Occultation Newsletter

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FROM THE PUBLISHER

For subscription purposes, this is the second issue of 1990. It is the sixteenth issue of Volume 4.

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There are sixteen issues per volume, all still available.

Although they are available to IOTA members without charge, non-members must pay for these items:

Local circumstance (asteroidal appulse) predictions (entire current list for your location)	1.00
Graze limit and profile prediction (each graze)	1.50
Papers explaining the use of the predictions	2.50

Asteroidal occultation supplements will be available at extra cost: for South America through Ignacio Ferrin (Apartado 700; Merida 5101-A; Venezuela), for Europe through Roland Boninsegna (Rue de Mariembourg, 33; B-6381 DOURBES; Belgium) or IOTA/ES (see below), for southern Africa through M. D. Overbeek (Box 212; Edenvale 1610; Republic of South Africa), for Australia and New Zealand through Graham Blow (P.O. Box 2241; Wellington, New Zealand), and for Japan through Toshio Hirose (1-13 Shimomaruko 1-chome; Ota-ku, Tokyo 146, Japan). Supplements for all other areas will be available from Jim Stamm (11789l N. Joi Drive; Tucson, AZ 85737; U.S.A.) by surface mail at the low price of 1.18
or by air (AO) mail at 1.96

Observers from Europe and the British isles should join IOTA/ES, sending DM 40.-- to the account IOTA/ES; Bartold-Knaust Strasse 8; 3000 Hannover 91; Postgiro Hannover 555 829 - 303; bank-code-number (Bankleitzahl) 250 100 30. Full membership in IOTA/ES includes the supplement for European observers (total and grasing occultations) and minor planet occultation data, including last-minute predictions, when available. See also p. 337 of issue 14 of this volume.

Notes:
1. Single issue at 1/4 of price shown
2. Price includes any supplements for North American observers.
3. Not available for U.S.A, Canada, or Mexico
4. Area "A" includes Central America, St. Pierre and Miquilon, Carribbean Islands, Bahamas, Bermuda, Colombia, and Venezuela. Area "A" observers may order the North American supplement by surface mail at $1.18, or by air (AO) mail at $1.50.
5. Area "B" includes the rest of South America, Mediterranean Africa, and Europe (except Estonia, Latvia, Lithuania, and U.S.S.R.).

HOMER F. DABOLL, 1920 - 1990

Joan Bixby Dunham and David W. Dunham

We regret to announce that Homer DaBoll died March 10th of cancer. Mr. DaBoll had been the the publisher and editor of Occultation Newsletter (ON) since its inception in 1974. He contributed in many ways to the International Occultation Timing Association, the development of Occultation Newsletter, and to observing occultations in general.

Homer was born May 22nd, 1920, and grew up in Hinsdale, Illinois. His academic career was interrupted by World War II. He served in Germany as a 1st lieutenant in the Army Corps of Engineers for two years at the end of the war. He was graduated from the University of Illinois at Urbana in 1947 with a major in physics and minors in chemistry and mathematics. A course in astronomy at the university helped spark his interest in the subject. He and Audrey were married in September 1947. Audrey had also grown up in Hinsdale, and had known Homer for many years. In 1949, he started work at the Argonne National Laboratory, where he worked, in his words, as an algae farmer until his retirement in 1982. He enjoyed growing algae and other plants in heavy water for studies that required organic compounds composed of deuterium rather than ordinary hydrogen.

Homer had a life-long devotion to astronomy. In 1957-58, he organized a Moonwatch team at Argonne, which became the Argonne Astronomy Club. He was also active in the Fox Valley Astronomical Society and in the Astronomical League. He was chairman of the North Central Region of the Astronomical League from 1961-1963. In 1972, he received the region's award for contributions to astronomy, especially for his articles about occultations in Northern Lights, the regional bulletin established in 1971.

Most amateur astronomers either design and build telescopes, seldom using them, or they buy rather than build them, and observe often. Homer was one of the few who excelled at both activities. On the construction side, his article, "A Simple but Accurate Foucault Tester", was published on pages 308 and 309 of the May, 1964, issue of Sky and Telescope.

IOTA's 8th annual meeting will be in San Antonio on August 18; see p. 381 for details.

Homer was an assiduous occultation observer, timing hundreds of events from numerous sites, each with precisely-reported coordinates, selected to find a properly-positioned hole in the many trees surrounding his home. He led dozens of successful grazing occultation expeditions; you could never get lost with his meticulous access maps.

Homer was editor and compositor of ON from its first issue, in July, 1974 until his death. The tools that Homer used for editing ON were an IBM selectric typewriter, scissors, tape, and careful attention to detail. He typed much of the newsletter himself, finding it easier to produce consistent results if all the typing was done on the same machine.

Fortunately, Homer corrected many errors and inconsistencies in material that we submitted for ON. Besides editing, he wrote many useful articles himself, such as his well-portrayed table of terminator separation from the dark edge of the Moon, as functions of lunar phase and cusp angle, on p. 26 of Vol. 1 (back of issue No. 3).

From ON issue 15 of Vol 3, April 1986: Homer defined a term, isoskiatic, for those horizontal lines on a profile that represent various depths in the shadow of the Moon, an asteroid, or other object, as in one arc second south or 1.5 km north. This word (eye"so-skee-at'ik, meaning "equal shadow" in Greek) can be used either as a noun or as an adjective (isoskiatic line and isoskiatic are equivalent) and means connecting, or a line connecting, points on the Earth's surface that are equally deep in the shadow of a solar system object as cast by an extraterrestrial luminous body, or the representation on a map of such a line.

When Homer's cancer was discovered six years ago, surgery revealed that it was quite advanced; the doctors expected him to live at most three years. But they did not count on Homer's stubbornness. On more than one occasion, he made medical history and was the subject of a medical journal article. Although he was hospitalized and underwent debilitating chemotherapy treatments often during the past few years, we were always able to mesh our contributions with his schedule so that he was able to produce every ON issue and ON supplement until February this year. This was no easy task with such a time-critical field as occultations. Homer's devotion to IOTA and to producing ON motivated him to carry on long after most would have given up. The last item was a supplement on occultations during the total lunar eclipse of 1990 February 9 that he distributed (only to Eastern Hemisphere subscribers) less than two months before his death.

He held offices in IOTA from its founding in 1975 until December, 1989. At different times, he was the IOTA treasurer, vice-president, and/or secretary. His dedicated service as Editor and in his IOTA offices was key to the success of both ON and IOTA. We shall miss him very much.

IOTA NEWS

David W. Dunham

IOTA Meeting. The 8th annual meeting of IOTA will be held on Saturday, August 18th, at the Southwest Research Institute in San Antonio, Texas. The meeting will start a few hours after a spectacular graze of Jupiter visible southwest of San Antonio. See the separate article on the next page for more details about both events.

ASP-IAPPP Meeting. On July 13-15, the Astronomical Society of the Pacific and IAPPP will hold a meeting on "Automated Observatories and Global Networking" in Boston, MA. Although there will be little directly related to occultations, Peter Manly plans to give a talk on observatory controllers at the meeting. So informal discussions about video systems applicable to occultations are possible.

