Occultation Newsletter

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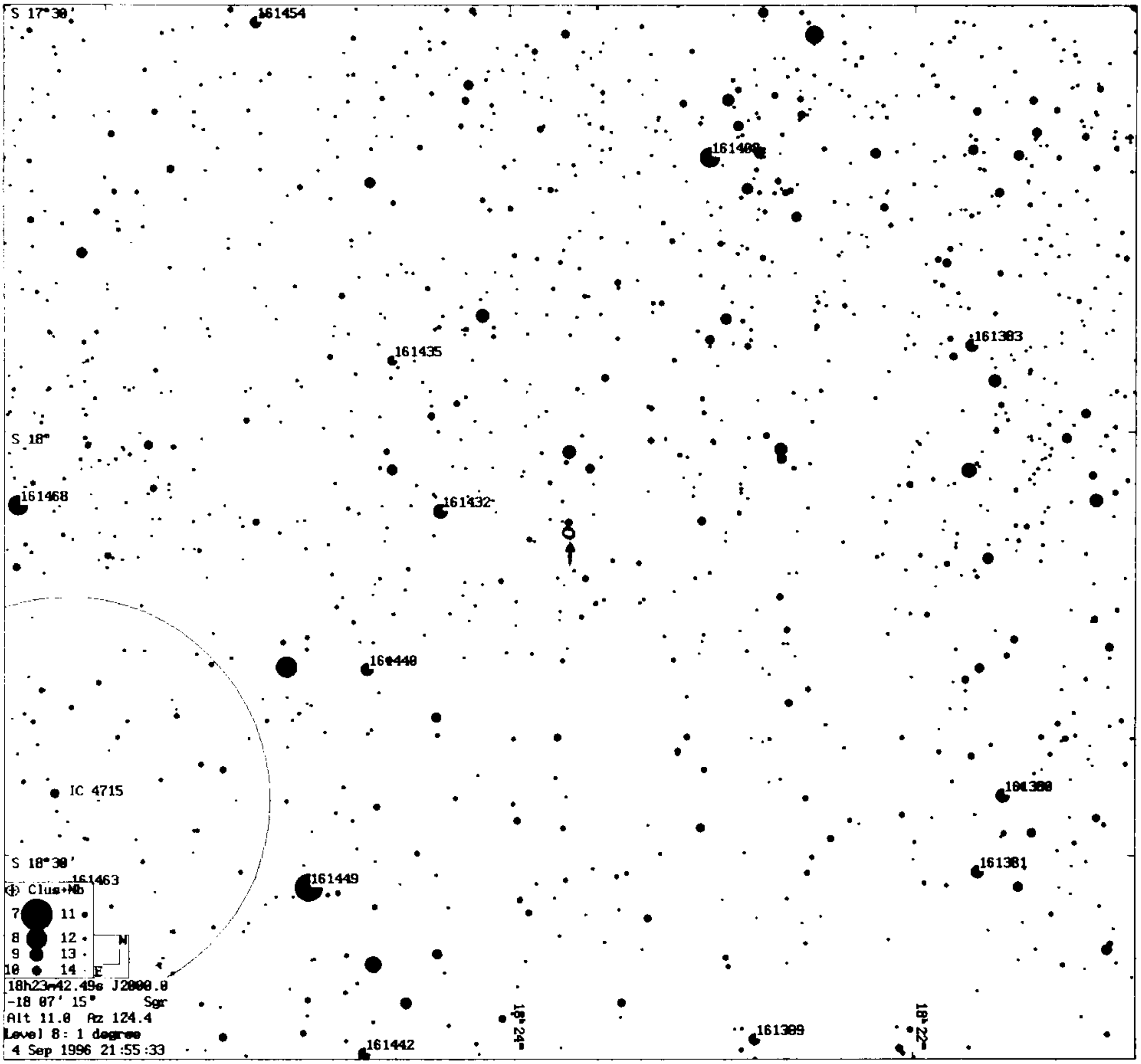

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Nova Sagittarii 1996 is in the center of the field indicated by the circle with the arrow under it. See the article on page 244 for more information.
(This star field was printed from Guide v5.0 from Project Pluto.)

In This Issue

For subscription purposes, this is the first issue of 1996. The deadline for submissions for the next issue is Saturday, 1996 October 5. The next issue will be sent to the printer on or before Saturday, 1996 October 12. It will be mailed on or before Saturday, 1996 October 26.

Memberships and Subscriptions

IOTA annual membership dues, including **ON** and supplements are $25.00 US for U.S.A., Canada, and Mexico; $30.00 US for all others. Annual IOTA membership dues may be paid by check or money order drawn on a United States bank, or by charge to VISA or MasterCard. If you use VISA or MasterCard, include your account number, expiration date, and signature.

ON subscriptions (1 year = 4 issues) are $20.00 US for U.S.A., Canada, and Mexico; $25.00 US for all others. Single issues are 1/4 of the subscription price.

Although the following are included in membership, nonmembers will be charged for: Local circumstance (asteroidal appulses) predictions $1.00 US; Graze limit and profile predictions (per graze) $1.50 US; Papers explaining the use of the above predictions $2.50 US. Asteroidal Occultation supplements will be available for $2.50 US: for South America via Orlando A. Naranjo (Universidad de los Andes; Dept. de Fisica; Mérida, Venezuela); for Europe via Roland Boninsegna (Rue de Mariembourg, 33; B-6381 DOURBES; Belgium) or IOTA/ES (see back cover); 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 Toshiro 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.).

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What to Send to Whom

Send **ON** articles and editorial matters (in print or **preferably in electronic form**) to:

Rex L. Easton
Editor, Occultation Newsletter
2007 SW Mission Ave. Apt. 1
Topeka KS 66604-3341
U.S.A.
E-Mail: SkyGazer@smartnet.net

Send new and renewal memberships and subscriptions, back issue requests, address changes, graze prediction requests, reimbursement requests, special requests, and other IOTA business, **but not observation reports**, to:

Craig A. and Terri A. McManus
Secretary & Treasurer
2760 SW Jewell Ave
Topeka KS 66611-1614
U.S.A.
E-Mail: I.O.T.A.@mcimail.com

Send Lunar Grazing Occultation reports to:

Richard P. Wilds
V.P. Grazing Occultation Services
3630 SW Belle Ave
Topeka KS 66614-4542
U.S.A.
E-Mail: DarkMatter-at-HART@worldnet.att.net

Send Total Occultation and copies of Lunar Grazing Occultation reports to:

International Lunar Occultation Centre (ILOC)
Geodesy and Geophysics Division
Hydrographic Department
Tsukiji-5, Chou-ku
Tokyo, 104 Japan
E-Mail: ILOC@ws11.cue.jhd.go.jp

Send Asteroidal Appulse and Occultation reports to:

Jim Stamm
11781 N. Joi Drive
Tucson AZ 85737
U.S.A.
E-Mail: JimStamm@aztec.asu.edu

From the Editor

Rex L. Easton

You may have noticed a change in the **ON**. It has a new look and a new editor. The Dunhams were real troupers for taking on the **ON** in addition to all of their other work after Homer F. DaBoll died. They deserve a round of applause from all of us. I hope I can be of help to them by lightening their load and allowing them to concentrate on their other work for IOTA. It is my plan to get you your issues on a regular, quarterly basis after we get caught up. In order to get caught up, I will be putting out an **ON** every two months. (See the table for the planned schedule.) This should give everyone time to renew and time for the Secretary & Treasurer to send out renewal notices so people get them soon enough to not interrupt their subscription. (See the article "Notes from the Secretary & Treasurer," pg 244, for important information.) I also plan to get caught up on the unpublished articles that are not time critical and haven't expired yet. That will help keep the issues from being two or three pages long, but you will also need to send in your articles to help out. **Be sure to read the deadline for article submission on the inside front cover. It is a deadline. Articles received after the deadline will go into the next issue.** Strict adherence to this rule is necessary to get caught up and to keep publishing on time.

Arrival Time	Issue Quarter	Vol.	No.
Sep. 1996	Mar. 1996	6	11
Nov. 1996	Jun. 1996	6	12
Jan. 1997	Sep. 1996	6	13
Mar. 1997	Dec. 1996	6	14
May. 1997	Mar. 1997	6	15
Jul. 1997	Jun. 1997	6	16
Sep. 1997	Sep. 1997	7	1

My goal is to keep and make the **ON**, as much as possible, a respectable, professional looking publication for the reporting of scientific research results, techniques and equipment useful for gathering results, and the human interest side of doing scientific work. It is work that requires an attention to detail and quality, but it is also very exciting and fun. Good example articles that cover the human interest aspect of occultation work are by Andrew Elliot, "Graze Expedition 1991 February 21", Vol. 5, No. 3, Pg. 77; Don Stockbauer, "The Jupiter Graze of August 18 from Texas", Vol. 5, No. 1, Pg. 5; Dr. Eberhard Bredner, "I Will Never See Le Chateau-Chambrésis", Vol. 4, No. 16, Pg. 396; and Richard J. Taibi, "Amazing Graze", Vol. 4, No. 15, Pg. 376. They show the challenges of getting a site, fighting the weather, dealing with equipment that doesn't always want to work, and predictions that aren't always perfect. Even with all of the challenges they face, there is always a feeling of hope and excitement and no matter what happens, you know they'll be back another day to do it all over again.

We need more of these.

You probably noticed the absence of the Man in the Moon icon in the publication title. I spoke with Joan Dunham, the previous editor, and she said that there have been several complaints about its fakeness over the years. On the other hand, it does have some sentimental value to some. I decided to put in its place the IOTA emblem. It seems more appropriate and looks a little more professional. Now the masthead announces the organization as well as the publication. I got a positive response from most everyone that I talked with about it. Some were happy to see him go, others were a little sad at his passing but welcomed the change.

Please read everything on every page of this issue for there is a lot of new information and a new location for some existing information. The "What to Send to Whom" column will be in each issue so you will only need to reach as far as your current **ON** to have the latest names and addresses to which to submit your work and ideas. "The Offices and Officers of IOTA" now includes the officer's e-mail address for your convenience. I will be using the lower case Greek letter Iota to denote the end of an article. I considered using a ★ (which is a little more noticeable), but the iota seemed more appropriate. ι

IOTA News

David D. Dunham

Major Occultations: Important occultations in late September are described in this issue. See especially the article, starting on p. 229, on occultations during the total lunar eclipse on the 26th-27th, which were not mentioned at all in the articles about the event in this month's issues of **Sky and Telescope** and **Astronomy**. Occultations during the eclipse will be observable from virtually all of the Americas, Europe, and Africa, the region of visibility being optimally positioned to include most **ON** readers. The occultation of the brightest star occulted during the eclipse, 6.1-mag. Z.C. 35, will provide a spectacular highlight for observers in most of the U.S.A.

On September 30th, the best asteroidal occultation of 1996 is expected in northern Europe and western Asia. Fourth magnitude δ^3 Tauri will be covered by the slow moving large asteroid (121) Hermione, the brightest star occulted by a large asteroid since the occultation of 1 Vulpeculae by (2) Pallas in May of 1983. Since the event can easily be seen with a pair of binoculars or opera glasses, careful planning and publicizing of the event could allow many observations of this event to give a detailed outline of Hermione and the space near it. More information is given on p. 240.

Finally, Nova Sagittarii 1996 is undergoing a series of lunar occultations, I believe the first ever predicted of a nova. Unfortunately, at 12th magnitude and fading, observations will be difficult and will require very large telescopes; see p. 244.

Predictions: Local circumstance predictions of asteroidal and planetary occultations and appulses were finally distributed to most IOTA and IOTA/ES members during August, much later than we had hoped. The continuing transition from centralized prediction services dependent on mainframe computers to a more distributed, PC-based system caused problems with the calculation and distribution of the 1996 lunar grazing and total occultation predictions, but the situation seems to be under control now. But some predictions probably slipped through the cracks. If you want and do not have total or grazing occultation predictions, including ACLPPP profiles for most IOTA members, for the rest of this year, please contact your regional computor as given in either the 1996 or 1995 Grazing Occultation Supplement for your hemisphere, and/or the grazing occultation coordinator of either IOTA or IOTA/ES.

OCCULT: We are now distributing version 3.15, and David Herald has added even a few more capabilities since then. For version 3.15, a bug in the asteroidal occultation predictions was corrected, making them more accurate and in better agreement with Edwin Goffin's predictions of those events. See the article starting on p. 201 of the last issue describing how to obtain this valuable software and documenting the changes made through version 3.14. Version 3.13 was most widely distributed in March through June, but few were provided version 3.14 before 3.15 became available. We apologize for some delays in processing orders, caused by the many changes and improvements, and the desire to distribute a more up-to-date version. The version 3.15 (and probably 3.16) improvements from 3.14 will be described in the next issue.

IOTA Meeting: We still hope to have the 1996 annual IOTA meeting in Houston, TX, the weekend of October 26-27, but we can not be definite about it yet. If the meeting will be held that weekend, notification will be distributed to the membership (by e-mail to as many as possible) by September 20th. Otherwise, the meeting will be held in November or December, and announced in the next **ON**.

ESOP 15: The Fifteenth European Symposium on Occultation Projects, sponsored by the European Section of IOTA, was held in Berlin, Germany, August 24-27. An account of it will appear in the next issue. In the meantime, plans are being made to hold ESOP 16 in the U.K., probably at or near Greenwich, the first weekend of September, 1997. Universities and colleges that might provide adequate facilities and accommodations are all closed during the second half of August, when the ESOP meetings are traditionally held. ι

New Member Welcome

We wish to extend a warm welcome to the following new members of the IOTA team:

Laurie Ainsley	Fort Wayne, IN
Ian Bacon	Scarborough, Australia
W. P. Chen	Taiwan
Oscar Cole-Arnal	Waterloo Ontario
Chris Magri	Farmington, ME
John McAnally	Waco, TX
Peter Offutt	Urbana, IL
John Oliver	Gainesville, FL
Paul Qualtieri	Jonesboro, AR
Mike Reynolds	Oakland, CA
J.R. Stapleton	St. Andrews, Scotland

If any of these people are in your area, set up the next event with them. ι

Occultations During the Total Lunar Eclipse of 1996 September 27

David W. Dunham

This eclipse is the best placed for North America since 1993; the Moon will be in the zenith at mid-eclipse near the Amazon River delta. The local time is Thursday evening, September 26th, for most Americans, and Friday morning, September 27th, for Europeans and Africans. Several 9th and 10th magnitude stars in Pisces will be occulted during this eclipse, but the highlight for most North American observers will be the occultation of Zodiacal Catalog (ZC) number 35, the brightest star occulted during this eclipse with a photoelectric V magnitude of 6.1, according to the Bright Star Catalog (the ZC gives 6.4, a less accurate photo visual mag.). The star's spectral type is G5 and its SAO number is 109119. A spectacular graze of ZC 35 will be visible during totality along the northern limit stretching from central California to upper Michigan, and along the southern limit crossing northwestern Venezuela. Those living within reasonable traveling distance of these limits are strongly encouraged to join one of IOTA's expeditions to time these grazes, and help with IOTA's project to accurately measure the polar diameter of the Moon--information needed to accurately calibrate IOTA's measurements of the solar diameter from timings of solar eclipse Bailey's beads that are referenced to the lunar profile in the lunar polar regions. Details of the ZC 35 total occultation and grazes are given on the following pages of this article. Occultations of other 7th-mag. ZC stars can be timed from other parts of the world from which this eclipse will be visible, including all of South America, and most of Europe and Africa. This eclipse is almost ideally positioned to be visible by the largest possible number of **ON** readers.

Since there has been no major volcanic activity during recent years, I expect that the umbral regions will be relatively bright during this eclipse, similar to last April's event. So even in the core of the umbra, it may be difficult to time occultations of 10th-mag. stars; use the largest available telescope to enable timing some of the fainter occultations. Most observers with relatively small telescopes should concentrate on timing the occultations of the few stars of 8th mag. In any case, observers of this eclipse should certainly include the timing of occultations in their program and not ignore them, as was done in the articles about the eclipse in the September issues of **Sky & Telescope** and **Astronomy** (the eclipse occultations were mentioned in my article, "Lunar Occultation Highlights for 1996", on pages 77 and 78 of the January issue of **S&T**).

Value: 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 opportunity 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.

Observing Strategy: Try to gain access to the largest telescope possible and concentrate on timing occultations around the entire Moon's limb. Especially, try to observe reappearances, as they are often under-observed during eclipses. If the largest telescope available to you is portable, it would be best to take it to the nearest grazing occultation path. Observations of northern limit grazes will be more difficult than southern limit grazes since the northern part of the Moon is in the umbra for a shorter time than the southern part. If a northern limit graze path of a relatively bright star (necessary since the northern 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. The ZC 35 northern limit graze is the best for this, since it is bright enough that it can be seen easily, and should be spectacular, with even a small telescope.

The Star Field: The eclipse star field, shown in two charts, is in Pisces about 8° east of the "Circlet". Saturn is in opposition about 2° away. No significant clusters or nebulae are in the star field, and there are also no known asteroids brighter than 16th magnitude.

One plot shows only the stars, down to magnitude 13.0 from David Herald's Space Telescope Guide Star Catalog (GSC) based catalog of 593 stars in the field, which I have merged with Wolfgang Zimmermann's XZ94D version of the XZ catalog. David Herald provided an ASCII version of the special GSC subcatalogs that he created for the 1996 lunar eclipses for use with his OCCULT program. Underlined stars are, or may be, double. The chart equinox J2000 bounds are close to those determined by David Herald, and are a little larger than his boundaries; all XZ94D stars within the J2000 bounds are included. The Moon's figure is a reduced copy of a view of the Moon generated with OCCULT 3.15, but annotated to show the maria more prominently, and with rays around Copernicus, Kepler, and Aristarchus added (mainly from previous moon views generated by Bob Bolster). 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 335°, 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.

Topocentric Paths: The other chart shows the same star field, but also includes numbers of the brighter stars and topocentric tracks for the Moon's center for 24 locations while the Moon's center is on the chart and is above the local horizon. This "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) XZ-catalog PC-Evans total occultation predictions, misses a few of the stars near the right margin, but those stars will not be occulted by any part of the Moon in the umbra for any location on the Earth's surface. Apparent place coordinates (with precession, nutation, and aberration applied to 1996 September 27) are used.

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. 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 2h U.T. to 4h U.T., extend north from the path. The tick marks extending south of the paths mark the four eclipse contacts and mid eclipse, which will occur at the following times:

UT	
h m	
1 12.3	First umbral contact (First Contact)
2 19.3	Start of totality (Second Contact)
2 25.4	Middle of the eclipse
3 29.4	End of totality (Third Contact)
4 36.3	Last umbral contact (Fourth Contact)

For stations where the early part of the eclipse occurs before moonrise, the paths start at the following times: Los Angeles, at 1:45 U.T.; and at Vancouver, 2:00 U.T. For paths near the right side of the chart, often the paths end near moonset and before fourth contact. So for Moscow, Mitzpe Ramon, and Harare, the paths end at 3rd contact. The path for Johannesburg ends at 3:45 U.T., that for Athens at 4:15 U.T., and the path for Cape ends at 4:30 U.T. For locations not shown on the chart, interpolate. I can provide topocentric path coordinates for other locations upon request; it would be best to request by e-mail to David_Dunham@jhuapl.edu.

