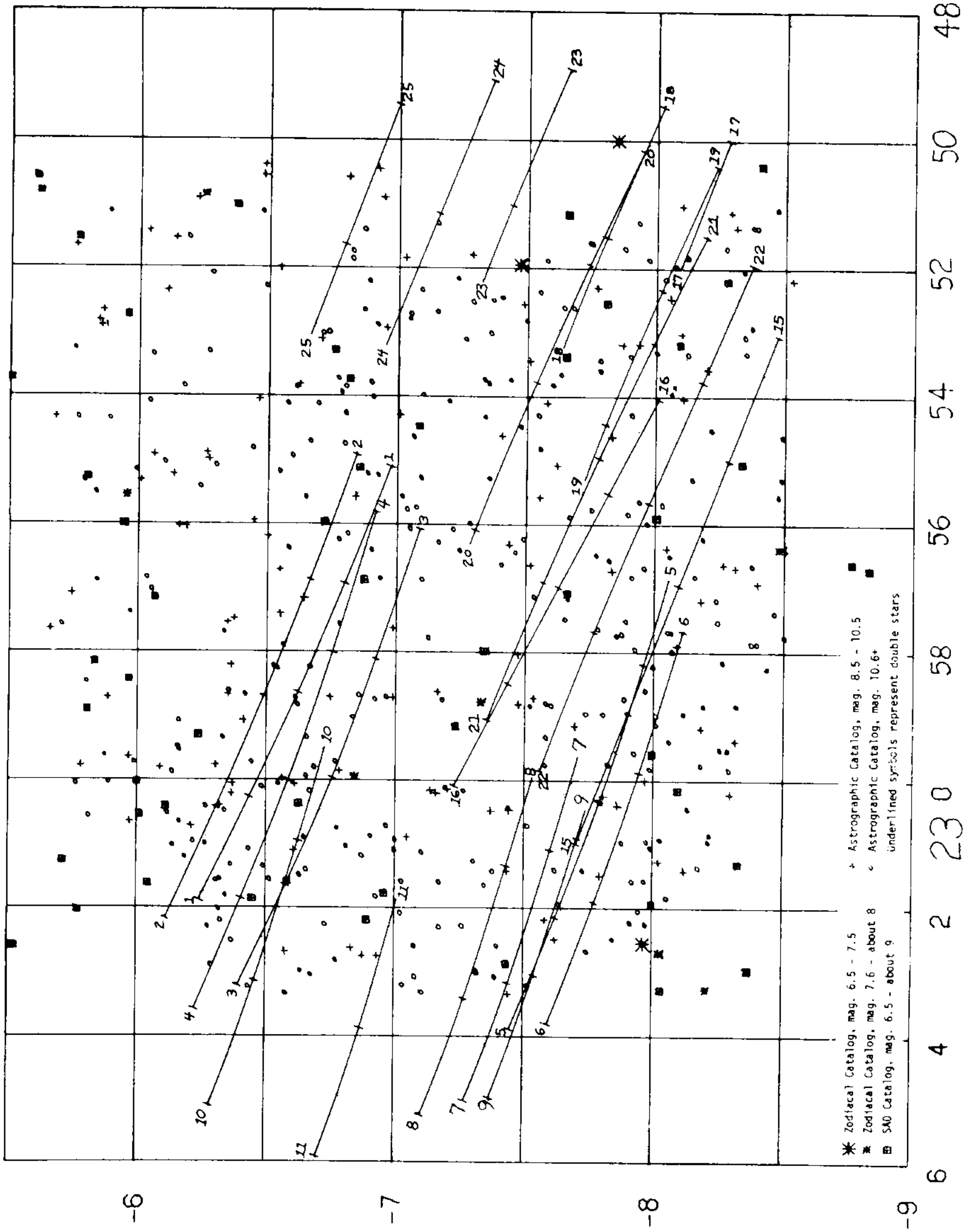
The charts and information presented here are similar to those published in *o.N.* for previous lunar eclipses, such as the one last September (*o.N.*, *1* (16), 170). The two charts, one giving stellar identifications and the other showing the tracks for 22 cities in the area of visibility of the eclipse, were prepared by John Phelps, Jr., using computer plots and data generated by Dunham at the U. S. Naval Observatory. The coordinates of the numerous non-SAO stars were calculated by Herald using data from the San Fernando zones of the *Astrographic Catalog (A.C.)*.

Tick marks along the paths of the moon's center shown for various locations on the second chart mark integral hours of U.T. from 9^h to 13^h; the motion is from right to left (the moon's right ascension is always increasing). If less than five ticks are shown, the path begins or ends at 4° moon altitude, the low end being identifiable by the absence of a tick at that end. Times of umbral eclipse events are as follows: First contact, $9^h17^m.9$ U.T.; start of totality, $10^h31^m.3$; mid-eclipse, $10^h54^m.2$; end of totality, $11^h17^m.1$; and last umbral contact, $12^h30^m.5$. The cities corresponding to the numbers given at the ends of the plotted tracks are listed in Table 1. The lunar radius varies from 16'.75 when the moon is on the horizon to 17'.05 when it is in the zenith. The position angle of the lunar equator will be 246°, to help in locating reappearing stars using lunar features if Watts angles are not included in your predictions. The star field can also be used to locate emerging stars. The Leningrad *Ephemerides of Minor Planets* shows that there will be no occultations of asteroids during this eclipse.