Alcon-90. Are you planning to attend the Astronomical League's convention at Washington University in St. Louis, MO, July 31 - August 4? If so, would you be willing to give a pitch for IOTA? If the answer to that is also yes, please call me at 301-474-4722 before July 14 (when I leave for the July 22nd solar eclipse), and I can provide you with viewgraphs and a VHS-format videotape of occultations and eclipses for the presentation. Information about Alcon-90 can be obtained from Stephen Best; 6943 Amherst Ave.; St. Louis, MO 63130.

Star Catalogs Available from the Astronomical Data Center. I recently filled a few long-standing requests for star catalogs on magnetic tape, and also gave a copy of them, along with appropriate documentation, to Wayne Warren for deposit in the Astronomical Data Center (ADC). These include the USNO P, K, L, and XZ80J lunar occultation prediction catalogs, and the merged Lick-Voyager and Combined Catalogs (the latter used by Goffin and me for planetary and asteroidal occultation predictions), all described in previous issues of O.N. Magnetic tape copies are now available from: The Astronomical Data Center; National Space Science Data Center; Code 933; NASA/Goddard Space Flight Center; Greenbelt, MD 20771; U.S.A. Also available from the ADC are the Positions and Proper Motions (PPM) catalogs, both north and south editions, which replace the AGK3 and SAO catalogs with much better positional information (especially better than SAO), and the final version of USNO's Zodiacal Zone catalog (ZZ90); these should greatly improve astrometric reductions of asteroid photographs. Later this year, I plan to use these new catalogs to update the Combined Catalog and the XZ.

Occultation Manual and ZC Names Updates. We are out of copies of IOTA's Preliminary Occultation Manual (POM); the McManuses are now making copies from a copy whose quality is not the best. Wayne Warren has made several changes to the POM text file, many at my suggestion, and is working on a few additions, such as Don Stockbauer's graze shift calculation write-up. Wayne has translated the text file to a "Script" file to produce a much more legible and professional-appearing printout. Unfortunately, we do not have time to make the many changes that are really necessary for a "final" version of the manual, but this intermediate version, which should be ready and available from the McManuses in a month or two, will be a significant improvement over the preliminary version.

The same situation exists for the Zodiacal Catalog (ZC) names list. I will soon send the McManuses a disk file of this information, so they can manipulate it to give SAO and X numbers (instead of the now unused Z numbers) for variable stars and faint components of double stars that are not in the ZC. These latter stars have separate entries in the U.S.

Naval Observatory's (USNO's) XZ catalog (version XZ80J).

Travel. Besides traveling to the path of the July 22nd solar eclipse, to the IOTA meeting/Jupiter graze in August, and to Duluth, MN, for the September 13th graze of Epsilon Geminorum, I expect to make two business trips later this year. The first will be right after the IOTA meeting, to attend an American Geophysical Union meeting in Kanagawa, Japan, August 21-25. This trip is not definite (probability about 75%), but if I go, I will visit the International Lunar Occultation Centre (ILOC) and discuss with Mitsuru Soma (National Astronomical Observatory) analyses and software that might replace some important functions of USNO's OCC program used for detailed graze and solar eclipse predictions. The second (definite) will be to attend the 41st International Astronautical Federation (IAF) congress in Dresden, German Democratic Republic (DDR) October 8-12. During the previous weekend, I plan to meet Hans-Joachim Bode in Hannover, and we will try to have a small regional IOTA/ES meeting in the DDR. During the week following the IAF meeting, I will be in Moscow as a guest of the Soviet Space Research Institute. Unfortunately, I was not able to make the other international trip mentioned on p. 360 of the last issue, to the Netherlands in May.

I plan to attend two upcoming divisional meetings of the American Astronomical Society, the Planetary Sciences meeting in Charlottesville, VA, October 22-26, and the Dynamical Astronomy meeting in Coconut Grove, FL, April 4-6, 1991.

Next ON. The next issue of ON, which will be the first issue of Volume 5, will probably be distributed in early October, with a deadline of September 20th for receipt of material for that issue.

IOTA MEETING AND JUPITER GRAZE

David W. Dunham and Rick Frankenberger

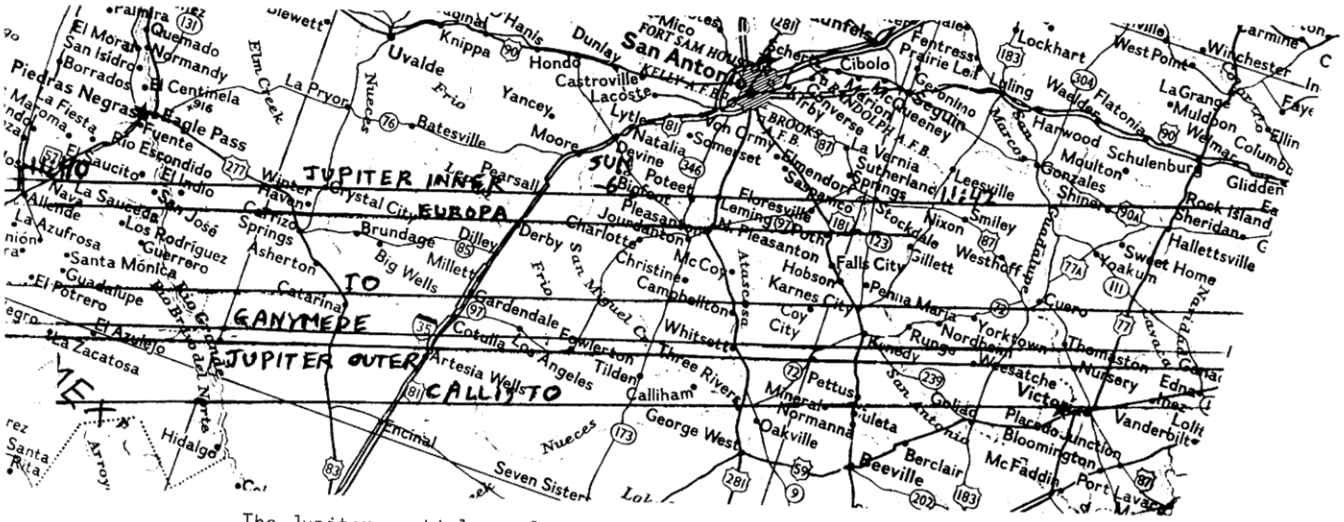
Meeting. The 8th annual meeting of IOTA will be held on Saturday, August 18th, at the Southwest Research Institute in San Antonio, Texas. The meeting will start at noon, Central Daylight Time, to allow time for observers of the Jupiter graze to return to the San Antonio area. The meeting will last until 10 pm or until all business is transacted, whichever comes first; there will be a break for dinner. The meeting might start earlier in the morning if the Jupiter event is hopelessly clouded out, and this is obvious several hours beforehand. The Southwest Research Institute is at the intersection of Oak Hill and Culebra Roads, about a mile from the latter's intersection with Interstate 410 on the west-north-west side of San Antonio. When you arrive at the institute, tell the guard that you are attending the astronomy meeting. A map will be sent to you upon request to Rick Frankenberger; 8702 Timberbriar Dr.; San Antonio, TX 78250; telephone 512,681-2276 (home).