Table 1. Stations

City	Lat.°	E.Long.°
Moscow, Russia	55.755	37.570
Mitzpe Ramon, Israel	30.597	34.763
Harare, Zimbabwe	-17.759	31.116
Johannesburg, S.Afr.	-26.182	28.075
Athens, Greece	37.972	23.725
Cape Town, S. Africa	-33.933	18.475
Stockholm, Sweden	59.333	18.050
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, Brz.	-22.898	-43.186
St. John's, Nfld.	47.537	-52.753
Buenos Aires, Arg.	-34.605	-58.434
Caracas, Venezuela	10.507	-66.928
La Paz, Bolivia	-16.535	-68.076
Santiago, Chile	-33.418	-70.630
Montreal, Quebec	45.500	-73.600
Lima, Peru	-12.100	-77.050
Miami, Florida	25.750	-80.250
Mexico City, Mexico	19.250	-99.100
Los Angeles, Calif.	34.113	-118.302
Vancouver, Brit.Col.	49.500	-123.100
North Pole	90.000	0.000

The Stars and their Numbers: Apparent positions were plotted so that the RA and Dec. given in the detailed IOTA (PC-Evans) predictions could be used to locate stars whose occultations are listed. The numbers of stars of magnitude 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 sometimes appear between the star and its number. All star numbers increase with R.A. from right to left across the chart. If available, a two-digit ZC number, ranging from 14 (near the upper right corner of the chart) to 40 (in the upper left part of the chart, near an extension of the lunar center path for Rio de Janeiro), is plotted. The next preference, if available, is an XZ94D (or X) number in two ranges, from 88 (lower right) to 411 (lower left corner)and in the 32000's. If neither ZC nor X numbers are available, the star's sequential number in the catalog is given, with the lowest example being 21 in the lower right part near the right margin, and the highest being 575 in the upper left, just south of an extension of the track for Caracas. These numbers can be distinguished from the X and ZC numbers since they increase more rapidly across the chart, and are "out of order" relative to the more common X numbers.

ZC 32 is also known as 93 B. Piscium (number 93 in Bode's catalog, an old, obscure catalog that must not be confused with the better-known Flamsteed catalog) and ZC 35 is 98 B. Piscium (also Bode's catalog). Curiously, ZC 35 will be occulted by the asteroid (124) Alkeste on October 15th, less than 3 weeks after the eclipse, along a path that will probably cross Alaska, and possibly Japan or Taiwan.

Double Stars: Known double stars are underlined on the charts. Data about the visual and occultation doubles that are in the SAO Catalog are given below. The non-SAO doubles are all wide pairs where each component has a separate XZ number, including X00190 and X00191, X00292 and X32490, and X00381 and X00383.

Table 2. Visual and Occultation Doubles

USNO#	D	SAO/BD	Desig.	Mag1	Mag2	Sep.	P.A.
X00104	C	109024	BAL 942	9.1	11.6	7.0	299°
X00132	K	128612	WO30D27	9.9	9.9	0.1	90
X00136	V	109039		8.6	8.6	0.2	90
X00206	M	109065		9.3	9.5	0.2	170
X00297	M	109113	STF 23	7.9	10.2	0.1	103
X00301	X	109117	JB87N02	9.8	9.8	0.1	0
X00350	X	109142		8.7	8.7	0.04	115

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), BAL and STF are abbreviations of visual double star observers. WO is W. M. Worssel, who noted a gradual occultation of SAO 128612 in S. Africa on 1930 Dec. 27, and JB is Jean Bourgeois in Belgium, who believes that SAO 109117 is probably double based on an event that he observed on 1987 Nov. 2.

Predictions: Those with PC-Evans predictions already have data for the occultations of all of the XZ94D catalog stars, which includes most stars in the field down to 10th mag. Those with OCCULT 3.13 can compute predictions of either the XZ or GSC stars. For the latter, they must copy the eclipse star catalog files for this eclipse, 96-2.*, to GSC.*. Then, select GSC from the star catalog menu before making the run. If you have neither the XZ predictions nor OCCULT, and plan to time occultations using a large telescope, Kent Okasaki can send you predictions by e-mail. Send him your coordinates, and whether you can receive uuencoded or mime-encoded (or neither) attached files, and he can generate the XZ and GSC predictions for your site, and e-mail them to you. See p. 202 of the last issue for contacting him; Kent has another e-mail address that he uses at home, which is 73112.3157@compuserve.com

As noted previously, the occultation of ZC 35 will be the highlight of the eclipse for most North American observers. Predictions of the times and conditions of both its disappearance and reappearance are given in Table 3 computed with OCCULT for dozens of North American cities, similar to the predictions for the lunar occultation of Comet Hale-Bopp given in **ON** 6 (9), p 195. Under the % Sunlt column, the percent of the Moon's disk which is not in the umbra is given ("E" means eclipse, rather than the usual + or - designating the waxing or waning phases), and under "Cusp Ang", which is undefined the usual way during eclipses, the umbral distance is given, being 0 for an event at the center of the umbral shadow and 100 for one at the edge of the umbra. Note that the station longitudes, affecting the sign of the **a** factor, are negative west of Greenwich.

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]. They can also be sent by e-mail directly to ILOC and, for grazes, to Richard Wilds; see "What to Send to Whom" for addresses, and see **ON** 6 (8), p. 173 for the format. A sample e-mail report, a copy of which can be used as a template for your report, is available by e-mail from me or from Kent Okasaki, and can also be downloaded from IOTA's Web site at the URL for lunar events given at the end of this issue. 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; e-mail HeraldD@canberra.dialix.oz.au. 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 GSC number, if you have it. 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 a map and Table 4 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 1996 and 1995 distributed earlier. Paths near the left side of the map start just after moonrise at the western end, and those near the eastern edge stop shortly before moonset; they are marked with "A" after the index number. Other paths, especially those in the middle of the chart, end when the graze occurs in the bright penumbral region rather than in the umbra; they are marked with "B" or "U" after the index number. Tick marks are given at 20 minute intervals, with time increasing along the path from west to east. The tick marks are on the side of a total occultation, that is, south of northern limits and north of southern limits. The curves are solid during totality and are dashed during the partial phases.

Lunar Polar Diameter: As noted above, the ZC 35 occultation offers the best possibility for observation at both the northern and southern limits for an accurate lunar polar diameter measurement.

ZC 35, N. Limit: The northern limit for 6.1 mag. ZC 35 crosses the Southwestern and Midwest parts of the U.S.A., and is shown on the map on p. 77 of the January issue of **S&T**. It is shown in more detail on three maps published here. So far, only one expedition has been organized for the graze, south of Minneapolis, MN. We will be contacting other local astronomical societies soon to set up other expeditions and will put the details on our lunar occultation Web site; see "IOTA Online" for the URL. I hope to lead one of the efforts myself. From west to east, possible expeditions are:

California: Near Paso Robles, with observers from the Santa Cruz - Monterey area and/or from Santa Barbara -Ventura. Near Delano in the San Joaquin Valley, from Fresno and Bakersfield, but possibly joined by a few observers from the Los Angeles and San Francisco areas (I expect to be at a meeting in Pasadena on Sept. 26th, so I may lead the effort near Delano). North of China Lake.

Nevada: North of Las Vegas.

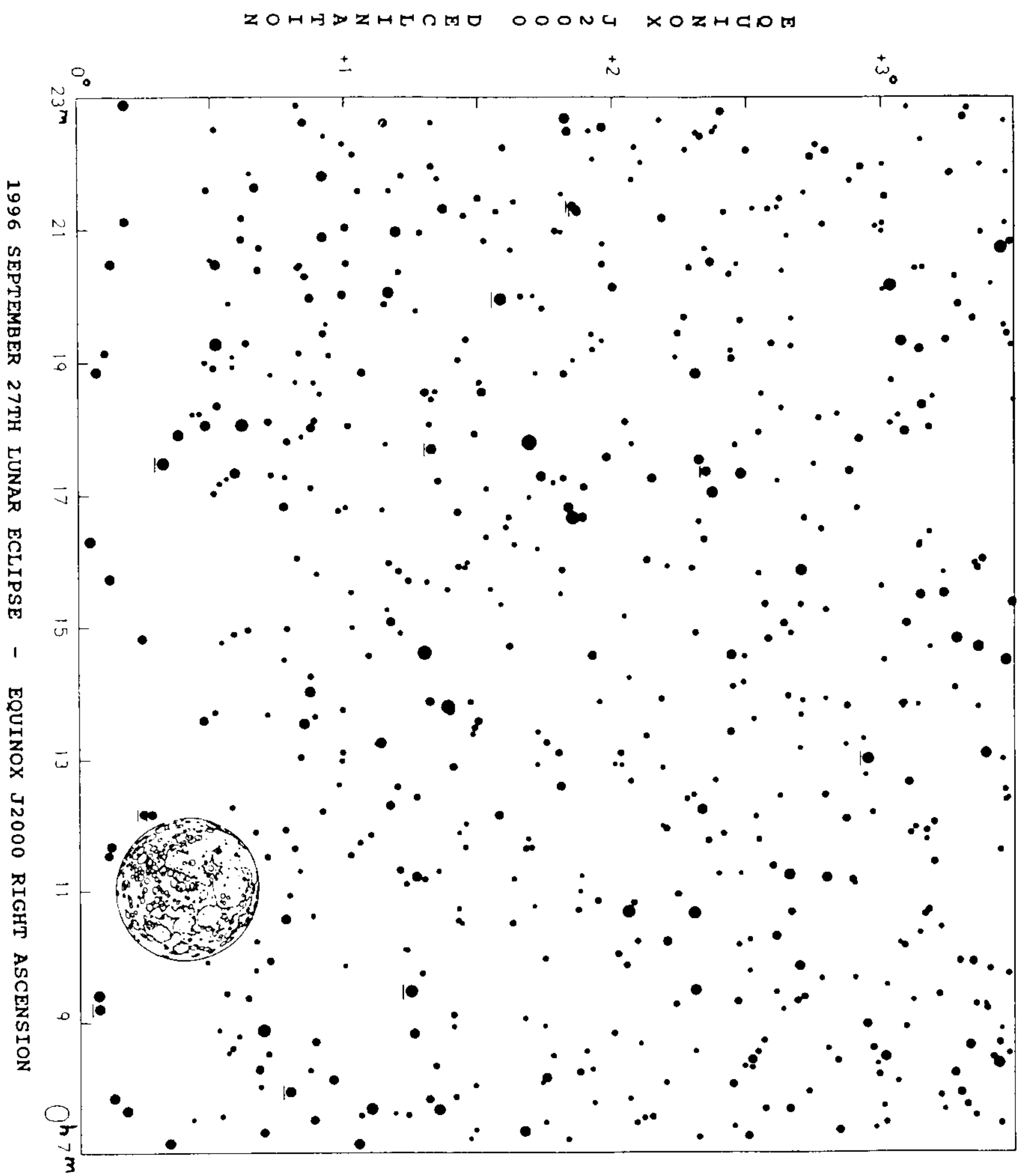
Colorado: North of Palmer Lake, from Colorado Springs and Denver.

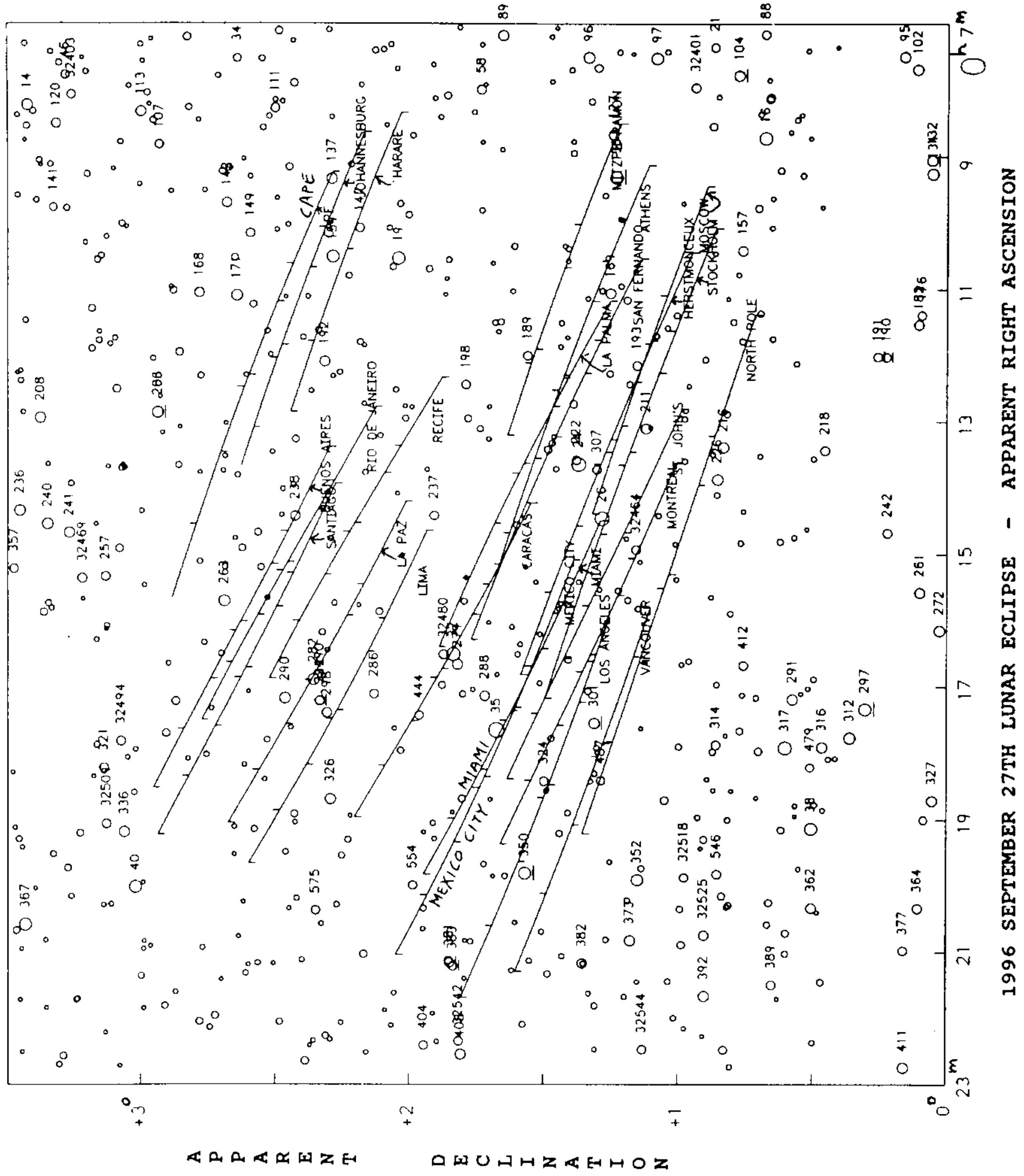
Nebraska-Iowa: Near Norfolk or Sioux City, from Omaha, NE; near Mason City, NE from Topeka and possibly Kansas City.

Minnesota: An expedition to Dodge Center, about 18 miles west of Rochester, is being organized by Jim Fox; 14601 55th St. S.; Afton, MN 55001-9626; phone 612-436-5843 (home) and 612-733-2690 (office); e-mail: JHFox@worldnet.att.net. The graze will be 10:15 PM CDT, so the expedition will meet at 8:00 PM at the Dairy Queen on US 14 in Dodge Center.

ZC 35, S. Limit: Another map shows the southern limit across northwestern Venezuela. Unfortunately, the path misses all of the islands in the Caribbean Sea. Paul Maley plans to observe this graze with other Houston area observers, near Barquisimeto, working with members of an astronomical society there. They will be flying to Caracas on Wed., Sept. 25, and will leave Fri., Sept. 27, stopping in Aruba on the way home. If you might be interested in joining this effort, telephone Paul at (713) 334-1406 or send him an e-mail message at PMaley@GP808.jsc.nasa.gov. He is working with astronomers Orlando Naranjo, e-mail Naranjo@ciens.ula.ve, and Patricia Rosenzweig, e-mail Patricia@ciens.ula.ve, at Universidad de los Andes, Merida, Venezuela, to set up the arrangements with others in Barquisimeto. Astronomers from Mexico and Germany have also expressed an interest in joining the effort.

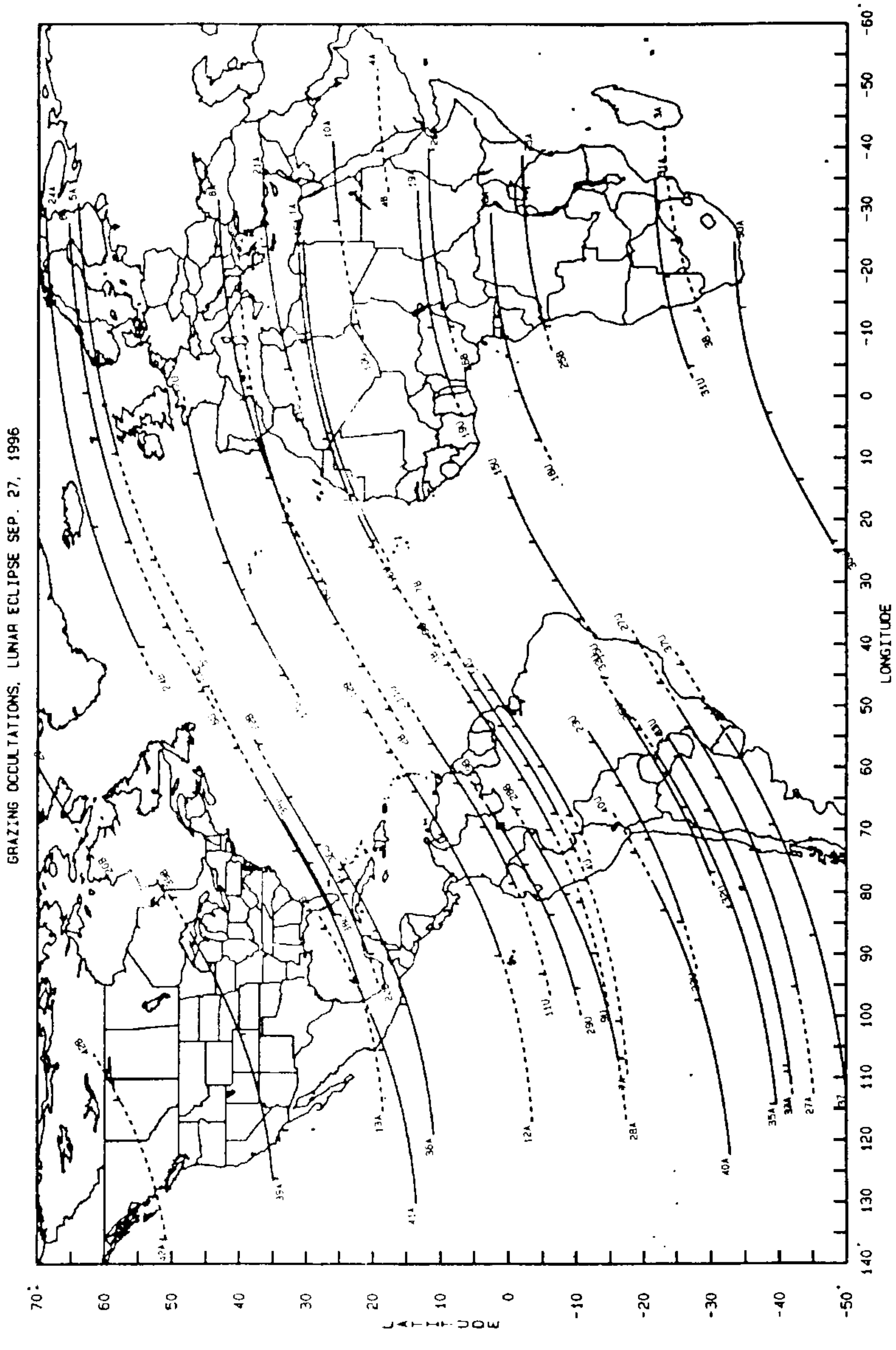
Other Graze Expeditions: The only other known expedition is one for a 7th mag. star to the Lecanto area of west central Florida being organized by Harold Povenmire, telephone (407) 777-1303 near Melbourne, but the graze occurs just outside the umbra so it will be very difficult at best. Some better possibilities are shown on Riedel's map, such as the southern limit graze of 7.0 mag. ZC 26 crossing southern Spain and southern Italy, and a southern limit graze of 9.0 mag. X00211 (SAO 109068) crossing southern Iberia; near Rome, Italy; and northern Bulgaria. There may be expeditions for the latter from either Madrid or Valencia in Spain,