On the map identifying the stars, the Zodiacal Catalog number is given for Z.C. stars. Add 146000 to the three-digit numbers given for non-Z.C. stars to obtain the star's SAO number. The USNO reference number (in the special M-catalog created for this eclipse from Herald's list) is given for non-SAO stars noted as B.D. or A.C. stars. The M-numbers are given in the extended-coverage USNO total occulta-



tion predictions for the eclipse, which might be obtained (depending on time and computer availability) from Dunham at P.O. Box 488, Silver Spring, MD 20907 (phone 301,585-0989). Observations of occultations



timed during the eclipse should be sent to Herald at P.O. Box 254, Woden, A.C.T. 2606, Australia; we will prepare and publish a summary of all observations received in a future issue of *O.N.*

Z.C. 3353 = λ Aquarii is a long-period variable, but with an amplitude of only 0.1 magnitude. The only other known variable star in the eclipse star field is EF Aquarii, a 10.6-magnitude eclipsing variable with an amplitude of 0.8 magnitude. It is not in the A.C. nor is it shown on our map. It is about 2^s of R.A. west and 2'.9 north of the 11th-mag. star M00431 or at the approximate 1950 coordinates, R.A. $23^h01^m19^s$, Decl. -6°26'.6. Double stars in the field are listed in Table 2; Z.C. 3389's duplicity is inferred from spectroscopic data.

Table 1: 1979 Sept. 6 Eclipse Tracks for 22 Cities

1 Auckland	8 Manila	18 Miami
2 Dunedin	9 Nanking	19 Kansas City
3 Brisbane	10 Perth	20 Mexico City
4 Melbourne	11 Lembang, Java	21 Los Angeles
5 Tokyo		22 Vancouver
6 Khabarovsk, Siberia	15 Anchorage	23 Bogota
	16 Honolulu	24 Lima
7 Taipei	17 Montreal	25 Santiago

Table 2: Doubles in 1979 September 6 Eclipse Field

Star(s)	MAG1	MAG2	SEP.	P.A.	Code
M00097 = BD -6°6098	8.9	9.3	1".2	136°	M
SAO 146419	9.3	9.5	0.04	69	X
ZC 3372 and M00222	8.7	10.1	20.2	201	D&E
SAO 146439	9.5	10.7	1.0	196	C
ZC 3388	6.2	6.3	0.18	192	O
SAO 146499	9.0	13.1	3.3	77	C
3rd star		13.7	4.0	320	C
ZC 3389	8.4	8.4	0.05?	?	V

OCCULTATION TALLY AND PRELIMINARY ANALYSIS OF THE 1978 MARCH 24 LUNAR ECLIPSE

David Herald

All reports of the eclipse so far received have come from observers in Australia, and most of those were from people attending the 8th National Australian Convention of Amateur Astronomers, where the observers were extremely lucky; after a week of continuous cloud, seven hours of clear skies permitted most of the eclipse to be observed. In all, 86 occultation timings have been reported so far, distributed as follows:

Rank	Observer	Total	# R's	# SAO	# 'K'	# 'J'
1	D. Herald	17	5	5	6	6
2	M. Ashley	15	5	7	5	3
3	J. Stevenson	7	2	4	3	-
4	J. Elso	7	2	4	2	1
5	N. Loveday	7	-	3	2	2
6	G. Searle	5	1	3	2	-
7	B. Jarvis	5	1	3	1	1
8	B. Soulsby	5	1	2	1	2
9	F. Baker	5	-	1	2	2
10	R. Price	3	1	3	-	-
11	R. Lanigan-O'Keefe	3	-	1	2	-
12	B. Tregaskis	3	-	1	1	1
13	I. Grant	1	-	1	-	-
14	G. Kellock	1	-	1	-	-
15	L. Metcalf	1	-	1	-	-
16	G. Spencer	1	-	1	-	-
	Totals	86	18	41	27	18

I have reduced all the observations using the published (j=2) lunar ephemeris assuming ET - UTC = $49^s.18$, and plotted the residuals on a polar diagram (Fig. 1). On the plot, only the average residual for all those observers attending the convention was plotted for each star, and SAO, AGK3 (K), and J catalogue stars are distinguished. As can be seen from the plot, there is good consistency between the residuals of stars in the different catalogues. The dashed curve corresponds to a least squares best fit to the residuals; it corresponds to a shift in the position of the moon of $-0^s.26$ in R.A., and -0".52 in declination.

One star was observed to disappear by twelve observers at the convention. Since most observers were located at different sites, it is illustrative to plot the individual residuals against the Watts angles for each event, and compare this with the profile derived from Watts' charts. As can be seen from Fig. 2, there is a substantial difference in detail, which, as any graze observer is aware, is not surprising. However, it does illustrate, yet again, the limitations of Watts' charts, and the corresponding uncertainties in residuals, after having been corrected on the basis of the charts.

Fig. 1

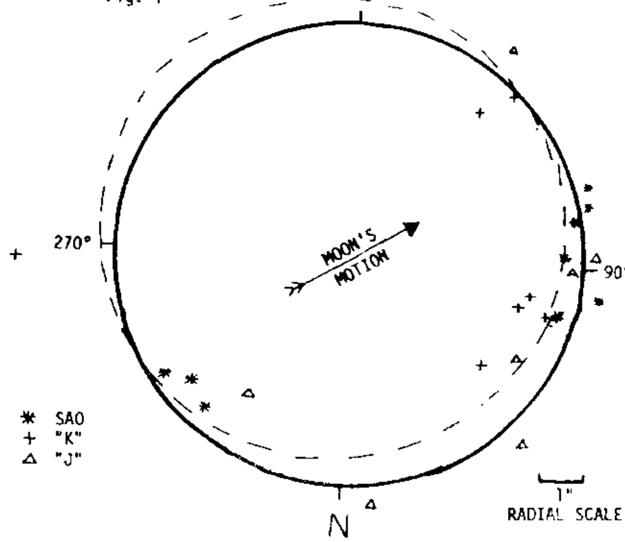


Fig. 2