At the meeting, a short business discussion (mainly financial report) will be followed by technical presentations and discussions. If you would like to give a presentation or want to add a topic for discussion to the agenda, please contact Rick at the address/phone above. Any observations of the Jupiter graze and the July 22nd solar eclipse will certainly be described. Plans for the two 1991 solar eclipses and for important upcoming asteroidal occultations will be major topics. Grazing occultation developments will be discussed. The recently-published results from the 1983 Pallas occultation will be discussed, along with publishable analyses of other important events, such as last July's occultation of 28 Sagittarii by Saturn and by Titan. Projects where volunteer help is needed, especially by those with PC's, will be described. The latest developments in fast-changing equipment (espcially video) technology will be of interest to many. Some of the better occultation and eclipse videotapes will be shown for the benefit of those who haven't seen them before. A detailed agenda will be prepared closer to the meeting date. August 18th promises to be a long and interesting day.

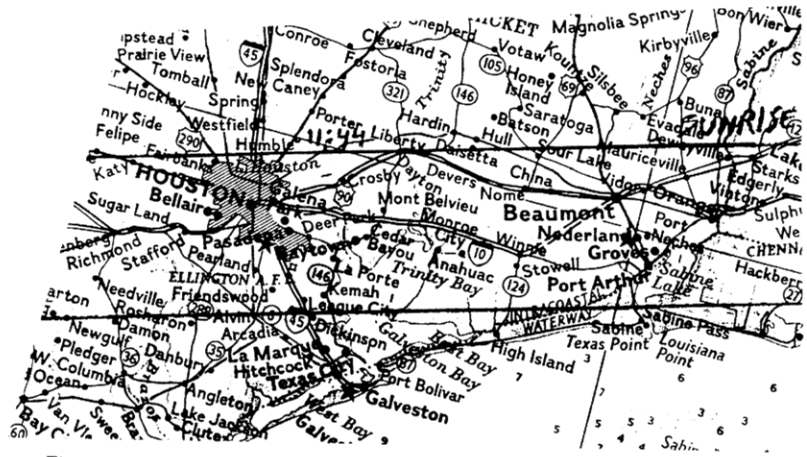
Jupiter Graze. Information about the occultation of Jupiter by the 5% sunlit waning Moon is given in David's article in the August issue of Sky and Telescope, pages 177 and 179. Times of the occultation can be estimated for all populous regions of the U.S.A. and Canada from the maps that will appear with that article. But the most interesting places to observe the event will be within the 35-mile-wide partial occultation zone, especially near its northern edge. At this location, the partial occultation will have its maximum duration, about 16 minutes, with the southern edge of the ball of the planet undergoing grazing occultation-like phenomena during the central few minutes. Bob Bolster produced the view of the Moon shown here using his version of John Westfall's MOONVIEW program. Celestial north (0° position angle) is up.

The maps show the partial occultation zone at the southern limit of the occultation of Jupiter across Texas, based on calculations by Joseph Senne. Senne will soon send all IOTA members near the path detailed predictions for the event within their specified travel radii. The southern limits of the occultations of the Galilean satellites (actually, the northern edges of their partial occultation zones, which are only about a mile wide) are also shown. Since they are all south of the northern edge of Jupiter's zone, short total occultations of each of the satellites will be visible from the latter location. They are shown only as far east as they might be observed in the brightening dawn sky; their events will be difficult to see everywhere east of a line extending due south from San Antonio.

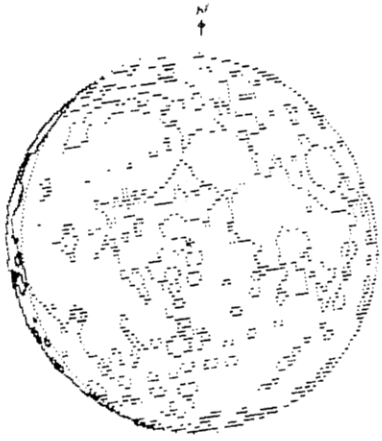
The IOTA expedition will go as far west as possible in Texas to observe the graze, in order to see the phenomena in as dark a sky as possible. Possible sites include Crystal City, several miles farther east where the northern path edge crosses US 277, and near El Indio close to the Rio Grande. Crystal City was the site for one of our expeditions for the very similar 1968 October 19 graze of Jupiter; see p. 274 of the 1968 October, p. 51 of the 1969 January, and p. 122 of the 1969 February issues of Sky and Telescope. Central graze will occur at 11:41 U.T. in the area, or 6:41 am CDT. Contact Rick at the address given above for meeting time, place, and other details about the graze effort. Arrangements for carpooling from San Antonio can be made.



The Jupiter partial occultation zone across Texas - Part 1.



The Jupiter partial occultation zone across Texas - Part 2.



The Moon during the Jupiter Occultation.

PROGRAM FOR PRELIMINARY ANALYSIS OF VISUAL AND VIDEO OBSERVATIONS OF THE OCCULTATION OF 28 SGR. BY SATURN

David W. Dunham and Daniel Klos

On p. 365 of the last issue, an appeal was made for help in making a preliminary analysis of the 1989 July 3rd occultation of 28 Sagittarii by Saturn. A few readers have volunteered to use PC's to reformat and/or key in the data, but we could use help from a few more. There is not great time pressure to do this work, but it should be done. Using a few sample observations, Klos will design a format, perhaps starting from the ILOC lunar occultation machine-readable format (which has already been used by a few observers). He will coordinate this with Doug Mink at the Center for Astrophysics, Cambridge, MA. Mink will read the data that we provide for analysis, mainly to plot observed event times on the sky plane at Saturn, to check consistency and to determine the extent of features in the rings and the planet's atmosphere. If you would like to participate in this work, contact Klos at W404 County K; Brillion, WI 54110; phone 414,864-7948.

Anyone with a VCR can also help with this project, by playing a few of the more than one dozen successful video tapes of the occultation, to determine times and perhaps estimate brightness levels. The method is simply to play the tape with your VCR and determine the times by counting seconds beats or with a stopwatch, treating it like a visual observation. Video display time insertion can facilitate this process. Contact Dunham at the address given in the masthead or by phone at 301,794-4722 if you can donate a few hours of effort to this task.

This will be a preliminary study for the video data, since a much better analysis of them can be performed using Paul Boltwood's digitization techniques and computer programs mentioned on p. 365 of the last issue. The latter are needed, especially to obtain lightcurves from the noisier video tapes to recover numerous events that will be missed by visual inspection. The preliminary study should help show what might be obtained from a comprehensive study with Boltwood's techniques, hopefully facilitating access to the fairly expensive equipment needed for the digitization, and gaining support for some of Boltwood's time to perform the work.