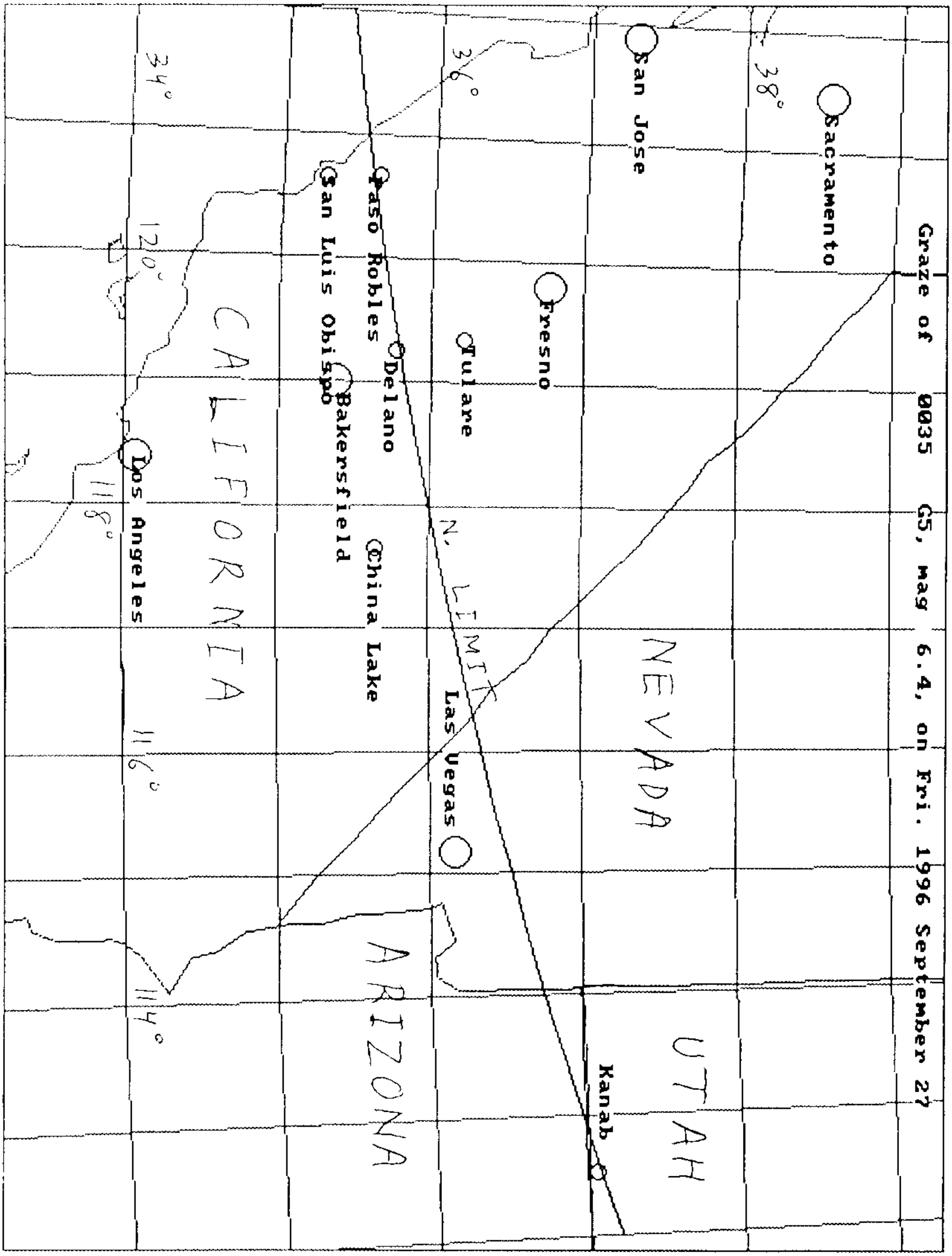

1996 SEPTEMBER 27TH LUNAR ECLIPSE - EQUINOX J2000 RIGHT ASCENSION
EQUINOX J2000 DECLINATION
0°
+1
+2
+3°
23m
21
19
17
15
13
11
9
0h7m

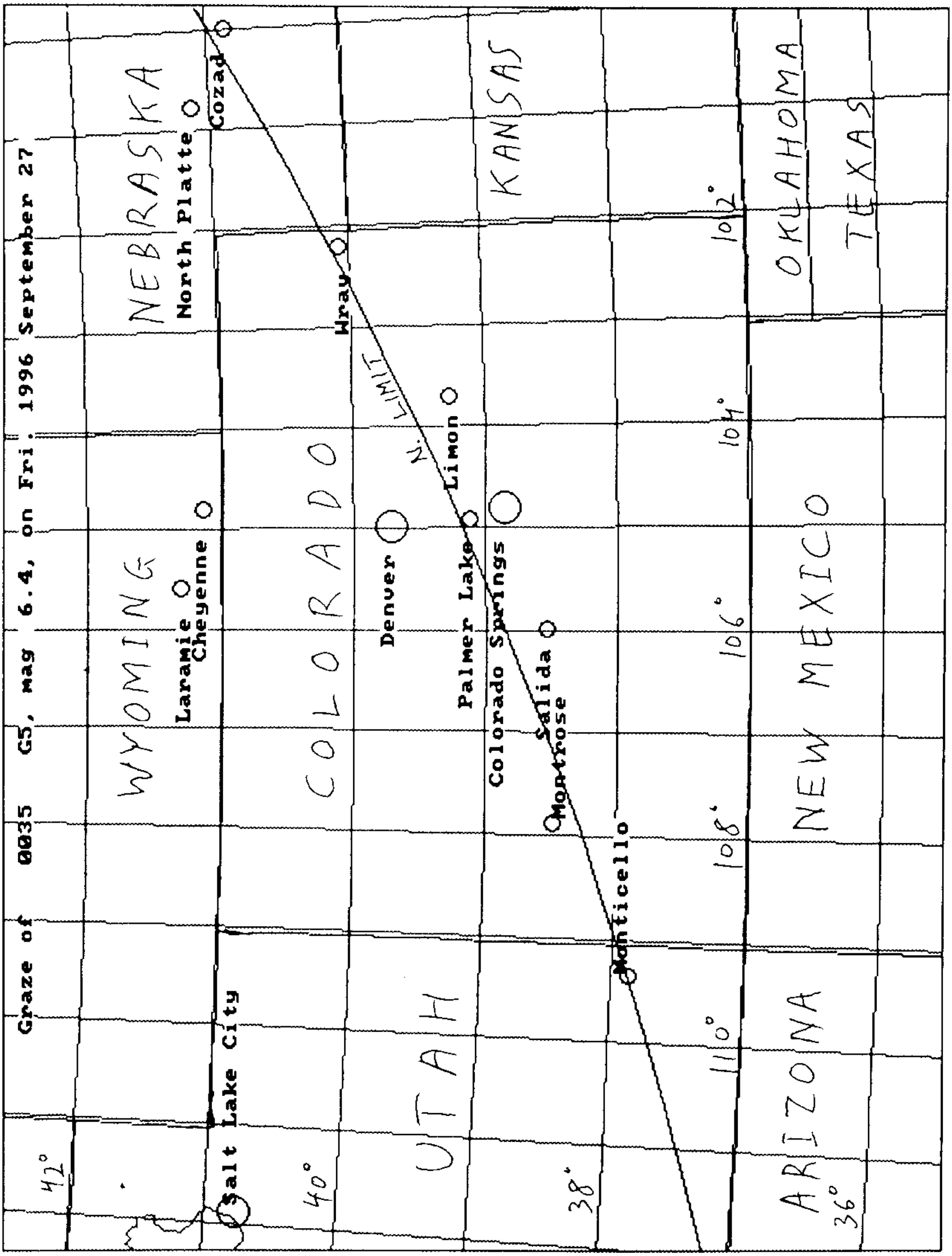

1996 SEPTEMBER 27TH LUNAR ECLIPSE - APPARENT RIGHT ASCENSION
APPARENT DECLINATION
CAPE
JOHANNESBURG
HARARE
BUENOS AIRES
SANTIAGO
RIO DE JANEIRO
RECIFE
LA PAZ
LIMA
CARACAS
MEXICO CITY
MIAMI
LOS ANGELES
VANCOUVER
MONTREAL
ST. JOHN'S
ATHENS
SAN FERNANDO
LA PALMA
HERSTMONCEUX
MOSCOW
STOCKHOLM
NORTH POLE

Lunar Occultation of 6.1-mag. Z.C. 35
on 1996 September 27

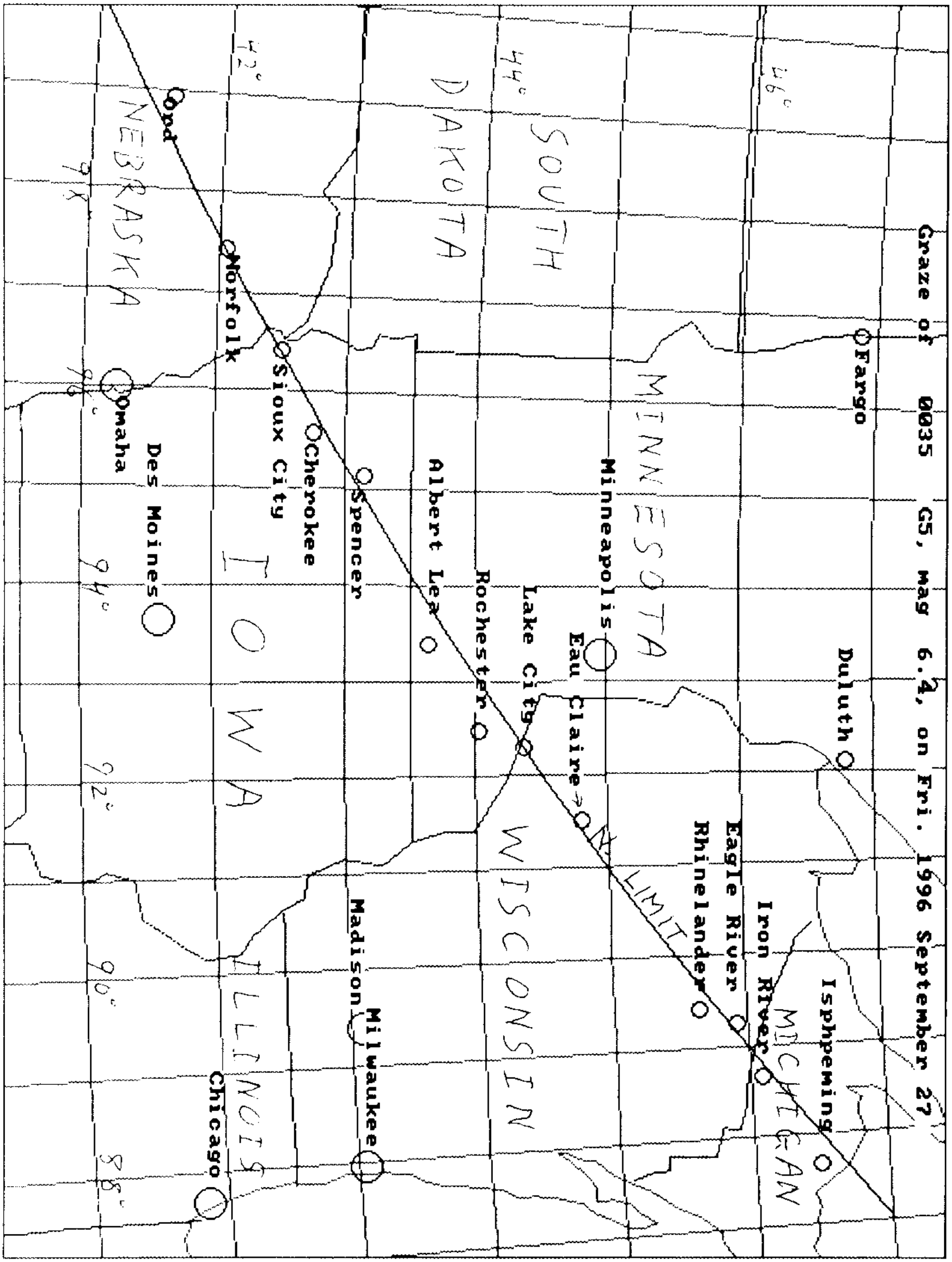
Location	E. Long.	Lat.	h,m	Disappearance Univ. T. h	m	s	Moon Alt	Az	% Sunlt	Cusp Ang	Pos Ang	W. Ang	a m/o	b m/o	Reappearance Univ. T. h	m	s	Moon Alt	Az	% Sunlt	Cusp Ang	Pos Ang	W. Ang	a m/o	b m/o
Los Angeles CA	-118.370	34.080	32	2	30	24	10	95	0E	83U	1	26	-0.1	+4.3	2	51	40	14	98	0E	81U	318	343	+0.9	-1.4
San Diego CA	-117.140	32.750	7	2	25	14	10	94	0E	81U	9	34	+0.0	+3.5	2	54	1	16	99	0E	79U	310	335	+0.9	-0.6
Las Vegas NV	-115.170	36.170	706	2	41	5	15	99	0E	83U	348	13	-0.9	+8.6	2	50	3	16	100	0E	83U	330	355	+1.9	-5.5
Phoenix AZ	-112.080	33.500	366	2	28	0	15	98	0E	80U	9	34	+0.1	+3.5	2	58	36	21	102	0E	78U	309	334	+1.1	-0.5
Flagstaff AZ	-111.620	35.210	2264	2	34	37	16	100	0E	82U	1	26	-0.1	+4.3	2	57	44	21	103	0E	80U	316	342	+1.3	-1.3
Tucson AZ	-110.920	32.220	784	2	23	53	15	98	0E	79U	15	40	+0.1	+3.1	3	0	20	23	103	0E	75U	302	327	+1.1	-0.2
La Paz Mexico	-110.283	24.167	0	2	4	2	12	94	17E	73U	42	67	+0.2	+2.0	2	58	32	24	100	0E	67U	276	301	+0.9	+0.6
Albuquerque NM	-106.667	35.083	1742	2	34	4	20	103	0E	80U	7	32	+0.1	+3.7	3	4	49	26	108	0E	76U	309	334	+1.5	-0.6
El Paso TX	-106.420	31.790	1285	2	23	30	19	100	0E	77U	20	45	+0.2	+2.9	3	5	53	28	106	0E	72U	296	321	+1.3	+0.1
Pueblo CO	-104.640	38.290	1539	2	47	49	24	108	0E	82U	352	18	-0.6	+5.8	3	4	13	27	111	0E	80U	323	348	+2.3	-2.7
Lubbock TX	-101.850	33.583	1048	2	30	4	24	104	0E	76U	18	43	+0.3	+3.0	3	12	37	32	112	0E	71U	297	322	+1.6	+0.0
Monterrey Mexico	-100.317	25.667	568	2	10	50	22	99	7E	68U	42	68	+0.5	+2.1	3	11	18	36	108	0E	59U	271	296	+1.4	+0.8
Acapulco Mexico	-99.917	16.850	3	1	56	22	20	95	30E	62U	67	92	+0.6	+1.2	3	2	29	36	101	0E	50U	246	271	+1.2	+1.3
Mexico City	-99.141	19.398	2246	2	0	16	22	96	23E	63U	61	86	+0.6	+1.5	3	6	39	37	103	0E	51U	253	278	+1.3	+1.2
San Antonio TX	-98.500	29.430	213	2	20	14	25	103	0E	70U	33	58	+0.5	+2.4	3	16	38	37	112	0E	63U	280	305	+1.6	+0.6
Austin TX	-97.730	30.290	196	2	22	47	26	104	0E	71U	31	56	+0.5	+2.5	3	18	22	38	114	0E	63U	281	306	+1.6	+0.5
Oklahoma City OK	-97.530	35.480	422	2	37	13	28	109	0E	76U	16	41	+0.3	+3.1	3	20	5	36	118	0E	71U	297	322	+1.8	-0.0
Brownsville TX	-97.490	25.910	5	2	12	56	25	101	4E	67U	44	69	+0.6	+2.1	3	15	43	39	110	0E	57U	269	294	+1.5	+0.8
Wichita KS	-97.330	37.680	423	2	44	35	29	112	0E	78U	8	33	+0.2	+3.5	3	20	1	35	119	0E	75U	305	330	+2.0	-0.4
Dallas TX	-96.790	32.790	143	2	29	46	28	107	0E	73U	25	50	+0.5	+2.7	3	21	1	38	117	0E	67U	287	313	+1.8	+0.3
Omaha NE	-95.950	41.300	341	2	59	27	31	118	0E	82U	354	19	-0.5	+5.2	3	19	23	34	123	0E	81U	319	344	+2.8	-2.1
Tulsa OK	-95.940	36.140	264	2	39	51	29	111	0E	76U	15	40	+0.4	+3.1	3	23	4	37	120	0E	72U	297	322	+1.9	-0.0
Topeka KS	-95.690	39.040	305	2	49	44	30	115	0E	79U	5	30	+0.1	+3.7	3	22	40	36	122	0E	77U	307	332	+2.2	-0.6
Houston TX	-95.390	29.750	13	2	22	46	28	106	0E	69U	35	60	+0.6	+2.4	3	21	59	40	116	0E	61U	277	302	+1.7	+0.6
Kansas City MO	-94.583	39.083	243	2	50	6	31	116	0E	79U	7	32	+0.2	+3.6	3	25	1	37	124	0E	76U	305	331	+2.2	-0.5
Des Moines IA	-93.630	41.600	308	3	0	0	32	120	0E	82U	357	23	-0.2	+4.5	3	25	2	36	126	0E	81U	315	340	+2.6	-1.4
Little Rock AR	-92.320	34.740	94	2	37	29	32	113	0E	73U	24	49	+0.6	+2.8	3	29	59	42	124	0E	68U	287	312	+2.0	+0.3
Guatemala City	-90.517	14.633	1593	2	1	53	31	97	20E	51U	80	106	+1.1	+0.8	3	11	5	48	104	0E	34U	229	254	+1.4	+1.9
Saint Louis MO	-90.250	38.630	149	2	49	52	34	120	0E	77U	15	40	+0.4	+3.1	3	34	35	41	130	3E	75U	296	321	+2.2	-0.1
Jackson MS	-90.200	32.320	98	2	32	30	34	112	0E	69U	33	58	+0.7	+2.5	3	33	5	45	125	2E	63U	277	302	+2.0	+0.6
New Orleans LA	-90.080	29.970	2	2	27	4	34	110	0E	66U	39	64	+0.8	+2.3	3	31	45	46	123	1E	58U	271	296	+1.9	+0.7
Memphis TN	-89.990	35.120	90	2	39	55	34	116	0E	72U	25	51	+0.6	+2.7	3	34	45	44	128	3E	68U	285	310	+2.0	+0.3
Mobile AL	-88.110	30.680	2	2	30	18	36	112	0E	65U	39	64	+0.9	+2.3	3	36	6	48	127	5E	59U	270	295	+2.0	+0.7
Milwaukee WI	-87.950	43.050	208	3	5	32	36	128	0E	84U	3	28	+0.1	+3.8	3	37	49	40	137	7E	83U	308	333	+2.5	-0.9
Chicago IL	-87.680	41.850	199	3	1	17	36	127	0E	82U	8	33	+0.3	+3.4	3	39	21	41	137	9E	81U	303	328	+2.4	-0.6
Montgomery AL	-86.300	32.360	52	2	35	44	37	116	0E	67U	37	62	+0.9	+2.3	3	40	57	49	132	11E	62U	272	297	+2.1	+0.6
Indianapolis IN	-86.147	39.790	260	2	55	23	37	125	0E	78U	17	42	+0.5	+3.0	3	43	36	44	138	15E	77U	293	318	+2.2	-0.1
Louisville KY	-85.750	38.220	156	2	51	6	38	124	0E	76U	22	47	+0.6	+2.8	3	44	26	46	138	16E	74U	288	313	+2.2	+0.1
Cincinnati OH	-84.510	39.140	180	2	54	27	38	126	0E	77U	21	46	+0.6	+2.8	3	47	16	46	141	21E	76U	288	313	+2.2	+0.0
Atlanta GA	-84.410	33.760	331	2	40	42	39	120	0E	68U	35	61	+0.9	+2.4	3	45	43	50	137	18E	66U	273	298	+2.1	+0.6
San Jose Costa Rica	-84.083	9.933	1234	2	9	20	40	96	9E	38U	103	128	+1.8	-0.3	3	7	40	54	101	0E	20U	204	229	+1.0	+3.1
Knoxville TN	-83.940	35.980	292	2	46	33	39	123	0E	72U	30	55	+0.8	+2.5	3	47	47	49	140	22E	70U	278	303	+2.2	+0.4
Detroit MI	-83.090	42.380	192	3	4	38	39	132	0E	83U	14	39	+0.5	+3.0	3	49	58	44	146	25E	83U	296	321	+2.3	-0.4
Tampa FL	-82.470	27.960	0	2	30	19	41	115	0E	58U	52	77	+1.2	+1.9	3	44	52	55	134	17E	54U	255	280	+2.0	+1.1
Cleveland OH	-81.660	41.480	217	3	2	52	40	133	0E	81U	18	43	+0.6	+2.8	3	53	34	46	148	32E	82U	291	316	+2.3	-0.2
Jacksonville FL	-81.650	30.320	7	2	35	56	42	118	0E	62U	47	72	+1.1	+2.0	3	48	55	54	139	24E	60U	260	285	+2.1	+0.9
Charleston WV	-81.630	38.350	197	2	54	28	41	129	0E	76U	27	52	+0.8	+2.6	3	53	34	48	146	32E	76U	281	307	+2.2	+0.2
Sudbury ON	-81.000	46.467	279	3	18	39	38	141	0E	91U	3	28	+0.1	+3.6	3	52	14	42	151	30E	91U	307	332	+2.6	-1.1
Charlotte NC	-80.830	35.220	236	2	47	31	42	126	0E	70U	36	61	+1.0	+2.3	3	54	11	52	146	33E	70U	272	297	+2.2	+0.5
Miami FL	-80.220	25.780	2	2	29	20	44	114	0E	53U	60	85	+1.4	+1.7	3	46	43	58	135	20E	51U	246	271	+2.0	+1.4
Pittsburgh PA	-79.970	40.440	245	3	1	12	41	134	0E	80U	24	49	+0.8	+2.6	3	57	29	48	151	39E	81U	285	310	+2.3	-0.0
Charleston SC	-79.960	32.810	3	2	43	4	43	124	0E	66U	43	68	+1.1	+2.1	3	54	34	54	145	34E	66U	264	289	+2.1	+0.7
Toronto ON	-79.383	43.650	124	3	10	19	40	139	0E	86U	15	41	+0.6	+2.9	3	58	15	45	154	41E	88U	294	319	+2.3	-0.4
Buffalo NY	-78.850	42.910	231	3	8	36	41	139	0E	84U	18	44	+0.6	+2.8	3	59	42	46	155	44E	87U	291	316	+2.3	-0.3
Raleigh NC	-78.650	35.790	120	2	51	5	44	129	0E	71U	37	62	+1.1	+2.3	3	59	10	52	151	43E	73U	270	295	+2.2	+0.5
Richmond VA	-77.460	37.540	52	2	56	15	44	133	0E	74U	34	60	+1.0	+2.3	4	2	31	52	155	49E	78U	273	298	+2.2	+0.3
Washington DC	-77.020	38.880	5	2	59	50	44	136	0E	77U	32	57	+1.0	+2.4	4	3	51	51	157	52E	81U	276	301	+2.2	+0.2
Baltimore MD	-76.620	39.310	7	3	1	15	44	137	0E	78U	31	56	+1.0	+2.4	4	4	49	50	158	53E	82U	277	302	+2.2	+0.2
Norfolk VA	-76.270	36.900	3	2	56	6	45	134	0E	73U	38	63	+1.1	+2.2	4	4	53	53	158	54E	78U	269	295	+2.2	+0.4
Dover DE	-75.530	39.160	0	3	1	56	45	138	0E	78U	33	58	+1.0	+2.3	4	7	12	51	161	58E	83U	275	300	+2.2	+0.2
Philadelphia PA	-75.150	40.000	33	3	4	16	44	140	0E	80U	31	56	+1.0	+2.3	4	8	10	50	162	60E	85U	276	301	+2.2	+0.1
New York NY	-73.920	40.730	43	3	7	10	45	143	0E	82U	31	56	+1.0	+2.3	4	10	55	50	165	65E	88U	277	302	+2.2	+0.0
Albany NY	-73.780	42.660	7	3	11	50	44	146	0E	86U	26	51	+0.9	+2.4	4	11	10	48	166	65E	91U	282	307	+2.2	-0.2
Montreal PQ	-73.567	45.517	61	3	19	4	42	150	0E	91U	19	44	+0.7	+2.6	4	10	44	46	167	65E	96U	290	315	+2.2	-0.5
Burlington VT	-73.220	44.480	36	3	16	42	43	149	0E	90U	22	47	+0.8	+2.5	4	11	57	47	168	67E	94U	286	312	+2.2	-0.4
Hartford CT	-72.690	41.760	13	3	10	44	45	146	0E	84U	30	55	+1.0	+2.3	4	13	37	49	168	70E	91U	278	303	+2.2	-0.0
Manchester NH	-71.460	42.990	57	3	14	42	45	150	0E	88U	29	54	+0.9	+2.3	4	16	10	48	172	74E	94U	279	305	+2.2	-0.2
Providence RI	-71.430	41.820	0	3	12	6	45	148	0E	85U	32	57	+1.0	+2.2	4	16	20	50	171	75E	92U	276	301	+2.2	-0.0
Quebec City PQ	-71.233	46.817	78	3	23	57	42	155	0E	95U	19	44	+0.7	+2.5	4	15	11	45	172	73E	100U	291	316	+2.2	-0.6
Boston MA	-71.090	42.320	7	3	13	33	45	149	0E	86U	31	56	+1.0	+2.2	4	17	2	49	172	76E	94U	277	302	+2.1	-0.1
Bangor ME	-68.783	44.783	7	3	21	10	45	156	0E	93U	28	53	+0.9	+2.2	4	21	25	47	178	83E	100U	281	306	+2.1	-0.4
San Juan PR	-66.117	18.467	4	2	51	54	63	126	0E	39U	103	128	+3.1	-0.3	3	54	59	72	161	34E	57U	198	223	+1.1	+3.4
Hamilton Bermuda	-64.767	32.283	50	3	4	37	56	149	0E	70U	64	89	+1.8	+1.3	4	25	30	59	187	89E	88U	240	265	+1.9	+1.0
Halifax NS	-63.600	44.650	27	3	26	8	46	165	0E	97U	35	60	+1.1	+1.8											
St Johns NF	-52.717	47.567	69	3	43	2	44	187	14E	101U	41	66	+1.1	+1.3											