RESULTS OF THE OCCULTATION OF 28 SAGITARII BY TITAN

Henk J.J. Bulder

This article presents the analyses of the photoelectric recording of the occultation of 28 Sgr by Titan made by Peter Serne and Hans Romijn at Leiden Observatory on July 3, 1989.

Equipment used:
45-cm reflector (Zunderman)
SSP3 photometer (Optec), diaphragm 30", B filter (Johnson),
2-channel flat-bed BD 9 recorder (Kip)
time registration from atomic clock at channel 2

Site:
Leiden Observatory, 52°09'25.3" N, 4°29'00.1" E

Circumstances:

The weather was clear, but the seeing was bad, with the star image 10"-15". During the recording, the dark current was measured several times, causing a major gap during ingress. In such time-critical events, it is better to make such measurements only once before and once after the actual occultation.

Reduction of the recording:
For reduction purposes, the recording was digitised by hand sampling 7 values every 3 seconds. Values were rounded to the nearest millimetre. In total, 1100 values were taken, giving a digitised recording from 22:38:04 to 22:45:55 UT (see Figure 1a).

Besides the regular dark current gaps, you will notice that light level at start is lower than at end. Possibly the equipment wasn't completely adapted to circumstances at the beginning of the recording.

To make it easier to determine T1-T4, a moving average was performed over 28 points (12 seconds), giving Figure 1b. This was only possible after replacing dark current measurements by linear interpolated values. It is clear that this procedure introduces faults especially during ingress. We suppose that this will not influence T1 and T2 as long as these points lie well outside the interpolated area. This condition is met. The values for T1 to T4 are found in Table 1.

As can be seen from Figure 1b before and after the actual occultation, there is a long periodic wave pattern that can be explained by probable errors in tracking the star. This causes periodic loss in star light reaching the photometer head.

Another thing that might strike your attention is the lack of a central flash even though Leiden is well placed near the central line. This is caused by using a blue filter. At Pic du Midi Observatory the strong wave length dependency of the central flash was noticed before, as can be seen in Figure 2 (Reference 1).

According to Baum and Code (Reference 2) it is possible to determine the scale height H from a photoelectric recording. The scale height is the change in radial distance through the atmosphere sufficient to change the density by a factor e, where e is the natual log base. To realise this, the measured flux has to be normalised so that the maximum level is 1 and the minimum level is 0. In this case, the line through the tops of the mentioned long periodic wave is used as maximum level. As a minimum level, the tangent of the moving average during occultation is taken. For ingress and egress, the resulting normalised flux is given in Figures 3a and 3b. The determined Baum and Code curves are drawn in. The equation for these curves is:

$$(F_o/F-2) + \log_e(F_o/F-1) = vt/H$$

For v, the value of 18.590 km/s has been used, since the occultation was nearly central. In this equation, H is the scale height, t is time in seconds from half flux, F_o/F is the normalised flux at time t. A least squares fit was performed for 45 seconds, both at ingress and egress, varying the portion before and after half flux until minimal mean errors were found. This resulted in values of H at ingress (H_i) and egress (H_e) of 51.3 km and 52.6 km, respectively. The corresponding half flux times are, at ingress, 22:39:04.1 UT and, at egress, 22:44:23.0 UT. The accuracy of ingress results is probably be somewhat less than that for egress because of the relatively large gap for dark current measurement.

The scale height values have to be corrected for curvature and gravity gradient, as described by Elliot (Reference 3). The correction results in values of 51.6 km for H_i, and 53.0 km for H_e. These values agree very well with values found at other observatories as can be seen in Table 2 (References 1 and 4).

From the half flux times, a radius of 2977 km was found (Reference 4), which is represented by a dotted line in Figure 4. The large solid circle represents Titan's surface (radius 2575 km). The dots in the centre of the circle represent central flash timings. In this figure the Leiden results are marked with small circles. They were in good agreement with the black dots of other observatories (indicated by first letter).

To see if there is good agreement between photoelectric recordings and visual observations, the Leiden results were compared with my own visual observations at Zoetermeer (Leiden and Zoetermeer are only 10 km apart). From Table 1 we see the photoelectric duration, T4-T1, was timed as 8 min 47 sec, while the visual measurements gave 8 min 34.5 sec. Part of the discrepancy can be explained by difference in wave length but most of it is probably caused by bad seeing making it very hard to determine actual start and end times. The agreements between the two timings of T2 and T3 were better.

Because there is good overall agreement, it might prove possible to determine half flux values for visual observations on the basis of observed pairs T1-T2 and T3-T4, using the half flux values of the photometer recording. The interpolated values for Zoetermeer found this way are 22:39:10 UT at immersion and 22:44:20 UT at emersion. These values are presented in Figure 4 by open squares. They

agree well with the broad spectrum vidicon observations at Meudon (inner black dots at M in Figure 4).

Perhaps it is possible to use visual observations of experienced observers together with photoelectric results this way. Further study is necessary to see if this yields good results.

Acknowledgments:
The author thanks Peter Serne for the use of his recordings and Jean Meeus for his help in making Figure 4.

References:
1. Sicardy, B. et al. (1990), Nature 343, 350-353
2. Baum, W.A. & Code, A.D.(1953), Astr. J. 58, 108-112
3. Elliot, J.L. et al. (1989), Icarus 77, 148-170
4. Hubbard, W.B. et al. (1990), Nature 343, 353-355

TABLE 1. Comparison of Photoelectric and Visual Observations

Contact	Leiden Sterne/Romijn)	Zoetermeer (Bulder)
T1	22:38:50	22:38:57.5
T2	22:39:45	22:39:46.3
T3	22:43:42	22:43:44.5
T4	22:44:37	22:44:32.0

TABLE 2. Scale Heights at Ingress and Egress

Site	Tel(m)	Color	H_i (km)	H_e (km)
Wise Obs. (Israel)	1	R	56	50
Ein Harod (Israel)	0.36	B	60	54
	0.36	R	59	52
Catania Obs. (Italy)	0.91	B	51.7	60.8
	0.61	U	52.4	58.3
	0.61	B	44.6	52.1
	0.61	V	46.7	55.0
Vatican Obs.	0.61	B		57
	0.61	R		57
Pic du Midi (France)	2	B	(47.8)	(47.7)
	2	G	51.2	52.9
	1	B	57.8	60.8
	0.6	Y	46.9	63.5
Meudon Obs. (France)	1		(87.4)	(100.1)
	0.6	B	(78.9)	(54.9)
Leiden Obs. (Netherl.)	0.45	B	51.6	53.0

Notes: Tel indicates telescope size in m
() observations containing possible errors

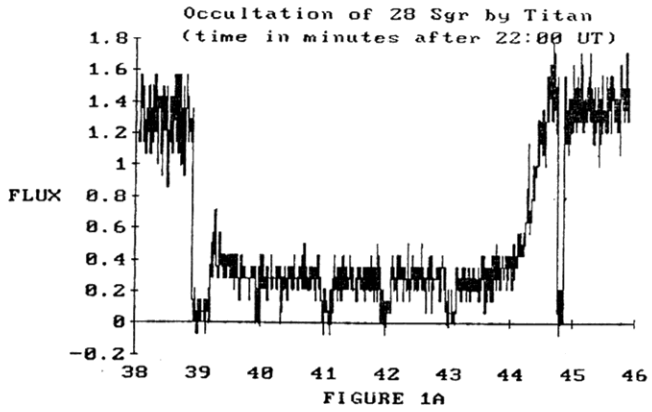


FIGURE 1A

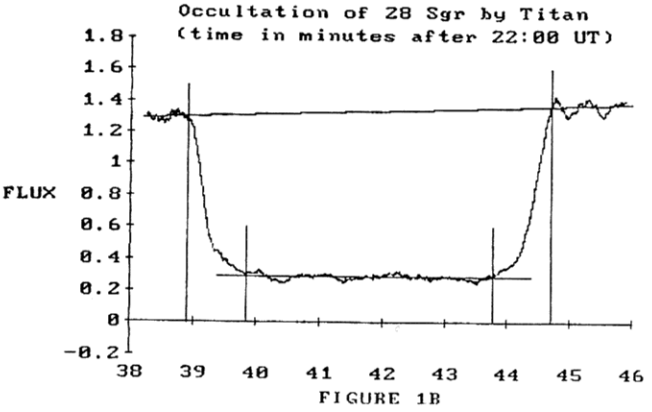


FIGURE 1B

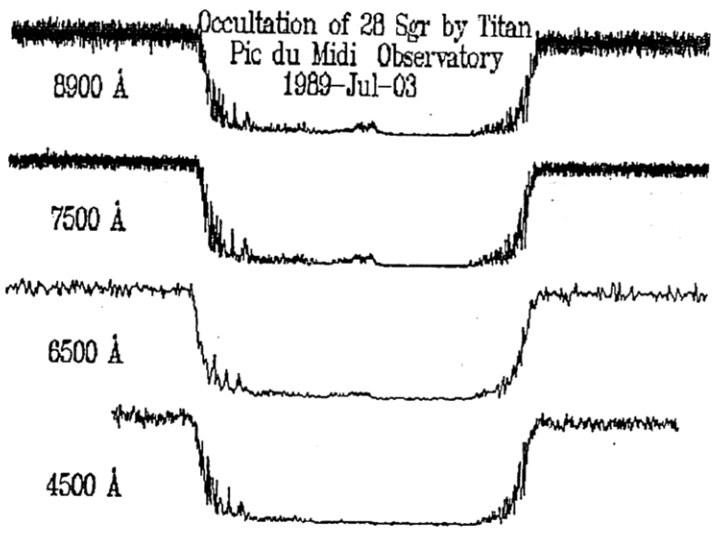


FIGURE 2

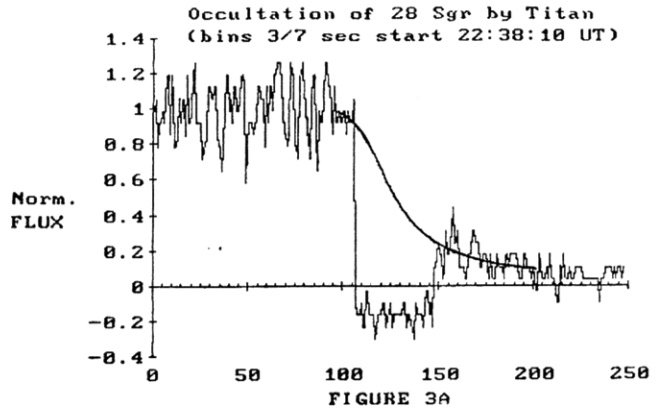


FIGURE 3A

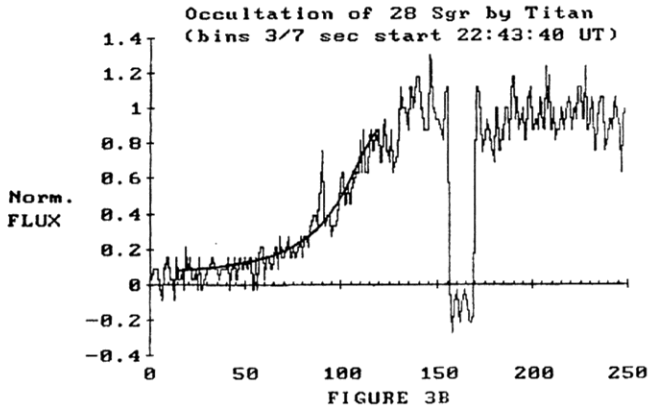


FIGURE 3B

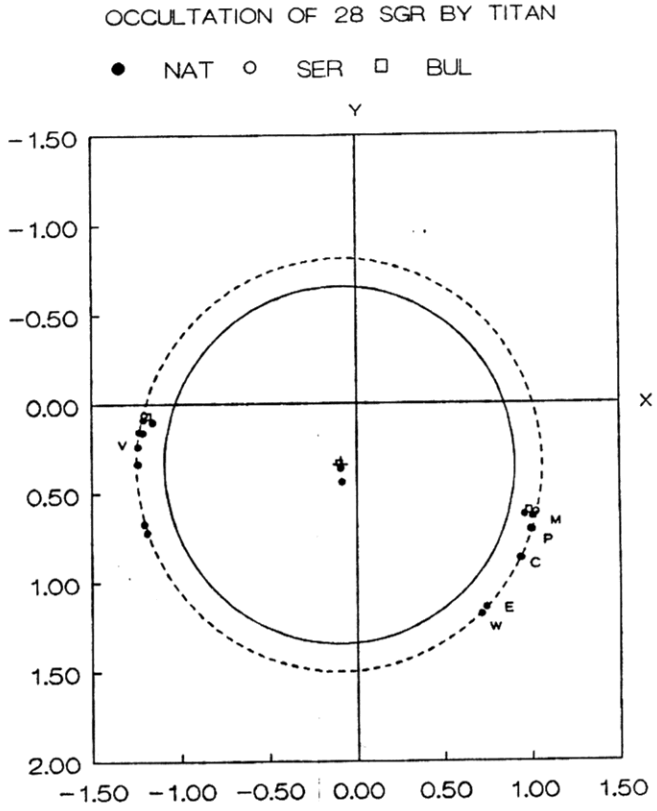


FIGURE 4

GALILEAN SATELLITES MUTUAL EVENTS

David W. Dunham and Jean E. Arlot

Galilean Satellites Mutual Phenomena. From 1990 November to 1992 March, 200 observable mutual occultations and eclipses of the Galilean satellites will occur as the Earth and Sun pass through Jupiter's equatorial plane. Predictions are given in a note by K. Aksnes, University of Oslo, and F. Franklin, Harvard-Smithsonian Center for Astrophysics, in Icarus 84, pp. 542-546 (1990); information about the better events will undoubtedly be published in Sky and Telescope and other popular journals. Timed photoelectric and video recordings of these events can be reduced to yield positions with an accuracy better than 100 km, while other Earth-based observations give positions to 400 km accuracy at best. Hence, the data can be used to refine the orbits of the satellites, information that will be valuable for the Galileo spacecraft mission.