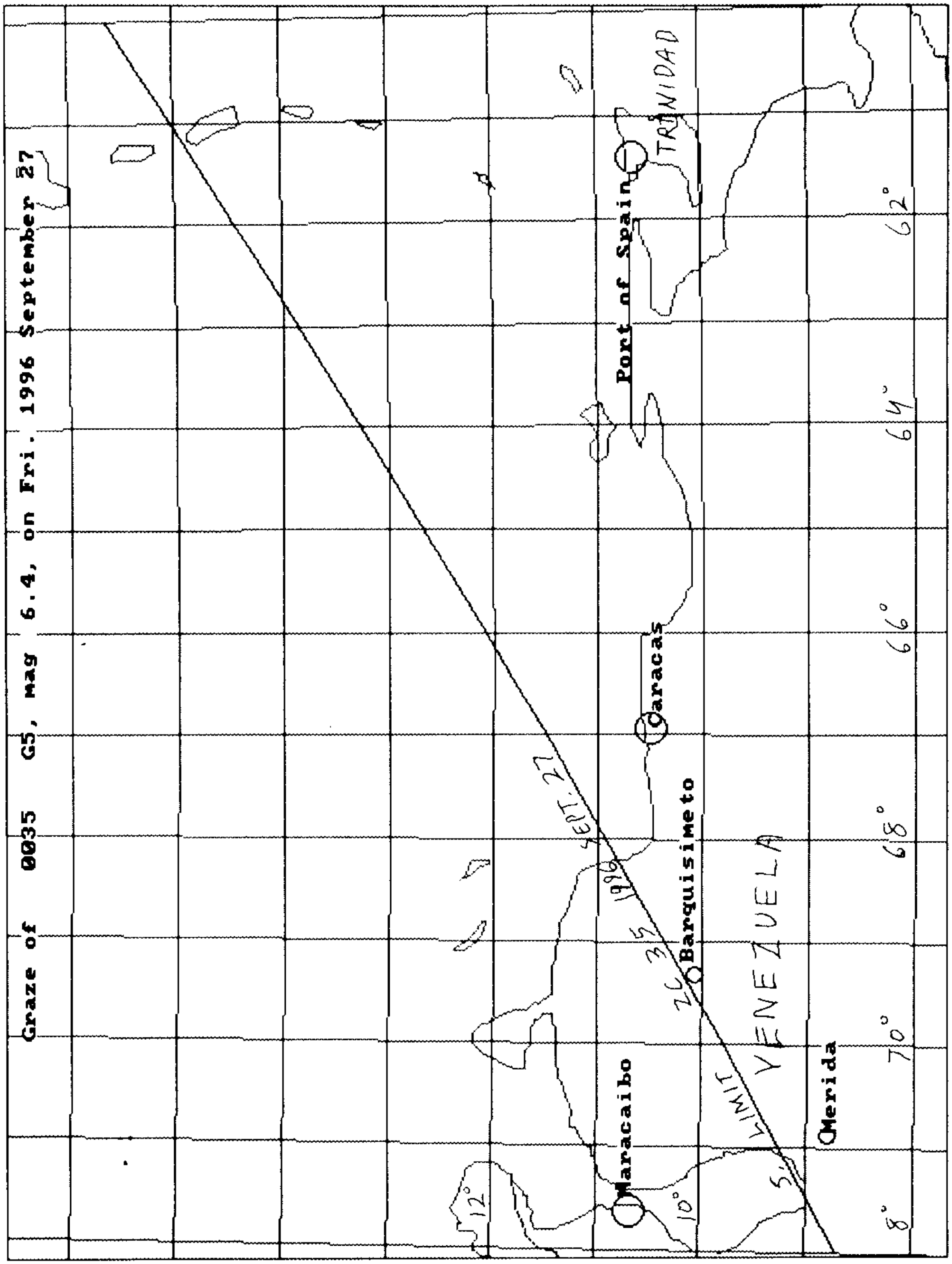

GRAZING OCCULTATIONS, LUNAR ECLIPSE SEP. 27, 1996
LONGITUDE
LATITUDE


Graze of 0035 G5, mag 6.4, on Fri. 1996 September 27
Sacramento
San Jose
Fresno
Tulare
Paso Robles
San Luis Obispo
Delano
Bakersfield
Los Angeles
China Lake
Las Vegas
Kanab
CALIFORNIA
NEVADA
ARIZONA
UTAH
N. LIMIT
34°
36°
38°
120°
118°
116°
114°



Graze of 0035 G5, mag 6.4, on Fri. 1996 September 27
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
WYOMING
COLORADO
UTAH
ARIZONA
NEW MEXICO
Cozad
North Platte
Wray
N. LIMIT
Limon
Cheyenne
Laramie
Denver
Palmer Lake
Colorado Springs
Salida
Montrose
Monticello
Salt Lake City
42°
40°
38°
36°
102°
104°
106°
108°
110°


Graze of 0035 G5, mag 6.4, on Fri. 1996 September 27
Fargo
Duluth
Isphpeming
Iron River
Eagle River
Rhinelander
MICHIGAN
MINNESOTA
Minneapolis
Eau Claire
Lake City
Rochester
Albert Lea
N. LIMIT
WISCONSIN
SOUTH DAKOTA
NEBRASKA
Ord
Norfolk
Sioux City
Cherokee
Spencer
Omaha
Des Moines
IOWA
Madison
Milwaukee
ILLINOIS
Chicago
42°
44°
46°
98°
96°
94°
92°
90°
88°


Graze of 0035 G5, mag 6.4, on Fri. 1996 September 27
Maracaibo
Barquisimeto
Caracas
Port of Spain
Merida
TRINIDAD
VENEZUELA
ZC 35 1996 SEPT. 27
S. LIMIT
12°
10°
8°
70°
68°
66°
64°
62°

and organized by Claudio Costa in Italy. Please send information about any expedition plans either to me or to Rob Robinson (e-mail Robinson@solarsky.net), and we'll get them posted on IOTA's lunar occultation Web site.

GRAZING OCCULTATIONS, LUNAR ECLIPSE 1996 SEP 27

NO.	USNO	SAOPPM D	MAG	%SNL	L	W.U.T. h	m	LONG	LAT
1	ZC 24	109078	6.9	73E	S	1	30.6	40	11
2	ZC 26	109084	7.0	72E	S	1	31.1	54	16
3	ZC 19	109048	7.8	68E	S	1	32.8	-10	-30
4	X 136	109039V	7.8	66E	S	1	33.9	-33	18
5	X 216	109073	8.9	69E	S	1	33.8	41	46
6	X 226	109080	8.9	69E	S	1	34.2	50	44
7	ZC 32	109101	7.3	59E	S	1	37.9	109	-18
8	X 211	109068	9.0	72E	S	1	39.0	30	27
9	X 279	109104	9.2	54E	S	1	44.7	98	-15
10	X 169	P143229	9.4	71E	S	1	53.1	-8	21
11	X 288	P143331	9.6	40E	S	1	57.2	96	-6
12	ZC 35	109119	6.4	22E	S	2	2.7	117	-4
13	X 301	109117X	9.0	19E	S	2	5.5	115	18
14	X32480	P143322	9.9	57E	S	2	8.0	74	-12
15	X 237	P143286	10.0	71E	S	2	10.1	39	-13
16	X 222	P143276	10.2	73E	S	2	10.6	27	18
17	X32464	P143296	10.0	70E	S	2	10.9	48	31
18	X 198	P143252	10.0	73E	S	2	11.0	15	6
19	X 189	P143243	10.0	73E	S	2	11.3	3	7
20	ZC 26	109084	7.0	10E	N	2	11.8	74	62
21	X 193	P143247	10.0	72E	S	2	12.1	0	31
22	ZC 32	109101	7.3	9E	N	2	12.7	99	17
23	X 286	P143330	10.0	21E	S	2	12.8	92	-28
24	ZC 24	109078	6.9	9E	N	2	13.4	45	53
25	X 159	109047	8.1	8E	N	2	13.8	-8	6
26	ZC 19	109048	7.8	8E	N	2	13.9	-7	8
27	X 282	109106	8.6	7E	S	2	14.5	112	-45
28	X 290	109109	8.9	7E	N	2	14.9	117	-17
29	X 282	109106	8.6	10E	N	2	15.2	100	11
30	X 206	109065A	8.6	8E	N	2	16.3	26	-49
31	X 171	109053	8.8	8E	N	2	16.5	-3	-27
32	X 263	109092	8.5	8E	N	2	16.9	79	-30
33	X 292	P143335P	9.9	1E	S	2	19.0	113	-42
34	X32490	P143336	10.0	1E	S	2	19.3	112	-42
35	X 298	109115	9.4	0E	S	2	20.7	114	-40
36	X 324	P143363	10.0	0E	S	2	24.8	119	11
37	X 290	109109	8.9	0E	S	2	29.2	112	-50
38	X 279	109104	9.2	10E	N	2	39.9	84	26
39	ZC 35	109119	6.4	0E	N	2	39.9	126	35
40	X 326	109131	9.1	0E	S	2	47.0	122	-33
41	X 350	109142X	7.9	0E	S	3	1.8	130	14
42	X 352	109144	8.4	12E	S	3	40.2	136	51

The Occultation of δ^3 Tauri by (121) Hermione

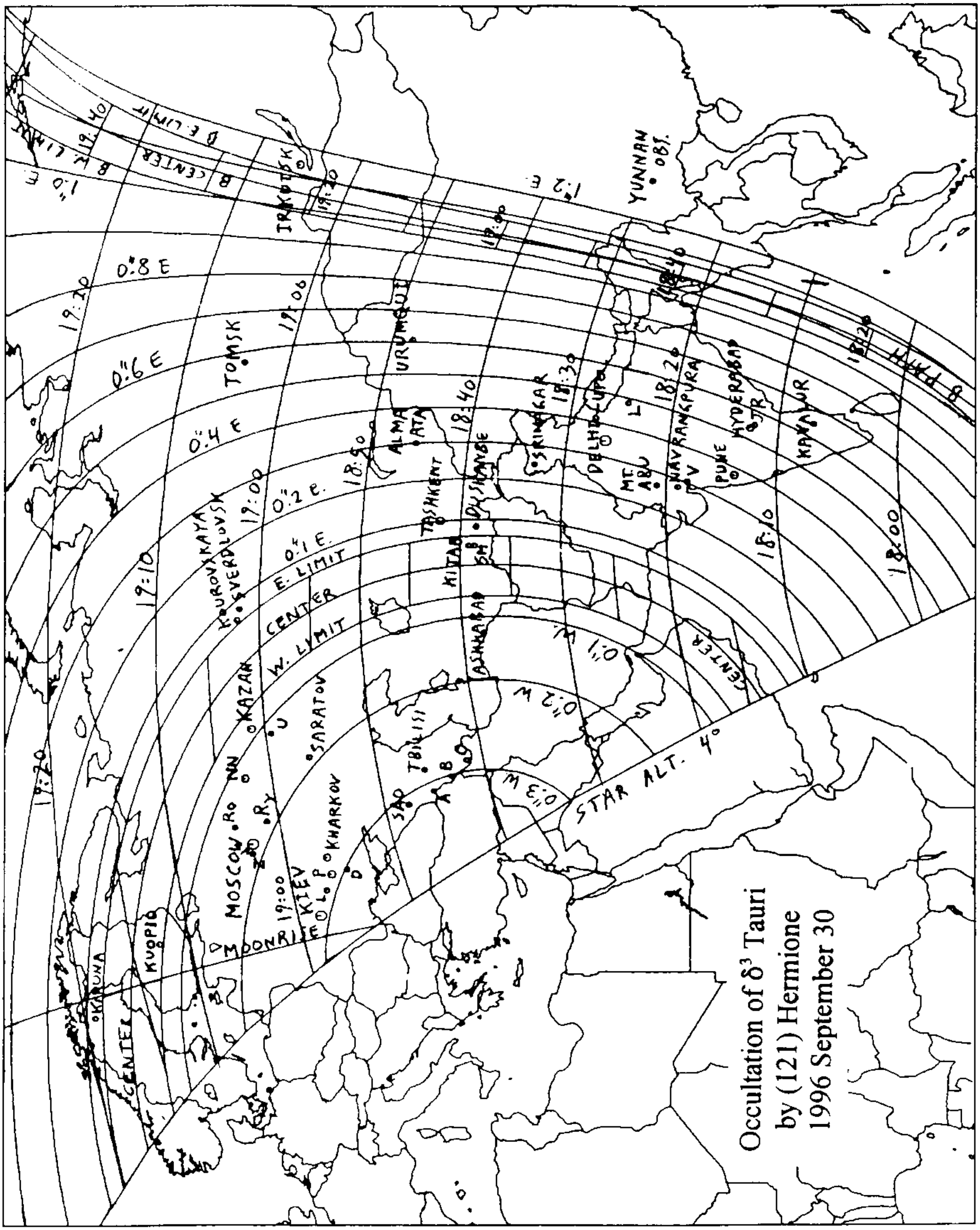
David W. Dunham

On September 30th, the 217 km asteroid (121) Hermione will occult 4.3-mag δ^3 Tauri = ZC 658 = SAO 93923 = PPM 119872, spectral type A2. This is the brightest star occulted by a large (greater than 200 km in diameter) asteroid since the 1983 May occultation of 1 Vulpeculae by (2) Pallas. Moreover, Hermione is near a stationary point so that its motion will be unusually slow, so that even timings accurate to only a second will be valuable for determining the asteroid's outline. Edwin Goffin's chart for this unusual event is reproduced here since few **ON** readers will have seen it previously.

Normally, this would be an easy naked-eye event in an area with low light pollution. But the 84% sunlit waning Moon will be only 12° from the Hyades and the altitude above the horizon will be relatively low along the path, so binoculars or opera glasses will be needed to reliably time this occultation. But even many who are not amateur astronomers have such optical aid that could be used to observe this event, so it would be worthwhile for astronomers in the region of possible visibility of this occultation to publicize this event in the science sections of newspapers and news magazines. In January 1991, Dr. Wang Sichao at Purple Mountain Observatory organized such an effort in China for the naked-eye occultation of γ Geminorum by (381) Myrrha. Over 3000 observers watched the star, but because the asteroid was small and the path prediction was in error by over 0.″5 (about 700 km on the ground), only 4 of them saw the actual occultation. The success of the Hermione effort, and the resolution of detail of Hermione's outline, will depend on the largest possible number of observers. Simple timing techniques need to be described, as well as all-sky charts showing the Moon, 1st magnitude stars and planets, and the Hyades at the time of the event to help potential observers with little or no prior knowledge of the sky locate the target star. Timings could be done relative to a synchronized national AM standard band radio broadcast, if someone organizing the event can make a master tape by simultaneously recording that broadcast and the Russian or Chinese shortwave time signals broadcast at or near the standard frequencies of 5 or 10 megahertz. Some suitable material for local use will be prepared when I get a chance, and can be obtained upon request to me at David_Dunham@jhuapl.edu; include a telephone number where you can receive a fax message in your request.

The regional chart shows the area where the star will be 4° or more above the horizon at the time of closest approach. Edwin Goffin's nominal path, including its center, and the eastern and western limits, are shown with time lines at 5 minute intervals. Hermione has a rather well determined orbit and the PPM position of such a bright star should be relatively accurate, so I expect that this prediction is accurate to about ±0.″3 or ±2.5 pathwidths. However, the error could be larger, and possible satellites of Hermione could occult the star at greater distances, so I am recommending that observers in areas even 1.″2 from the central line, that is, as far east as India, western China, and Irkutsk, monitor the star for a possible event. This region is shown on the map, with lines plotted at shift values from the nominal path at 0.″1 intervals from 0.″3 west (0.″4 west misses the Earth's surface) to 1.″2 east, and the time of closest approach of the asteroid to the star is shown at 10 minute intervals of Universal Time. There could also be an error in the time of the event, so observers should watch for a 15 minute period (even more could be useful) centered on the time of closest approach for their position, and should be especially attentive for an occultation within ±4 minutes of the predicted closest approach. The map shows the locations of major cities and observatories in India, Russia, and other F.S.U. countries (I don't have the coordinates of their boundaries that are needed to add to my boundaries database), especially those farther from the ocean and national borders that are plotted. These locations are listed in the table; in many cases, only the first letter of the name of the station could be plotted on the map for legibility.

The star is a triple star. The 7.5 mag. B component is 1.″5 away and is expected to be occulted along the path shown extending from the Bay of Bengal to Siberia, passing just west of Irkutsk. But

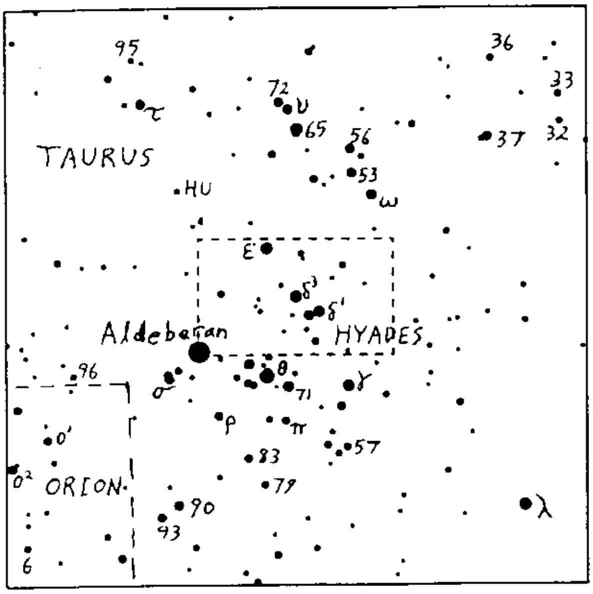


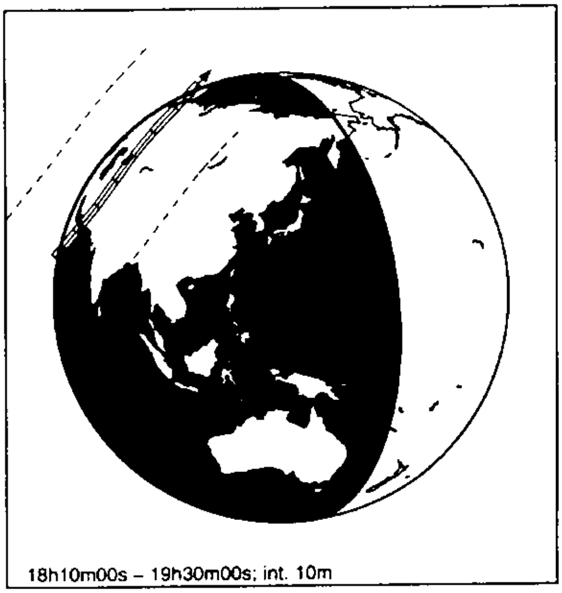
Occultation of δ^3 Tauri
by (121) Hermione
1996 September 30

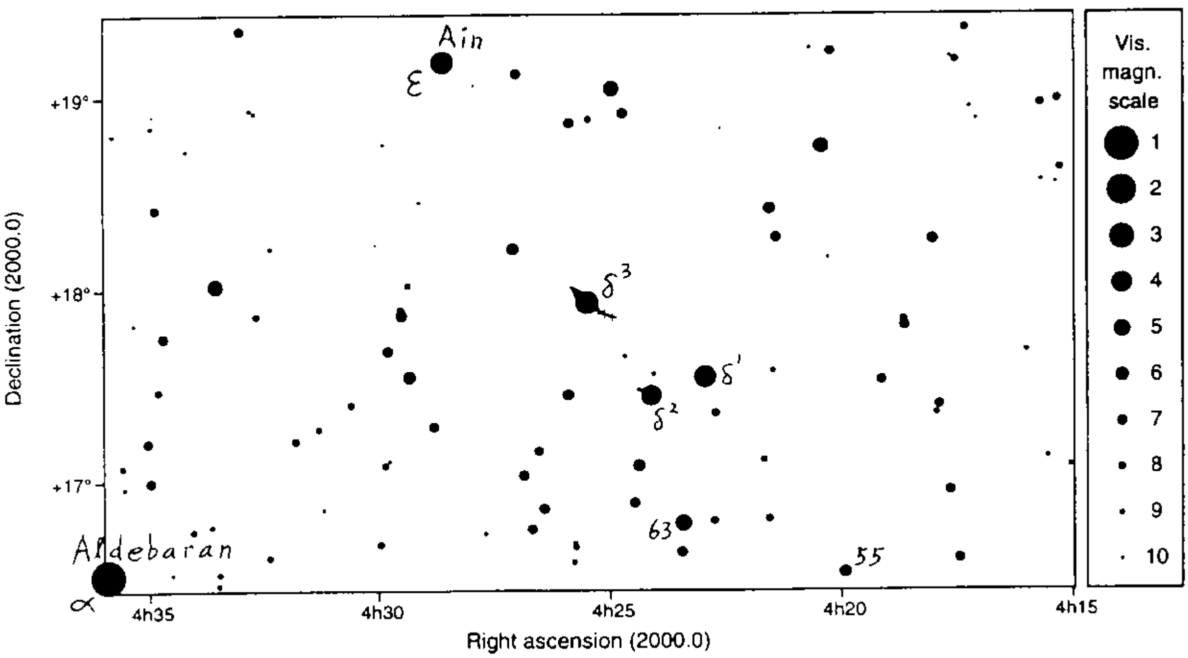
121 Hermione – PPM 119872 = δ³ Tauri

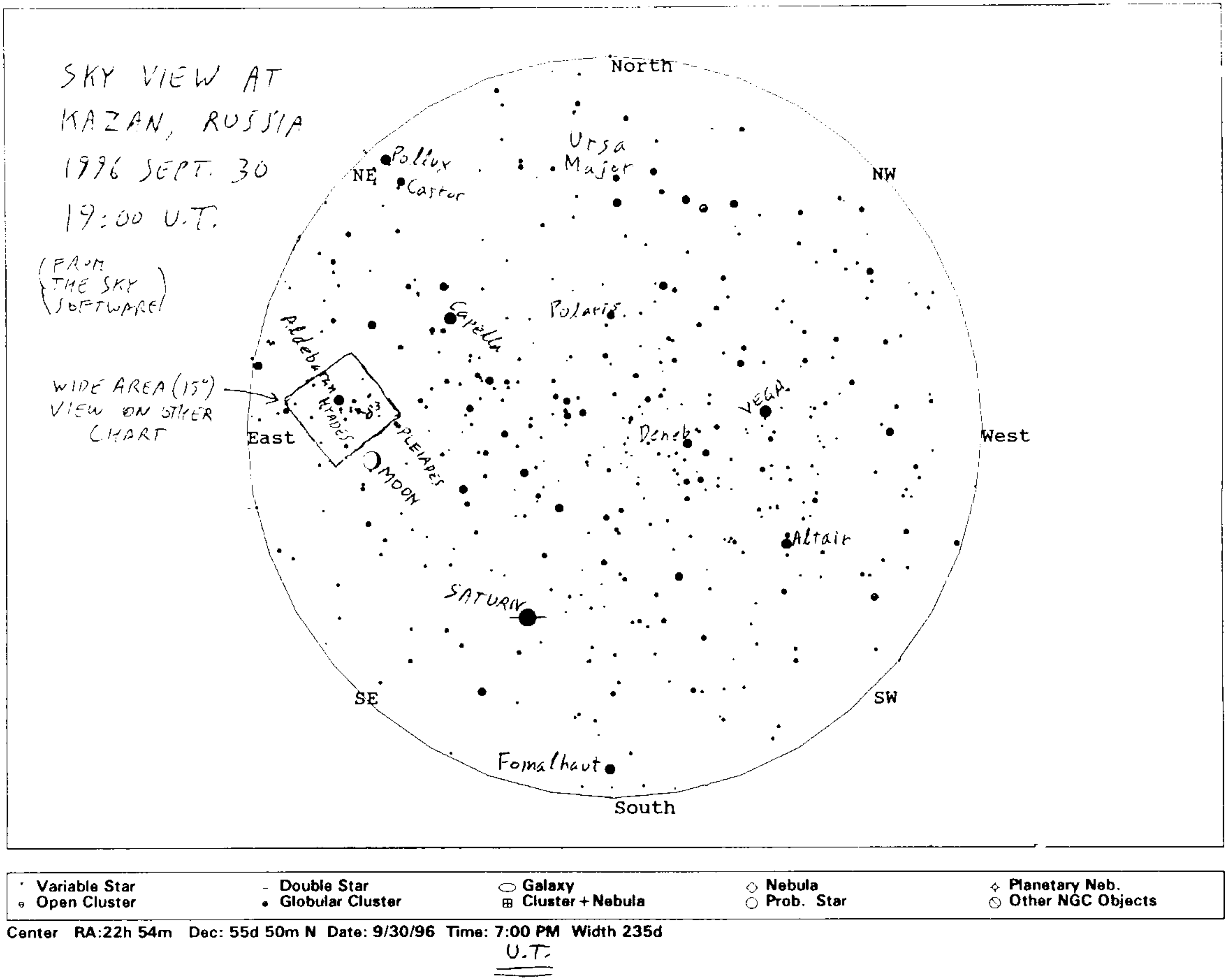
1996 sep 30 18h47.5m U.T.

Planet :			Star : SAO 93923	Source kat. PPMd
V. mag. = 12.52	Diam. = 217.0 km = 0.12"		α = 4h25m29.355s	δ = +17°55'40.98"
μ = 2.97"/h	π = 3.65"	Ref. = MPC24085	V. mag. = 4.29 sp. A2	Ph. mag. = 4.40
Δm = 9.0	Max. dur. = 150.2s		Sun : 120°	Moon : 12° , 84%








SKY VIEW AT
KAZAN, RUSSIA
1996 SEPT. 30
19:00 U.T.
(FROM THE SKY SOFTWARE)
WIDE AREA (15°) VIEW ON OTHER CHART
North
NE
NW
East
West
SE
SW
South
Pollux
Castor
Ursa Major
Polaris
Capella
Aldebaran
HYADES
δ3
PLEIADES
MOON
VEGA
Deneb
Altair
SATURN
Fomalhaut
Variable Star
Open Cluster
Double Star
Globular Cluster
Galaxy
Cluster + Nebula
Nebula
Prob. Star
Planetary Neb.
Other NGC Objects
Center RA:22h 54m Dec: 55d 50m N Date: 9/30/96 Time: 7:00 PM Width 235d
U.T.

since the 4.3 mag. primary would remain visible in case of an occultation, there would be only a few percent drop in brightness of the star, making observation of that event possible only with sensitive photometers or CCD systems. It also means that there will not be a 9 magnitude drop if the primary disappears; instead, the B component will remain visible, so there would appear to be a drop in brightness of "only" a little more than 4 magnitudes, still an easily seen remarkable event. An observatory within the occultation path could have up to 2.5 minutes of detailed observation of B unencumbered by the usually overwhelming light of A. There is also an 8.5 mag. C component about 10″ away, but its occultation path is expected to miss the Earth's surface a short distance above eastern Europe.

With such a large difference in brightness between the star and Hermione, effective astrometry for this event will be extremely difficult, especially with CCD equipment. At least, with the slow motion, the objects will appear in the same CCD field for more than a week before the event, possibly before moonlight might interfere, so astrometrists might have time to try spot filters, diffraction gratings, or other devices to form measurable images of both objects. Perhaps the best chance will be observations now planned with the Carlsberg Automatic Meridian Circle (CAMC); similar observations for previous events have resulted in predictions within 0″.1 of the truth, to about a path width in this case. But with moonlight interference during the few days before the occultation and the objects crossing the meridian in twilight up to two weeks or less before the event, there will not be very many nights when observations can be made so success is far from guaranteed. ι

1996 Lunar Occultations of Nova Sagittari

David W. Dunham and Mitsuru Sôma

The recently discovered Nova Sagittarii 1996, reported at mag. 10.6 in IAU Circular 6443, is undergoing a series of lunar occultations. High-speed photoelectric or CCD observations of these occultations in two or more colors might be useful for studies of the nova; as far as I know, an occultation of a nova has never been recorded. Sôma has computed details of the occultations at the National Astronomical Observatory in Mitaka, Japan. Dr. Sôma's maps showing the regions of visibility of the 1996 occultations are on the next page. The location of the sunset terminator is only approximate. The area where the event occurs after sunset is on the eastern sides of the maps, the region becoming smaller later in the year as the lunar percent sunlit decreases. The series will continue through 1997, with events during the first half of the year occurring during the waning phases (with emersions on the lunar dark limb). In IAU Circular 6450 (Aug. 14), the J2000 position of the nova is given as R.A. 18h 23m 42.501s, Dec. -18° 07′ 14″.80. Unfortunately, its magnitude on Aug. 14th was reported as 12.2, so it is fading, and the occultations described below are likely to be observable only with large telescopes at professional observatories, unless the nova unexpectedly brightens.

In Dr. Sôma's predictions below, the times and circumstances of the star's disappearance on the dark advancing side of the waxing Moon are given. PACBL is the position angle of the center of the bright limb (direction to the Sun from the Moon's center). The **a** and **b** factors are the linear changes in the event time relative to a change in the observer's position in longitude (positive eastward) and latitude, respectively, from the station. Predictions for other stations can be obtained upon request to Dr. Sôma, e-mail Somamt@cc.nao.ac.jp. The times may be in error by several seconds since the lunar profile has not been taken into account; predictions including the effect of the profile will be available soon. All events below are immersions (disappearances), except at Brasilia on Sep. 21, where the event is a grazing occultation; multiple occultations of the star by lunar mountains could occur any time within ±3 minutes of the given time.