Arlot at the Bureau des Longitudes; 77, avenue Denfert-Rochereau; 75014 - Paris, France; is organizing an international campaign to record these events. If you can record these events with photoelectric or video equipment at your observatory, please write to Arlot, specifying the type of detector and recording system, and telescope, and he will send you circulars containing all the information necessary to perform the observations. Aksnes and Franklin are also interested in receiving reports of successful observations.

GRAZING OCCULTATION PREDICTIONS

David W. Dunham

Corrections to Version 80J Graze Predictions. During the next several months, northern-limit waning-phase grazes on the dark limb will be frequent (such as during the upcoming Pleiades passages), so graze expedition leaders need to remember to apply a correction that we found improved the accuracy of last year's graze predictions. If the correction is not applied, many observers risk seeing no occultation (a miss) instead of a graze. As discussed in more detail on p. 361 of the last issue, you should apply a correction to all northern-limit dark-limb waning-phase grazes (specifically, those with Watts angle of central graze in the range of 340° to 360°) of the following magnitude:

0".045 x (latitude libration in degrees).

Some typical values for this correction are:

latitude libration	correction
-6°.0	-0".27
-5.0	-0.22
-4.0	-0.18
-3.0	-0.14
-2.0	-0.09

This means that significant south shifts are expected (the actual graze zone will be south of its predicted 80J location) when the latitude libration has large negative values. These librations occur when the Moon is in the region from Aquarius to Gemini, where most northern-limit waning-phase grazes now occur. The above formula is probably also valid for events with large positive latitude librations, but no such events with observed shifts have been reported while the current 80J prediction system has been in effect.

Calculating Grazes. Occasionally, I receive requests from people who want to compute, or write programs to compute, grazing occultations. The best source for formulae to program the computations is the section on grazing occultations starting on page 5-9 of Chapter 5, "Occultations of planets and bright stars by the Moon 1980-2000", in Astronomical Tables of the Sun, Moon, and Planets by Jean Meeus (Willmann-Bell, Inc., Richmond, VA, 1983). At the moment, we are not seeking volunteers to calculate the IOTA detailed predictions, since the computors listed in the annual hemispheric Grazing Occultation Supplements to O.N. can easily meet the current demand. Don Oliver, Houston, TX (address given in the annual Graze Supplements) is the custodian of the IBM PC version of the IOTA graze prediction programs, and their associated documentation files.

1991 Predictions. Hopefully, most ON readers will not need to be concerned with the detailed prediction changes, discussed below, that will be needed for 1991. As has been mentioned in previous issues, the current lunar/solar ephemeris (SMBDN) file used by Tom Van Flandern's OCC program (the ultimate basis for all of IOTA's and USNO's total and grazing lunar occultation predictions) ends at the end of this year. Alan Fiala at USNO has figured out the format of the lunar data (specified as apparent R.A., Dec., and sine parallax), and is working toward a goal of incorporating accurate modern lunar data, such as those from JPL DE200, into a new SMBDN file. This will be compared with the current file for 1990 to access the differences before use for detailed 1991 calculations. Fiala is strongly motivated since it will be needed to generate an accurate prediction of the northern limit for the July 1991 eclipse, to see if, considering the errors involved, some totality will be visible from accessible parts of the southwestern coast of Maui. Marie Lukac will soon need to use OCC and an SMBDN file to generate the occultation elements file for the 1991 total occultation predictions. If the new file is not ready, she will use a less accurate (errors of about half an arc second) SMBDN tape that extends well into the 21st century, based on the NILE analytical lunar ephemeris. That will be sufficient for the USNO total occultation predictions, but the new file will be needed sometime late this year for the detailed profiles for 1991 graze predictions, and also for detailed limit predictions for both 1991 solar eclipses.

GRAZING OCCULTATIONS

Don Stockbauer

My goals as coordinator of IOTA's lunar grazing occultation section are:

1. To provide a forum for the exchange of information through these articles;
2. To quality check the reports received and to request any needed clarifications;
3. To publish tabular summaries of each expedition's results;
4. To maintain an independent repository of the reports;
5. To notify Dr. David Dunham of updates to the Watts data base identified from plots of observations sent to me; and
6. To provide instructions and materials needed to report grazes, including a paper titled "How to Calculate a Shift"; the methods outlined therein are needed to accomplished item 5 above.

A major concern voiced over the past few years about grazes is that the observations are not currently being used to improve the Watts lunar limb correction data base. The stellar positions used to generate graze predictions are becoming more and more accurate due to the use of recent epoch catalogs. The lunar ephemeris is well known due to the lunar laser ranging experiment. David Dunham has begun a policy of correcting the Watts data if I forward a plot of an expedition's results to him which indicates that the data base is in error by more than 0".5 (the data should be certain in order to warrant a data base update). This procedure will be used for the time being. According to David Dunham, a comprehensive update of the Watts data base using all existing grazing occultation data will not occur in the near future, due to the magnitude of the effort required. Plotting one's data should be a standard practice because it is extremely hard to verify data consistency by analyzing the raw numbers. Since plotting the data will now directly benefit all graze observers, hopefully it will become second nature to everyone.

I have made a major revision of my "How to Calculate a Shift" paper incorporating many improvements suggested by its users over the years. This paper details procedures needed to plot the results of a graze expedition onto the predicted profile, from which both shadow shifts and Watts data base corrections may be determined. The paper's major sections are:

1. Correcting the Profile to the Actual Observing Location
2. Correcting the Sea Level Limit Prediction for Elevation
3. Calculating the Time of Central Graze
4. Plotting the Observations on the Predicted Profile
5. Calculating the Shift Value

I will send it free upon request. If you received an earlier version of the paper and want the current one, please request it again as I do not have a comprehensive list of those who received the earlier version.

If you indicate on the graze report form that you need more reports and do not receive any after a reasonable amount of time, please send another request in the form of a letter. It is very easy to overlook this when I file reports.

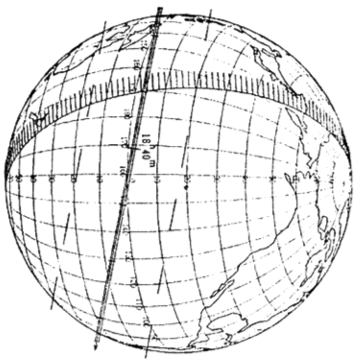
Thanks for all the reports received. The focus of this article has been the new policy of updating the Watts data, and I feel that it will surely result in more accurate predictions in the long run.

The two profiles are both for grazes listed in the last issue, on page 363. The profile for 45 Capricorni was taken from Ciel et Terre, 106, page 20.

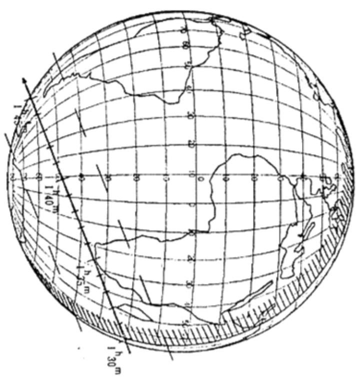
SUMMARY OF GRAZING OCCULTATION OBSERVATIONS

Date YMMDD	Star #	Mag.	% Snl	CA	Location	# Sta	# Tm	S	Ap Cm	Organizer	C	St	WA	B
880511	146804	8.0	23-	10N	Mesita, NM	1	10	1	10	MacPherson Morgan		6N	348	6
880905	1081	6.2	24-	8N	Tabilk, Austrl.	3	22	3	15	Alfred Kruijshoop		0	356	-67
881130	1487	1.3	58-	14S	Bernardo, NM	2	8	1	10	MacPherson Morgan		2N	195	-10
881203	138705	8.4	29-	18S	Albuquerque, NM	1	8	1	20	MacPherson Morgan		10N	198	33
881212	3031	5.9	16+	18S	Kilmaurs,Ont,Can	3	16	2	10	Brian Burke		0	164	40
890409	076081	7.9	12+	14N	Ridgeville, GA	6	30	1	25	Harold J. Carney				-65
890908	2383	2.9	46+	-5S	Cruzville, NM	1	8	1	10	MacPherson Morgan		6S	180	74
890908	2383	2.9	46+		Lubbock, TX	9	30	1	9	James W. Stevens			177	74
890908	2383	2.9	46+	5S	Springer, OK	6	37	1	8	Ed Vinson		3S	175	74
890908	2383	2.9	46+	8S	Golconda, IL	3	22	1	15	Harold J. Carney				
890922	0909	6.1	49-	2N	Lo-Reninge,Belgm	5	7	1	8	Bertrand Thooris		5S	358	-50
890922	0909	6.1	49-	2N	Evergem,Belgium	2	2	1	8	R. De Bosscher		5S	359	-50
890922	0909	6.1	49-	2N	Hoogstraten,Belg	5	15	1	20	Bulder/Vingerhoe.		5S	359	-50
890925	1353	8.0	17-	2S	Rhome, TX	1	2	1	20	Donald J. Stotz		7N	185	-12
891007	2617	4.7	40+	15S	Ormond Beach, FL	8	65			Harold J. Carney			165	60
891020	1068	6.9	61-	10S	Lamoni, IA	2	2	2	15	Robert Sandy		5N	191	-39
891022	1282	6.6	44-	4S	Bottelaere,Belgm	8	16	1	9	P. Vingerhoets		12N	187	-15
891105	188491	8.2	34+	17S	Cedarvale, TX	1	6	1	20	Donald J. Stotz		3S	163	39
891115	0844	5.7	92-	19S	Tucson, AZ	1	9	1	20	Jim Stamm		7N	194	-51
891123	1778	7.1	20-	17S	Rosiere, WI	1	2	1	13	Daniel Klos		2S	195	54
891204	164338	8.0	29+	18S	Cupertino, CA	4	16	1	8	Rick Baldridge		4S	162	7
891205	3252	7.0	39+	19S	Sonoita, AZ	2	5	1	20	Jim Stamm		9N	160	-9
891205	3252	7.0	39+	15S	Flush, KS	3	8	2	20	Richard P. Wilds		7N	165	-9
891205	3258	8.5	40+	15S	Sonoita, AZ	1	8	1	20	Jim Stamm		0	164	-11
891207	128417	7.2	62+	10S	Cotton Plant, FL	1	8	2	20	Tom Campbell		2N	170	-41
891207	128494	7.9	63+	6S	Cactus Forest,AZ	1	1	1	20	Jim Stamm			174	-43
891222	1944	5.6	28-	14S	Swainsboro, GA	1	6	3	12	Roger Venable		0	193	
900202	0302	6.4	43+	2N	Poway, CA	1	5	1	20	David P. Werner		2N	0	-66
900204	076472	7.5	67+	9N	Elmont, KS	7	54	1	20	Richard P. Wilds		0	11	-60
900205	0746	6.8	75+	2N	Clio, MI	1	2	3	51	Chris Bayus			5	-56
900208	1310	4.2	99+	-6S	Putte, Belgium	2	4	2	12	J. Schwaenen			187	-5
900302	075509	8.0	27+	6N	Fredonia, KS	1	12	1	33	Richard P. Wilds		0	3	-66
900303	076102	7.9	39+	9N	Cannon, TX	1	11	1	20	Donald J. Stotz		0	9	-64
900303	0701	7.1	49+	1N	Houston, PA	2	7	1	15	John Holtz			2	-59
900303	0541	4.0	39+	-10S	Flint, MI	1	0	1	51	Richard Walker			189	-61
900304	076770	7.6	51+	11N	Kearney, MO	4	20	2	9	Robert Sandy			12	-56
900304	076770	7.6	51+	11N	Padonia, KS	6	24	1	20	Richard P. Wilds		1N	12	-56
900401	078172	8.2	43+	12N	Hormersdorf,DDR	5	18	3	5	Viertel/Buttner		0	13	-38
900406	1486	4.6	85+	15N	Wilton Center,IL	1	2	1	13	Robert H. Hays,Jr		8N	15	22
900428	076945	7.7	12+	16N	Darlington, PA	2	17	1	15	Breidenback/Holtz		2N	13	-48
900428	076945	7.7	12+	16N	Fox Chapel, PA	1	7	2	20	John Holtz		2N	13	-48
900429	079006	8.9	29+	12N	Haamstede, Neth.	1	2	1	20	Henk Bulder		10N	13	-23
900502	1441	6.4	61+	13N	Middenmeer,Neth.	5	11	1	6	Henk Bulder		3S	14	23
900503	118342	8.5	70+	16N	Niepolomice,Pol.	2	8	2	15	Janusz Slusarczyk				