Aug. 24, Moon 77% sunlit, PACBL 271.1

Stations	UTC h	m	s	P.A. °	Star alt. °	Sun alt. °	a m/o	b m/o
Cape Town, So.Africa	16	48	55	164.3	57.4	-6.3	0.5	-8.4
Sutherland, S.Africa	16	42	5	148.5	58.5	-6.6	1.2	-4.4
Hartebeespoort,S.Af.	16	36	3	113.0	64.9	-10.5	2.0	-1.6
Colombo, Sri Lanka	18	55	30	23.6	24.7	-72.0	-0.2	3.0
Pottuvil, Sri Lanka	18	55	7	27.8	23.1	-71.6	-0.1	2.5
Lembang, Java, Indon.	18	54	2	115.2	3.5	-59.3	0.3	-0.6

Sep. 21, Moon 57% sunlit, PACBL 268.1

Stations	UTC h	m	s	P.A. °	Star alt. °	Sun alt. °	a m/o	b m/o
Quito, Ecuador	1	8	20	43.6	61.3	-30.6	2.0	2.5
Merica, Venezuela	1	51	2	5.8	41.3	-48.0	-1.1	7.7
Caracas, Venezuela	1	59	6	3.7	35.4	-53.3	-1.7	8.2
La Paz, Bolivia	1	20	51	116.1	55.2	-42.2	2.5	-0.9
Tarija, Bolivia	1	43	5	154.4	47.2	-48.5	4.5	-7.2
Brasilia, DF, Brazil	2	14	5	168.9	23.4	-70.5	---	---
Feira de Santana,Br.	2	18	54	166.7	13.0	-78.2	14.3	-37.3
Fortaleza, Brazil	1	59	51	110.1	14.6	-82.8	0.8	-0.6
Recife, Brazil	2	7	58	136.6	10.6	-82.6	1.1	-2.0

Oct. 18, 7h U.T., Moon 33% sunlit

(This occultation occurs in the central Pacific Ocean south of Hawaii where there are no known observatories, so no predictions are listed)

Nov. 14, Moon 14% sunlit, PACBL 262.0

Stations	UTC h	m	s	P.A. °	Star alt. °	Sun alt. °	a m/o	b m/o
Pottuvil, Sri Lanka	13	41	34	359.8	21.0	-22.3	-3.0	9.9
Lembang, Java, Indon.	13	23	46	101.9	5.3	-37.0	0.2	-0.1

Dec. 11, Moon 2% sunlit, PACBL 250.6

Stations	UTC h	m	s	P.A. °	Star alt. °	Sun alt. °	a m/o	b m/o
Brasilia, DF, Brazil	21	32	40	100.0	13.8	-0.3	0.4	0.2
Sao Paolo, Brazil	21	35	12	132.3	14.0	1.4	0.8	-0.9
Belo Horizonte, Brz.	21	34	43	120.4	10.8	-2.4	0.5	-0.4
Rio de Janeiro, Brz.	21	37	6	134.7	10.4	-2.2	0.7	-1.0
Feira de Santana,Br.	21	35	22	99.1	3.9	-10.2	0.1	0.1
Fortaleza, Brazil	21	38	28	71.2	0.1	-15.0	-0.2	0.6

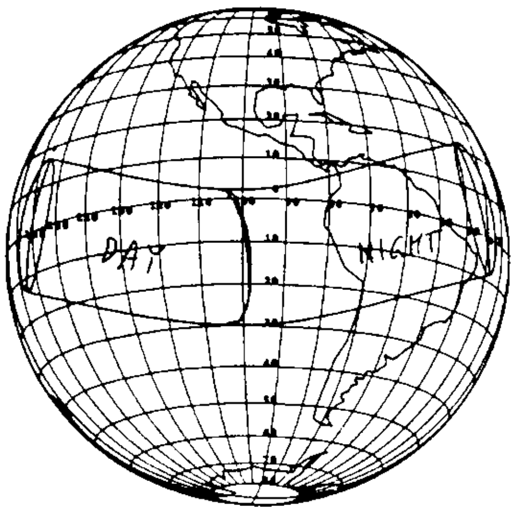
Notes from the Secretary and Treasurer

Craig A. & Terri A. McManus

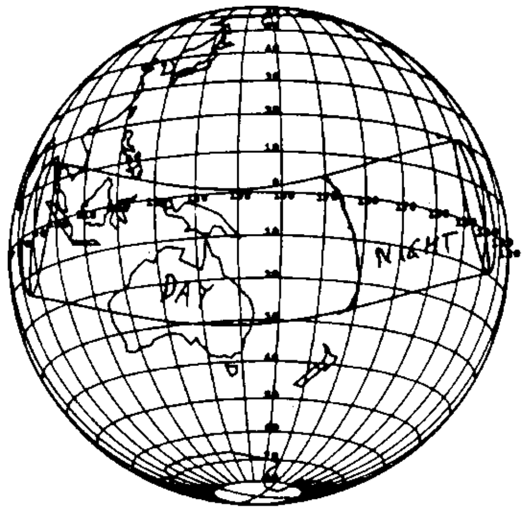
We are hoping that with the new publication schedule of the Occultation Newsletter we can stabilize the finances and renewals of IOTA. We are not in any financial trouble. However, we still have the Occultation Manual to produce for all members but we should be able to handle that and all the normal business needed.

A note to our non-United States members: if you send us a check or money order NOT drawn on a US bank, it is costing IOTA $8.00 US to process EACH check or money order through the banks here in Topeka. We have lower costs for Master Card and VISA, though these are still fairly high. We may need to start sending back any renewals that are not drawn on US banks. We are sorry for the inconvenience but we cannot afford to lose 25% of those dues to bank fees.

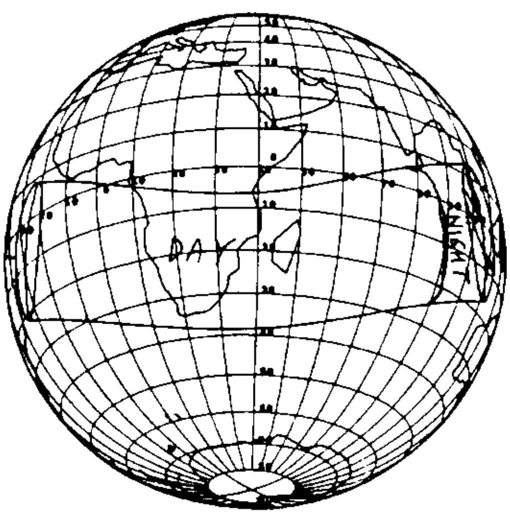
Occultation of Nova Sgr 1996
1996 9 21



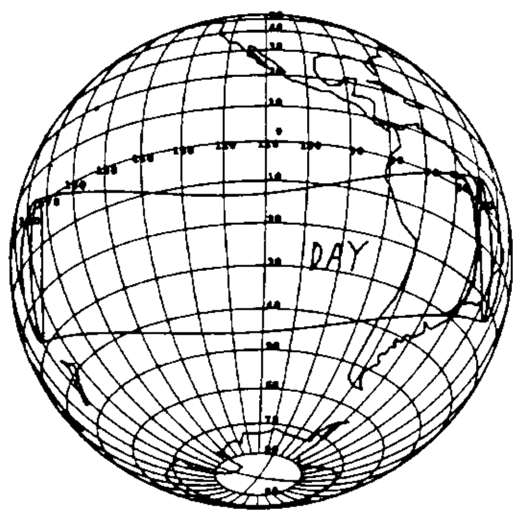
Occultation of Nova Sgr 1996
1996 10 18



Occultation of Nova Sgr 1996
1996 11 14



Occultation of Nova Sgr 1996
1996 12 11



Please look at the mailing label that comes on your ON. In the upper right hand corner of the label is your EXPIRATION ISSUE. If it reads "Vol. 06 No. 11" that means that your subscription (membership) has expired with the production of this issue. Each label will follow the same format. Subscriptions and memberships are for four issues of the ON. For example, if your membership expiration occurs with the issue Vol. 6 No. 12, you will receive the next issue and then your subscription (membership) will be due. With a consistent production schedule for the **ON**, you will need to keep your membership current to receive the predictions on time. We stamp each envelope with the message "LAST ISSUE TIME TO RENEW" when your subscription expires. We have also sent reminder postcards to people that have not renewed within a month or so after the issue comes out. With the bimonthly publishing schedule that Rex L. Easton is using to get us caught up, it is doubly important that you renew on time to maintain your subscription or membership. The more people that renew without being reminded saves the organization money on postage and postcards, so please check your label regularly.

Some members have complained that Terri and I do not answer many of the e-mail messages that we receive. This is for a simple reason: it costs IOTA a minimum of $0.50 US to send a message. We answer those messages that we feel need an answer. We do not acknowledge graze reports, address changes, or copies of e-mail that have been sent to other people. We get around forty or fifty messages every week. The cost to answer all of these would be prohibitive. Please remember that all of the work we do for IOTA is done in our basement, on our (admittedly old) computer, and over our phone line. We cannot afford a new computer at this time. When we can, we will be able to use all the great new software and Internet access. ι

Grazing Occultation Observations

Richard P. Wilds

We begin this month's report once again with some housekeeping chores. When reporting grazes keep in mind you can mail them to me in the following forms: 1. on IOTA report forms, 2. on 3.5 floppy disk, 3. on 5.25 floppy disk, or by e-mail.

Please remember to include all the information found in the graze list. A large number of graze reports are not being published due to a lack of appropriate information. If you sent me a report and it is not in the list, then I would suggest careful reading of the following. The shift is the most important information. If the shift is not included, then your report can not be included. The reason for this is that without the shift, then your report is just not helpful to the next graze team to go out and observe. Many observers send me a copy of their predictions. This is excellent and it is even better if you have the observing sites plotted on the profile as they were predicted before the event and compare this with what was observed. This is, of course, the information needed to determine the shift. The predictions are also a help in preparing the "Stellar Cross Reference." I have access to a vast array of astronomical databases and can track down many objects, but the predictions just make this job easier. Also remember the "PP" column on my report is not a column on the IOTA report form. This is a temporary fix to the current problem of

Lunar Grazing Occultation Results

UT Date yy/mm/dd	V P	P P	Star #	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap Cm	Organizer	Sh	N S	WA	B
93/01/25	V	A	146239	6.3	9	2.0S	Millersburg, Pennsylvania USA	3	27	1	10	Wayne H. Warren Jr.	0.7	S	171	-6.30
94/02/20		A	77057	6.2	66	8.0N	Methven, New Zealand	5	5	2	20	R. Dickie	0.3	N	10	1.60
94/10/12		A	163481	3.2	62	-6.5N	Lambertville, Michigan USA	2	8	1	20	Richard Walker	0.2	N	354	-5.81
95/03/11		A	95913	7.7	66	12.0N	Lamoni, Iowa USA	2	8	2	15	Robert Sandy	0.0		11	6.40
95/04/27		A	117751	5.3	63	4.6N	Pine Prairie, Texas USA	3	8	1	11	Wayne Hutchinson	0.7	S	2	6.20
95/06/09		R	157923	1.0	79	3.1S	Dudleyville, Arizona USA	3	24	1	12	Jim Stamm	0.0		175	2.09
95/07/23		A	94183	7.6	16-	2.2N	Pompono Beach, Florida USA	2	16	2	15	Hal Povenmire	0.1	S	356	4.81
95/07/24	V	R	94628	4.2	10-	1.7S	Estoi, Portugal	2	13	2	10	Rui M.D. Goncalves	0.0		177	5.72
95/08/08		A	161754	6.0	90	15.0S	Hearne, Texas USA	1	1	2	21	Wayne Hutchinson	0.3	N	170	-5.50
95/08/19	V	A	94036	6.3	38-	4.0N	Manchester, Tennessee USA	3	11	1	6	Scott Degenhardt	0.0		357	4.80
95/08/22		A	96541	8.5	14-	-1.5N	Evans City, Pennsylvania USA	1	5	1	25	John Holtz	0.8	S	356	6.91
95/09/05		A	162512	4.0	80	13.0S	Pleasant Hill, California USA	1	15	1	15	David Sims	0.3	S	170	-6.00
95/09/05	V	A	162512	4.0	80	13.0S	Taft, Texas USA	9	65	1	12	Rick Frankenberger	0.4	S	170	-6.00
95/09/05		R	162512	4.0	80	13.0S	Pelican Lake, Texas USA	5	12	1	15	Wayne Hutchinson	0.4	S	170	-6.00

Lunar Grazing Occultation Results

UT Date yy/mm/dd	V P	P P	Star #	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap Cm	Organizer	Sh	N S	WA	B
95/09/05		A	162512	4.0	80	13.0S	Taylorsville, Mississippi USA	3	10	1	15	Benny Roberts	0.3	S	170	-6.00
95/09/05		A	162512	4.0	80	13.0S	Hyco Lake, North Carolina USA	4	22	1	10	Mark Lang	0.3	S	170	-6.00
95/09/05		A	162512	4.0	80	13.0S	Barhamsville, Virginia USA	1	6	1	20	Robert H. Stewart	0.3	S	170	-6.00
95/09/17		A	94830	6.9	47-	3.9N	Rasquera, Spain	3	4	2	12	David Fernandez	1.0	N	357	6.31
95/09/17		A	94830	6.9	47-	3.8N	Vilafranca del Penedes, Spain	3	4	1	14	Carles Schnabel	1.0	N	357	6.30
95/09/17		A	95070	7.1	46-	4.2N	St. Augustine Beach, Florida USA	1	4	1	15	Hal Povenmire	0.0		356	6.27
95/09/20		R	97913	6.4	18-	9.6N	Pasco, Washington USA	5	18	1	15	A. George, TCAC	0.3	N	355	7.16
95/10/01		A	162001	6.6	54	5.8S	Orangeburg, South Carolina USA	1	2	1	15	Hal Povenmire	0.2	N	175	-5.82
95/10/14		A	94649	5.5	73-	6.0N	Dearborn, Missouri USA	3	7	3	15	Robert Sandy	0.8	S	357	6.30
95/10/15		A	95883	7.4	62-	5.2S	Stoneham Lake, Texas USA	5	10	1	21	Wayne Hutchinson	0.0		188	6.70
95/10/18		A	98267	4.3	34-	2.6N	Etowah, Tennessee USA	1	3	1	15	Hal Povenmire	0.3	N	356	6.85
95/10/18		A	98267	4.3	34-	1.0N	Research Triangle Park, NC USA	3	18	1	10	Mark Lang	0.3	N	356	6.85
95/10/31		R	145382	5.8	60	5.0S	Pyramid, South Africa	7	4	1	11	Tim Cooper	1.0	N	176	-5.50
95/11/09		A	93923	4.3	97-	0.9N	Tucson, Arizona USA	2	3	1	20	Jim Stamm	2.0	N	358	5.00
95/11/09	V	A	93923	4.3	97-	14.0N	Lancaster, Kansas USA	3	3	1	20	Walt Robinson	0.5	S	357	5.00
95/11/26		A	162512	3.9	15	4.6S	Burdette, Arkansas USA	2	15	1	20	Benny Roberts	0.3	S	171	-6.00
95/11/26	V	A	162512	3.9	15	4.5S	Hopkinsville, Kentucky USA	3	19	1	6	Scott Degenhardt	0.2	S	171	-6.00
95/11/26	V	A	162512	3.9	15	4.3S	Oxford, Kentucky USA	3	30	1	18	HART--R. Wilds	0.2	S	172	-5.98
95/11/26		A	162512	3.9	15	4.3S	Oxford, Kentucky USA	2	27	1	15	Hal Povenmire	0.2	S	172	-5.98
95/11/29		R	146210	5.3	53-	2.0S	Bundaberg, Queensland Australia	4	3	1	20	Phillip Kearney	1.0	N	181	-5.40
95/12/15		A	138298	4.5	49-	2.8S	Tisonia, Florida USA	1	6	1	15	Hal Povenmire	0.4	S	182	3.60
95/12/26		A	145768	6.6	21	0.1S	Melbourne, Florida USA	2	14	2	15	Hal Povenmire	0.0		157	-5.11
95/12/28		A	146891	7.9	42	5.0S	Catalina, Arizona USA	1	6	1	20	Jim Stamm	0.6	S	176	2.50
96/01/29		R	93897	3.9	73	10.4N	Chemnitz, Germany	7	23	1	8	Dietmar Buttner	0.2	S	10	5.40
96/02/12		A	159280	5.9	50	5.3S	Waverly, Georgia USA	2	11	1	15	Hal Povenmire	0.8	S	184	-3.18
96/02/13		R	159807	6.4	40-	2.5S	Sabadell, Spain	3	6	3	21	Carles Schnabel	0.0		182	-3.95
96/03/30		R	98267	4.3	77	10.0N	Port Perry, Ontario Canada	3	29	1	15	Guy Nason	0.4	N	5	6.78
96/04/04		R	X18897	8.9	00	?	Perafita, Spain	2	10	3	20	Carles Schnabel	0.0		181	1.05
96/04/21	V	A	93897	3.9	9	4.6N	Rock Harbor, Florida USA	5	67	1	11	Hal Povenmire	0.2	N	12	5.45
96/05/21		A	96015	5.1	11	10.9N	Suffolk, Virginia USA	2	4	1	20	Robert H. Stewart	0.0		8	7.25

Stellar Cross Reference			Lunar Topography
SAO #	ZC #	Other Ref.	WATTS Charts--Marginal Zone of the Moon
146239	3326	207B. Aqr	The Mountain Doerfel B and The Crater Zeeman.
77057	784	108 Tau	The Crater Froalich.
163481	2969	9 B Cap	Between the Craters Gioja, Byrd and de Sitter.
95913		X 9459	Between the Craters Rozhdestvenskiy, Lovelace, Froalich and Merril.
117751	1410	6 h Leo	Between the Craters Hermite and Rozhdesyvenskiy.
157923	1925	Spica - Alpha Vir	Over the Crater Drygalski and through the Mountains M3 and M1.
94183		X 6273	The Crater Plaskett.
94628	832	119 CE Tau	Through the Mountains M1 and Leibnitz A as well as over the Crater Cabeus.
161754	2715	89G. Sgr	The Mountain Doerfel B and the Crater Zeeman.
94036	697	SZ Tau	The Crater Plaskett.
96541		X10522	The Crater Plaskett.
162512	2826	Rho Sgr	The Mountain Doerfel B and the Crater Zeeman.
94830	871	PPM121357	The Crater Plaskett.
95070	904	PPM121690	The Crater Plaskett.
97913	1281	84B. Cnc	The Crater Plaskett.
162001	2755	PPM235258	The Craters Zeeman and Ashbrook and the Mountains M4 and M5.
94649	836	120 Tau	The Crater Plaskett.
95883	1011	PPM122739	Between the Craters Scott and Demonax.
98267	1341	65 A Cnc - Acubens	The Crater Plaskett.
145382	3133	19 Aqr	The Craters Zeeman and Ashbrook and the Mountains M4 and M5.
93923	658	68 Tau	The Crater Plaskett.
162512	2826	Rho Sgr	Through the Mountain Doerfel B and over the Crater Zeeman.
146210	3320	63 K Aqr	Through the Mountains M4, M5, over the Crater Wiechert and the Mountain M6.
138298	1685	91 U Leo	The Mountain Leibnitz A, the Craters Faustini and Nobile, and the Mountain Leibnitz B.
145768	3216	PPM205809	Between the Mountains Doerfel z and y and the Craters Hausen and Doerfel.
146891		PPM 174405	Through the Mountains M3 and M1 and the Crater Cabeus.
93897	648	61 delta Tau	Between the Craters Froalich and Merril.
159280	2209	32 Lib	Between the Mountains Leibnitz B and M6.
159807	2331	88B. Sco	Between the Mountains Leibnitz A and B and M6, and the Craters Faustini and Wiechert.
98267	1341	65 A Cnc - Acubens	Between the Craters Rozhdestvenskiy and Lovelace.
X18897		PPM195924	Between the Mountains Leibnitz A and B, and the Crater Faustini.
93897	648	61 delta Tau	Between the Craters Froalich and Merril.

having several different prediction programs around while we are in a state of transition from the USNO. However, the "PP" information is needed just like the shifts, if your reports are to be useful to the next graze team going out to make an observation. I would like to thank [illegible] for making this report a valuable tool to graze teams world wide.

You may notice our new format in the graze tables. The major item of change is the extension of the second table to include the Lunar topography of each graze. Because of this change I will discuss only those grazes which have other information of note. This will most often include the comments from the graze leader about interesting aspects of the current expedition. We begin with the 25 January 1993 report of Mr. Wayne H. Warren Jr. which I received via e-mail from Dr. David Dunham to Mr. Rob Robinson to Mr. Robert Sandy to me. I believe this shows that it is never too late and you can get it there just about any possible way. I gleaned the 20 July 1994 report from Mr. R. Dickie of New Zealand from the graze reports by Dr. Graham L. Blow (e-mail: Graham.Blow@actrix.gen.nz) in the Circular for July 1996 by the Occultation Section, Royal Astronomical Society of New Zealand. We continue with the 24 July 1995 report of Mr. Rui M.D. Goncalves (e-mail: Geomias@skull.cc.fc.ul.pt). He says the graze was very beautiful and he noted that it was still done without Joaquim Garcia who is still recovering from his heart attack. A most interesting fact is that he videotaped the graze using a CCD video camera attached to a 4" Newtonian Reflector. Along with his report in the proper format, Mr. Goncalves included a map of Portugal showing the graze path, a copy of the prediction and profile, and the location of his observers and their results on the profile. I received the same type of report from John Holtz for the 22 August 1995 graze.

In my last article we had several expeditions to observe grazes of Spica. This time we have several successful expeditions to observe grazes of the star Rho Sagittarius. In the 09/05/95 series the teams did well even though they were going for a fairly narrow graze zone. This is why some of the teams had somewhat low station to timing ratios. Their work was important, though, because the next series for 11/26/95 had the advantage of hitting the same narrow area of the moon. However they had the advantage of the lessons of the 09/05/95 crew. The 11/26/95 teams had better ratios due to this advantage. We have not received all of the reports yet for the 11/26/95, but we have noted one interesting story. Four teams met at the same location at Oxford, Kentucky, even though most teams did not know the others were suppose to be there. HART arrived on the site two hours before the graze after traveling from Kansas. We set up two video systems even though we only had all the parts for one. I had to hand hold my CCD since we only had one T-adapter. I was five miles from the others at a nearby town and had the town turn out to watch and videotape my effort. Keeping the CCD in the focal plane was so difficult I never saw the graze myself, but only found I had taped 16 events when I viewed the tape several days later. However, back at the sites occupied by the McManuses they were having excitement of their own. With a half hour to go until the graze their quiet graze road turned into a scientific main street. The Dunhams and Wayne Warren, Jr. showed up from Maryland, the Povenmires showed up from Florida, and a mystery team showed up from Missouri. The mystery team left moments after the graze, and only the name "St. Louis" had been heard by one of our team. The Dunhams, Povenmires, and HART met after the graze as we began to realize the presence of each team. We celebrated with dinner in town. If you want to get a quick view of several frames of the duplicity of Rho Sgr on one of the video series from Scott Degenhardt, then check into his web site at http://gus.phy.vanderbilt.edu/~dega/rho1.html

The 09/20/95 graze led by Anthony J. George Jr. of the Tri-Cities Astronomy Club of Richland, Washington was the first expedition by this team. He writes: "It was a beautiful morning, quite clear and luckily not windy. Just the day before, the winds were quite strong in the area. Our observers did not have any troubles, since we are in a somewhat rural location. One observer had a farmer come over and ask what we were up to. He let him look through the telescope at Saturn, which impressed him quite a bit and then was on his way." Doesn't this sound like a typical graze. It never surprises me when something happens in the middle of the night on a graze. Mr. George also included a reduction of his graze with his report. Dietmar Buttner of Germany sent a report on diskette of their 01/29/96 graze. His report also included a reduction of the observations by Henk Bulder, Dr. Bredner, and Mr. Buttner's team.

REMEMBER to apply the following shifts, which past experience has shown to be useful when using the ACLPPP (version 80N) and Riedel Grazereg profiles: See your hemispheric grazing occultation supplement for 1996. 1. Northern limit--Page 9. 2. Southern limit--Page 10. ι

New Double Stars

Tony Murray

This is the first article on new double stars since the last appeared in **ON 6(8)**. We have continued to receive reports from observers, but this article will be devoted solely to the new information published in Georgia State University Center for High Angular Resolution Astronomy's CHARA Contribution No. 3 (1995 March), "Catalog of Photoelectric Measures of Occultation Binary Stars," by Brian Mason.

Mason has requested a copy of IOTA's Catalog of Double Stars of the Moon's Occultation Zone". He was scheduled for four nights at the four-meter telescope at Cerro Tololo, Chile, in March 1996. He hopes to complete his interferometrical survey of occultation double stars during his time at Cerro Tololo, and to find good candidates for observation in our catalog.

Mason's catalog lists 784 observations of 365 multiple stars. Most of these are already included in IOTA's catalog. Table 1 on the following pages lists the 34 double stars from Mason's catalog that will now be included in our list. Most of the 34 had been discovered and reported in the literature but were somehow overlooked. Three were discovered recently and only lately have been reported. Table 2 lists four previously discovered double stars that were already in our catalog. Recent photometric measures of the four provide new data and result in new codes. Three of these four, SAO 76140, SAO 76155, and SAO 726336 have been observed photometrically during their second occultation series since their discovery. These later measures were evidently done with better equipment producing better signal-to-noise ratio or under better conditions. The three were observed in 1987 and 1988 by B. C.

Qian, Q. Fan, and A. Richichi. The results were published by Qian and Fan in 1991, and by Richichi in 1993.

The column headings for the two tables are the same. The first column is the SAO number. The second column is the Method, P for photoelectric in these tables. The third column is the double star code, V (definite new binary) and X (probably new binary) the two for all of these. The Mag1 and Mag2 columns are the visual magnitudes for the primary and secondary. The column ProjSep is the projected separation of the binary components at the lunar limb. It is sometimes referred to as the vector separation. The projected separation is that component of the separation between the stars that is perpendicular to the lunar limb. The observation itself produces a time interval between the two events. Since the lunar rate at the instant of the occultation can be calculated with great accuracy, the position angle of the separation vector measured east from north can be calculated. Of course, a single observation can produce only this single measure. But two or more simultaneous observations from widely separated position angles on the Moon's limb can produce the double stars' actual separation and position angle. If the timings are done with great care and accuracy, the results can be very accurate. This is one reason this work is so important. The date and discoverer are the date of the observation and the observer. The notes are given at the end of the tables.

Jose Gomes Castano of Madrid, Spain wrote requesting a copy of our double star list. Jose is a member of a group gathering data on double stars using filar micrometers and CCD cameras. His group would like to expand into photometric observations of occultations. He requested instruction on reducing multiple observations to determine the double stars' true separation and position angles. The following (provided by Joan and David Dunham) is being sent to him:

The easiest way is to do a graphical solution, as shown in the figure. Plot the observations with the axes centered on the primary. The vector separations (lines a_1 and a_2) are plotted at their angles from the North. Lines are drawn perpendicular to the observed locations of the secondary (b_1 and b_2). Those perpendicular lines intersect at the true location of the secondary. The angular separation and the position angle can be measured from the plot. In the figure, these are line c and angle α_3.

If computation is more desirable than plotting and measuring, the values for c and α_3 can also be determined from the geometric relationships. The two triangles formed by a_1, a_2, b_1, b_2, and c are right triangles. The values for a_1 and a_2, and their position angles α_1 and α_2 are known. The line d joining the vertices of the perpendiculars is found from the law of cosines,

1) $d^2 = a_1^2 + a_2^2 - 2a_1a_2 \cos(\alpha_1 - \alpha_2)$

The angles β_1 and β_2 formed by lines a_1 and d, and a_2 and d can be found from the law of sines,

2) $d/[\sin(\alpha_1 - \alpha_2)] = a_1/\sin \beta_1 = a_2/\sin \beta_2$

The angles for the triangle formed by d, b_1, and b_2 are found from the fact that the sum of the angles in the triangle is π, and the perpendiculars form right triangles. Then the angle γ is equal to the sum of β_1 and β_2. This is from $(\pi/2 - \beta_1) + (\pi/2 - \beta_2) + \gamma = \pi$, or

3) $\gamma = \beta_1 + \beta_2$

Since the angles in this second triangle are now known, sides b_1 and b_2 can be determined from the law of sines

4) $d/\sin \gamma = b_1/\sin(\pi/2 - \beta_1) = b_2/\sin(\pi/2 - \beta_2)$

The separation, c, is then found from the right triangle equation

5) $c^2 = a_1^2 + b_1^2$

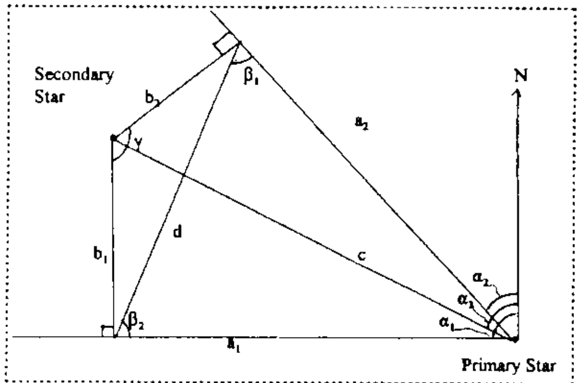
The equation for the other right triangle $c^2 = a_2^2 + b_2^2$ can be used to check on the computations.

The position angle, α_3, can be computed by finding the angle $\alpha_1 - \alpha_3$ from

6) $\tan(\alpha_1 - \alpha_3) = b_1/a_1$

The value for $\tan(\alpha_3 - \alpha_2)$, b_2/a_2 can be used as a check on the computations.

The two observations must be at appreciably different angles α_1 and α_2. If the angles are very nearly the same, then the sine of the difference will be nearly zero, and equation 2 becomes ill determined.



Correction: The first SAO 138009 in the last article's table, in ON 6(8), should be SAO 138004.

Table 1. New Double Stars

SAO	M	N	Mag1	Mag2	PrjSep	P.A.	Date	Discoverer	Notes
76259	P	V	7.6	8.8	15.5	114.0	71Nov04	Bartholdi	
76804	P	V	7.9	10.2	40.1	69.0	90Jan05	Richichi	
76841	P	V	7.6	10.1	82.0	94.0	88Dec22	Richichi	
77310	P	V	6.5	8.3	147.0	274.7	85Mch03	Schmidtke	
77977	P	V	8.2	10.7	64.3	76.0	93Feb03	Richichi	
78514	P	V	8.8	9.4	40.4	304.0	92Nov14	Richichi	
79241	P	V	6.8	7.6	71.4	181.4	86May20	Schmidtke	
79797	P	V	9.4	11.0	15.0	100.0	71May10	Dunham	
79940	P	V	5.9	10.0	440.0	110.0	83Mch24	Schneider	
80317	P	V	8.3	10.6	44.1	98.7	82Apr30	Peterson	
80327	P	V	8.4	9.7	326.0	104.6	82Apr30	Peterson	
80361	P	V	7.2	9.1	18.1	102.1	82Apr30	Peterson	
80497	P	V	8.7	9.8	6.1	143.4	83Apr21	Schneider	
80527	P	V	8.6	9.5	13.2	180.2	83Apr21	Schneider	
93059	P	V	6.9	8.5	6.1	298.5	79Sep10	Evans	
93070	P	X	9.7	10.3	6.0	327.7	77Oct01	Africano	
93913	P	V	7.6	10.6	182.0	108.8	81Sep20	Radick & Lien	
94002	P	V	7.0	7.0	2718.0	288.6	81Nov13	Blow	
98010	P	V	6.7	10.1	172.0	255.7	81Dec15	Peterson	
98711	P	V	9.0	10.1	250.0	310.6	83May18	Evans	
109269	P	V	7.2	8.4	13.0	282.0	72Dec02	Dunham	
109552	P	X	7.7	11.2	37.9	98.3	83Nov16	Evans	
118764	P	V	5.8	6.6	44.6	0.0	89May15	Guhl	1
119227	P	V	7.9	12.8	32.0	63.8	83Jun21	Schneider	
146043	P	V	8.4	9.6	10.0	139.0	72Oct18	Radick & Lien	
146395	P	V	9.4	11.	25.2	21.3	79Sep06	Evans	
157548	P	V	9.2	10.5	554.0	290.0	72Jun21	Dunham	
161229	P	V	9.6	10.6	50.0	296.0	78Apr27	Radick & Lien	
162049	P	V	6.7	10.2	84.4	64.9	79Oct27	Radick & Lien	
164061	P	V	6.8	8.2	429.0	77.0	80Dec12	Radick & Lien	
186917	P	X	9.2	9.5	115.0	243.0	72Jul24	Dunham	
	P	X	9.9	10.6	480.0	101.4	81Oct16	Blow	2
	P	X	9.0	10.8	774.0	217.0	78Nov02	Edwards	3
	P	X	9.2	14.2	88.0	98.0	91Jan27	Richichi	4

Table 2. Double Stars with New Observations

SAO	M	N	Mag1	Mag2	PrjSep	P.A.	Date	Discoverer	Notes
76140	P	V	4.6	6.1	10.0	0.0	69Aug07	Evans	5
76155	P	V	4.4	5.4	1.3	69.0	71Sep10	Eitter	6
76236	P	V	7.3	7.4	1.6	134.0	71Nov05	Bartholdi	
77647	P	V	7.1	9.1	20.9	103.0			7

Notes:

1. 75 Leo
2. BD +15° 0564
3. BD +18° 0901
4. BD +25° 1250
5. 19 Tau
6. 20 Tau
7. Richichi observed 29Apr08

Online Astronomy

Rex L. Easton

In this column I plan to present new and interesting sources for astronomy that are from the digital world of cyberspace. I will be giving you new world wide web (WWW) sites, file transfer protocol (FTP) sites, gopher sites, Usenet news groups, and e-mail mailing lists. There are so many sources and they change so often that this column will need to be a collaborative effort by us all. Send me any of the above mentioned sources that you have found and I will put them in. My first source is a calendar that I recently found on the WWW. This is something that I have been looking for for a long time. It lists phenomena and space missions by month for the next 12 months. It also has a listing of historical events for the current month. The URL is http://newproducts.jpl.nasa.gov/calendar/calendar.html. It's titled Space Calendar (JPL). ı

Asteroidal Occultations in September and October

David W. Dunham

The datasets for 1996 planetary and asteroidal occultations were finally completed in early August. I apologize for being so late with these data, needed for IOTA's local circumstance predictions, but at least we are a little ahead of where we were a year ago with the 1995 predictions. We promise to do better for 1997.

The local circumstance predictions, which by now have been distributed to IOTA members by the graze computors, are in the same format as those for 1995. All events predicted by Edwin Goffin are included, rather than just those using the IOTA criteria described in **ON** 6 (4), p. 76 (Sept. 1994). An asterisk (*) or minus sign (-) appears between the date and the name of the occulting object if the event meets the IOTA criteria. The minus sign indicates that the edge of the object will miss the star by more than 1″2 so that an occultation, even by a possible satellite of the object (if it's an asteroid), is unlikely. Observers are encouraged to monitor the * events that occur under reasonable conditions at their location. Although the nominal predictions for recent events have been rather better than in the past, thanks mainly to the improved PPM positions and to updated orbital elements for many asteroids, you should monitor these events even if the expected path is several hundred kilometers away, since there can still be astrometric error for the main event and secondary occultations by an asteroidal satellite is possible. To independently confirm observations of the latter, observers are encouraged to watch from two stations about a km apart.

Edwin Goffin's charts have been distributed to North American observers only for those events meeting the IOTA criteria, and for events involving major planets, which are asterisked only if the occulted star is brighter than mag. 8.5. B1950 and J2000 positions of all of the stars, at least through October, were given in a list distributed with the predictions. The list of the end-of-1996 non-asterisked events will appear in the next issue. If you want to monitor many of the events that do not meet the IOTA criteria, you may want to request the special supplement that includes these events from the McManuses, but the chances of actually seeing an occultation during these events is very small.

Some of the events use updated orbital information, so the distance given in your predictions might not agree with the charts for 1996 that were distributed last year. Usually, the differences are small and not noticeable. When the list of events is published in the next **ON**, you can tell if an orbit has been updated by comparing the ephemeris source with that given on your chart. For several events, to be documented next time, such as the Oct. 29th occultation by (243) Ida, a code of H means that the star position has been updated with recent observations made with the Carlsberg Automatic Meridian Circle (CAMC) on La Palma, Canary Islands, and should be accurate to about 0″1, better than most asteroid ephemerides. This is usually not the case if the star DM/ID no. starts with L1 to L5 (Lick number), which case, the star position is usually from a Lick Observatory catalog and is accurate to about 0″3, similar to those for PPM stars.

In addition to the CAMC star position update, Martin Federspiel in Switzerland has also updated the orbits of 24 Themis and 52 Europa using CAMC data for those asteroids for the occultations on Sept. 10th and Nov. 5th, respectively, and these updates were included in the IOTA database in time for distribution to the others for computing local circumstance predictions. He has also more recently similarly improved the orbits of 66 Maia, 74 Galatea, 243 Ida, and 39 Laetitia for occultations by those objects on Sept. 11, Nov. 9, Oct. 29, and Dec. 28, respectively, but those were too late to be included in the IOTA 1996 asteroidal occultation database. Except for the Dec. 28th event, these also include CAMC updates to the target star positions, so these updates should be accurate to 0″15 or so. Federspiel's maps showing the updated paths for the Maia and Galatea events are shown here, and they supersede the IOTA prediction for these events. Corrections for the other events will be published in the next **ON**.

Some of the occultations, most meeting IOTA's criteria, were found by Isao Sato in Japan and were not in E. Goffin's charts distributed late last year.

Regional maps showing the paths of asteroidal occultations, and the S. limit of one occultation by Venus, are given here showing IOTA's nominal paths for events that occur in September and October, and that meet the IOTA criteria. Lines across the paths mark 1 minute intervals; moonrise (MR) and moonset (MS) lines are also plotted. Paths end either at low altitude (A) above the horizon or in bright twilight or sunlight (S). One event, involving Boliviana on Oct. 15, meets the IOTA criteria but is not on the map due to a computational difficulty with the almost due north-south path. If space gets too tight for this issue, the regional map for Europe and Africa might be omitted here, since none of the paths pass over, or even close to, Europe or southern Africa (the main areas with **ON** subscribers on that map), with the exception of the Hermione occultation of September 30th, which is the subject of a separate article, including its own map.

Two errors need to be corrected in the 1996 Planetary Occultation Supplement to **ON** distributed last year. On page 2, line 11, "second half" should read "first half". On p. 4, the SAO number of the star occulted by (400) Ducrosa on Aug. 28 should be 210594.

The 1996 asteroidal occultations, at least those for November and December, will be documented more thoroughly in the next issue. Some information about individual events during August (past) through October are given below; I thank Wayne Warren for providing the latest information about the double stars:

Aug. 10, Oongaq: The star is ADS 10685, but the B component is only mag. 13.0 and 16".5 away in P.A. 286°.7, and will probably not be occulted.

Sep. 2, Hedda: The star is ψ^3 Aquarii = ZC 3428.

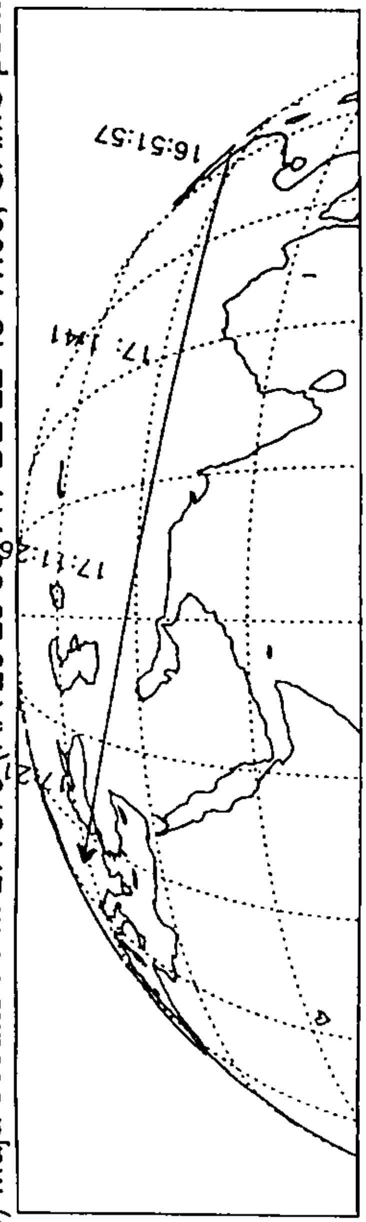
Sep. 3, Emita: The occulted star, SAO 77313, is a double star, ADS 4200. Separate predictions are given for the two components, A (mag. 7.2) and B (mag. 7.8). They are currently separated by 4".02 away in P.A. 272°. The nominal predicted path for the A component misses the Earth's surface by about 0".5 to the north, and the path for the B component is expected to cross Siberia.

Sep. 12, Schwarzschilde: The star is HR 8360 with spectral type K2III.

Oct. 15, Alkeste: The star is ZC 35, which happens to be the brightest star occulted during the total lunar eclipse of September 26-27 described elsewhere in this issue.

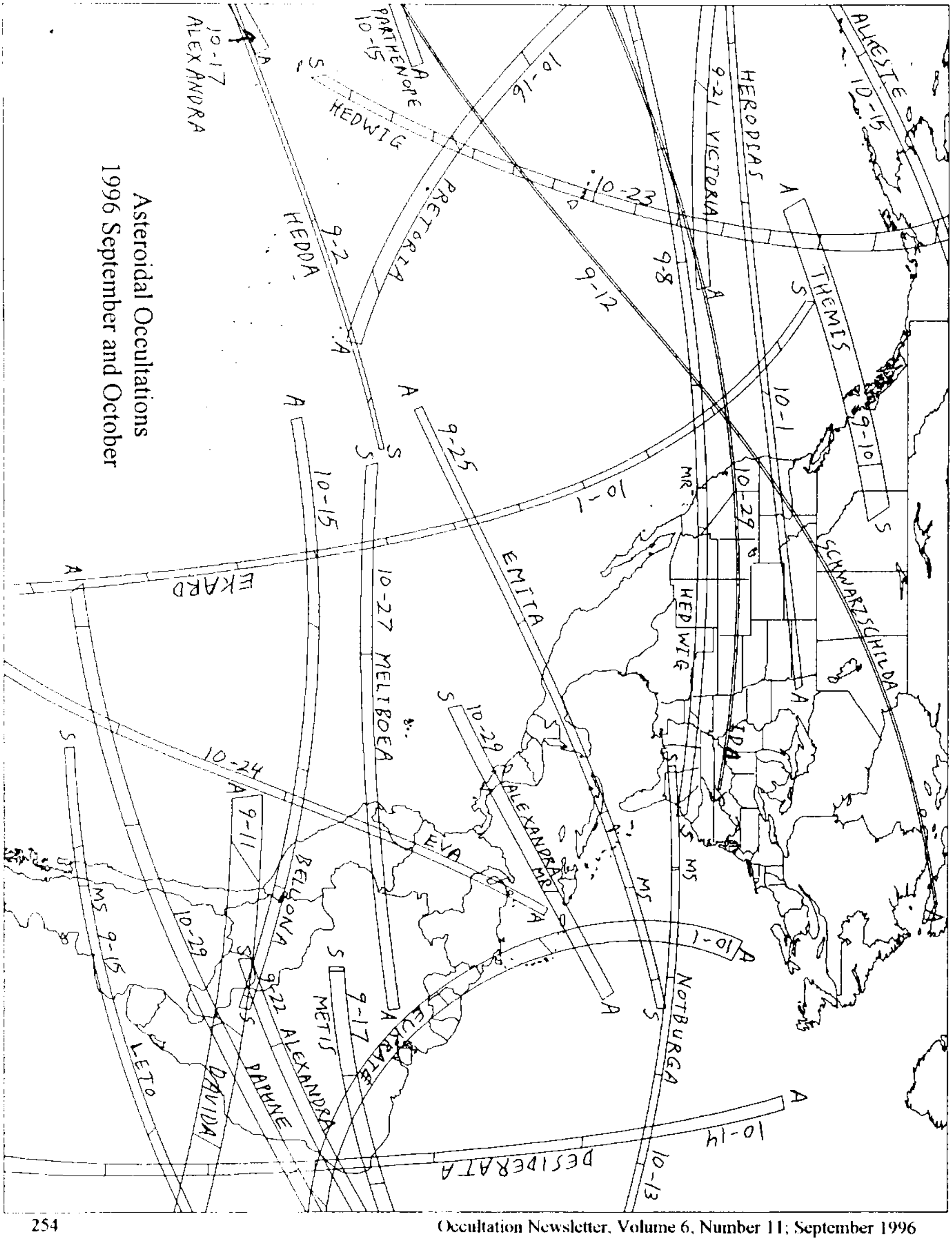
Oct. 21, Gunila: The star is ADS 701. Separate predictions are given for the two components, each mag. 8.1 and separated by 0".17 away in P.A. 156°. Since Gunila's angular diameter will be about 0".04, only one component will be occulted by the asteroid at a time, and the magnitude drop that will be seen will be only 0.7 (since the stars are too close to resolve directly), rather than the larger one given in the predictions.

Oct. 29, Ida: This asteroid is of special interest due to its satellite, Dactyl, discovered by the Galileo spacecraft. The path shifts considerably to the north into the central U.S.A., as shown on the Western Hemisphere regional map in this issue (so this supercedes the southern path given on my map in the February issue of **Sky & Telescope**). A further update by Martin Federspiel also using some CAMC observations of the asteroid will be put on IOTA's asteroidal occultation Web site and will also be included in the next **ON**.



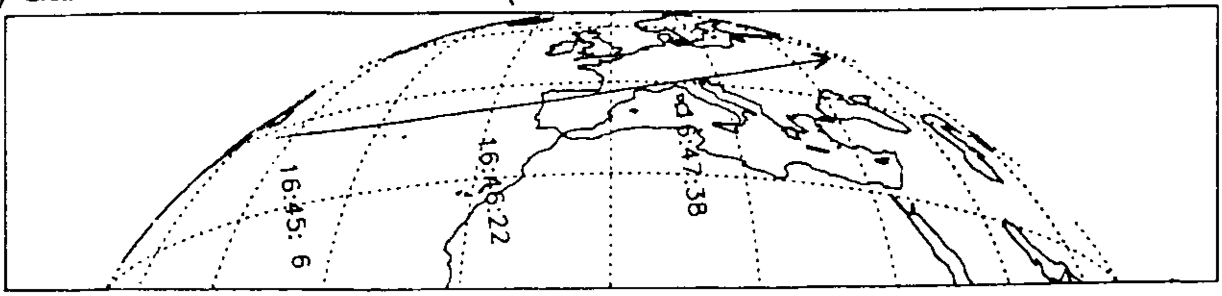
(66) Maja occults PPM 271079 (RA 20 23 58.117 DE-22 43 41.00, CAMC position)

date: 1996 9 11 time: 17 8 59.UT; d=3.92", PW=11.83deg, pi=4.92", mu=10.09"/h

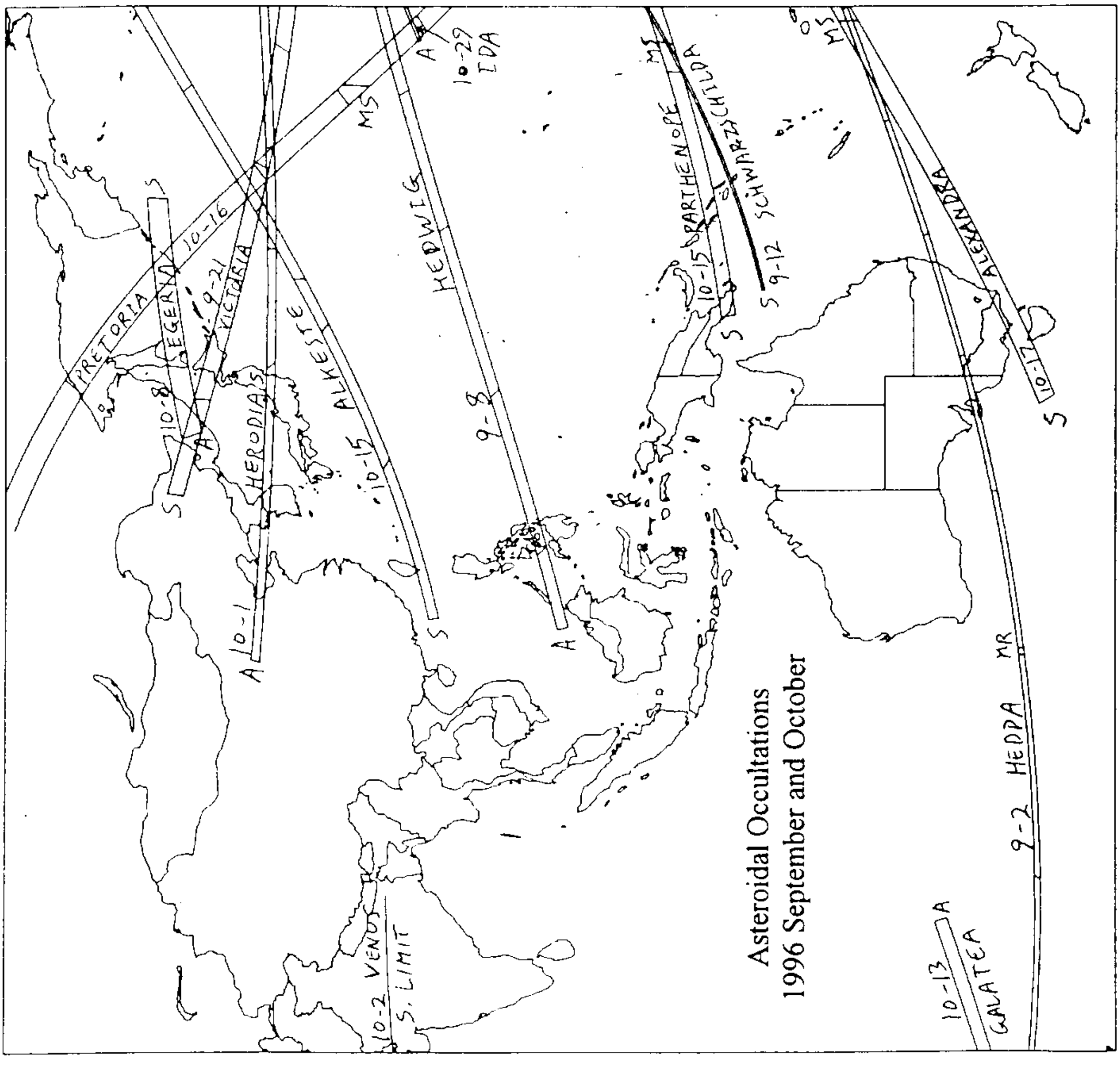


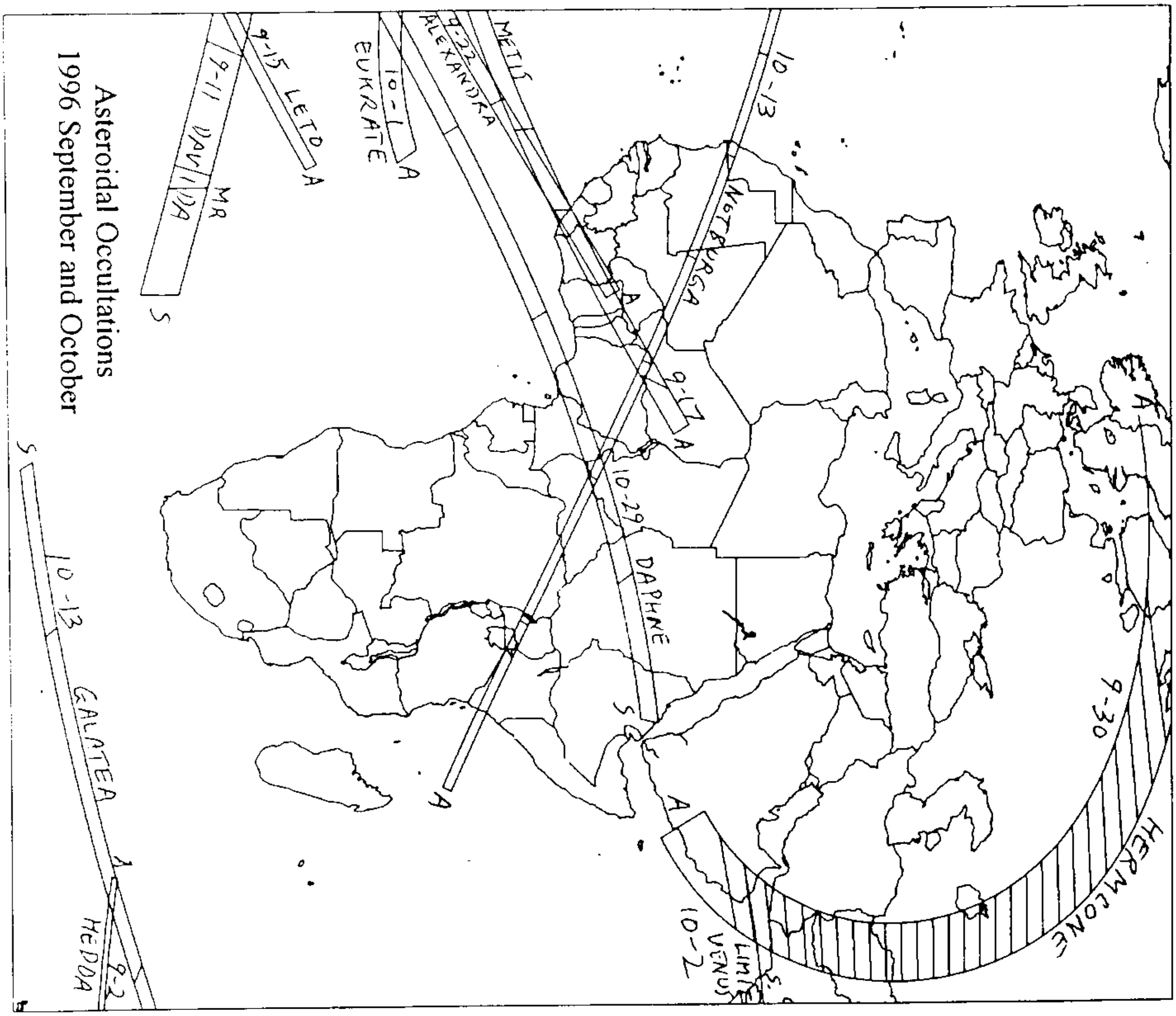
Asteroidal Occultations
1996 September and October

(74) Galatea occults PPM 236882 (RA 20 4 4.277 DE-17 11 53.81, CAMC position)



date: 1996 11 9 time: 16 46 47.UT; d=3.20", PW=352.11deg, pi=3.72", mu=58.56"/h




Asteroidal Occultations
1996 September and October
METIS
9-22
ALEXANDRA
10-1
EUKRATE
9-15 LETO
9-11 DAVIDA
MR
10-13
NOTBURGA
9-17
10-29
DAPHNE
10-13
GALATEA
HEDDA
9-2
9-30
HERMIONE
10-2
VENUS
LIMIT

IOTA's Mission

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.

The Offices and Officers of IOTA

President	David W. Dunham, Dunham@erols.com
Executive Vice President	Paul Maley, PMaly%jscdo6@jsenic.jsc.nasa.gov
Executive Secretary	Rocky Harper, Rocky@tenet.edu
Secretary & Treasurer	Craig A. and Terri A. McManus, I.O.T.A.@mcimail.com
Vice President for Grazing Occultation Services	Richard P. Wilds, DarkMatter-at-HART@worldnet.att.net
Vice President for Planetary Occultation Services	Jim Stamm, JimStamm@aztec.asu.edu
Vice President for Lunar Occultation Services	Kent Okasaki, KentO@hpctgjm.hpl.hp.com
Editor for Occultation Newsletter	Rex L. Easton, SkyGazer@smartnet.net
IOTA/ES Section President	Hans-Joachim Bode, Bode@kphunix.han.de
IOTA/ES Secretary	Eberhard Bredner
IOTA/ES Treasurer	Alfons Gabel
IOTA/ES Research & Development	Wolfgang Beisker, Beisker@gsf.de
IOTA/ES Public Relations	Eberhard Riedel, 100756.3510@compuserve.com

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IOTA Online

The Occultation Information Line at 301-474-4945 is maintained by David and Joan Dunham. 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, IL) or 713-488-6871 (Houston, TX). The IOTA WWW Home Pages are at **http://www.sky.net/~robinson/iotandx.htm** for lunar occultations and eclipses (maintained by Walt Robinson) and **http://www.anomalies.com/iota/splash.htm** for asteroidal occultations (maintained by Jim Stamm).

Observers from Europe and the British Isles should join the European Service (IOTA/ES), sending a Eurocheck for DM 40,00 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. German members should give IOTA/ES an "authorization for collection" or "Einzugs-Ermaechtigung" to their bank account. Please contact the secretary for a blank form. Full membership in IOTA/ES includes the supplement for European observers (total and grazing occultations) and minor planet occultation data, including last-minute predictions, when available. The addresses for IOTA/ES are:

Eberhard Bredner
Ginsterweg 14
D-59229 Ahlen 4 (Dolberg)
Germany
Phone: 49-2388-3658 (in Germany 0-2388-3658)
Fax: 49-2381-36770 (in Germany 0-2381-36770)

Hans-Joachim Bode
Bartold-Knaust-Str. 8
D-30459 Hannover 91
Germany
Phone: 49-511-424696 (in Germany 0-511-424696)
Fax: 49-511-233112 (in Germany 0-511-233112)