List created 5/31/1990



Anonymous by Kleopatra 1990 Aug 20



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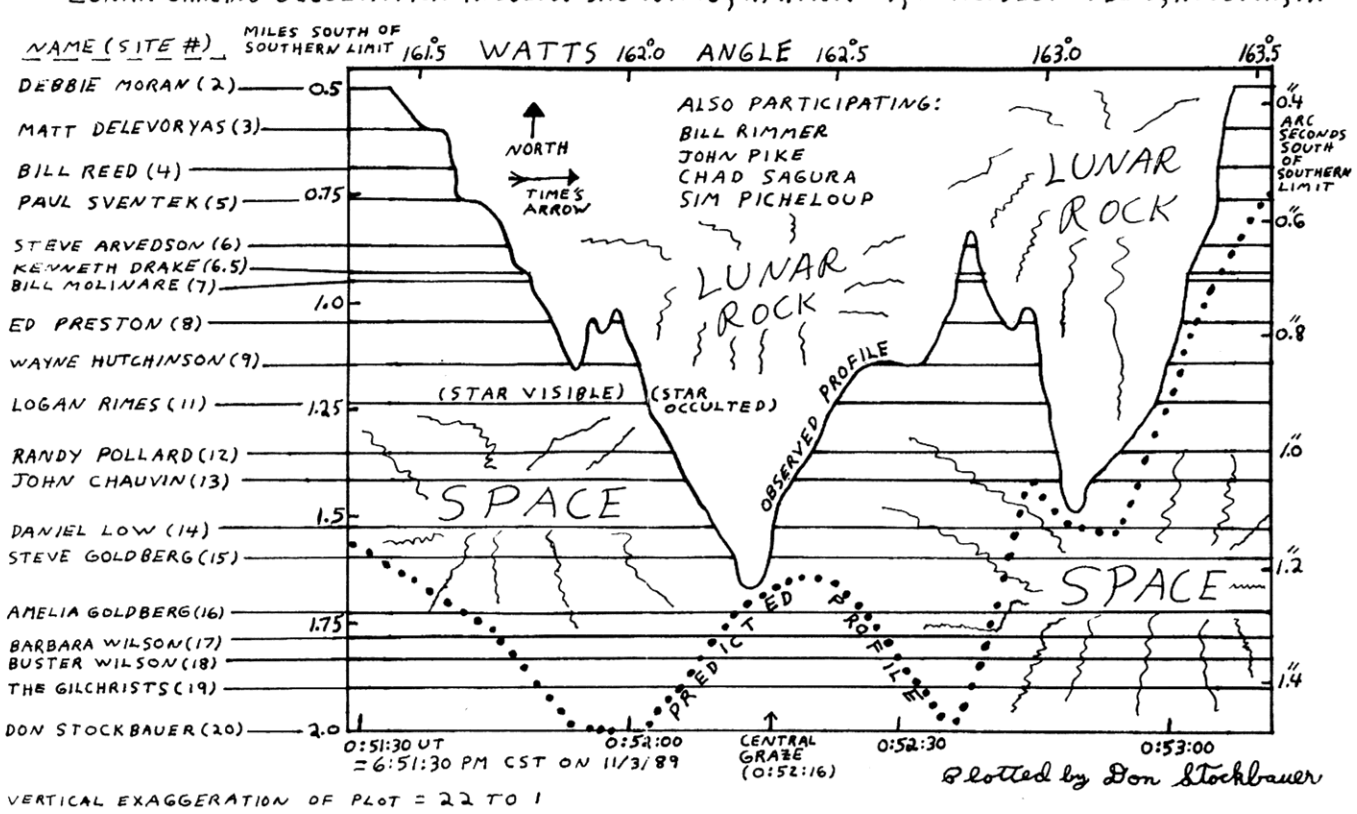
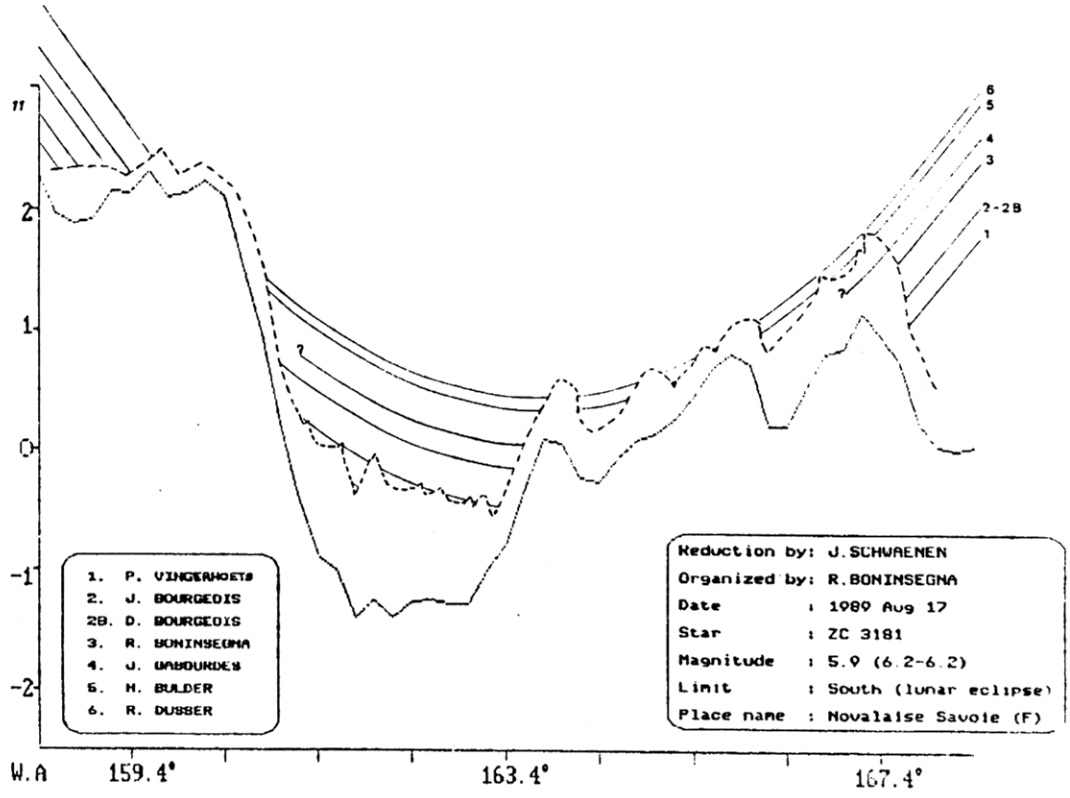

LUNAR GRAZING OCCULTATION RESULTS. SAO 187318, 11/4/1989(UT), W. T.C. JESTER BLVD, HOUSTON, TX
NAME (SITE #)
MILES SOUTH OF SOUTHERN LIMIT
WATTS ANGLE
DEBBIE MORAN (2)
MATT DELEVORYAS (3)
BILL REED (4)
PAUL SVENTEK (5)
STEVE ARVEDSON (6)
KENNETH DRAKE (6.5)
BILL MOLINARE (7)
ED PRESTON (8)
WAYNE HUTCHINSON (9)
LOGAN RIMES (11)
RANDY POLLARD (12)
JOHN CHAUVIN (13)
DANIEL LOW (14)
STEVE GOLDBERG (15)
AMELIA GOLDBERG (16)
BARBARA WILSON (17)
BUSTER WILSON (18)
THE GILCHRISTS (19)
DON STOCKBAUER (20)
NORTH
TIMES ARROW
ALSO PARTICIPATING:
BILL RIMMER
JOHN PIKE
CHAD SAGURA
SIM PICHELOUP
LUNAR ROCK
SPACE
(STAR VISIBLE)
(STAR OCCULTED)
OBSERVED PROFILE
PREDICTED PROFILE
ARC SECONDS SOUTH OF SOUTHERN LIMIT
0:51:30 UT
=6:51:30 PM CST ON 11/3/89
CENTRAL GRAZE (0:52:16)
Plotted by Don Stockbauer
VERTICAL EXAGGERATION OF PLOT = 22 TO 1


1. P. VINGERHOETS
2. J. BOURGEOIS
2B. D. BOURGEOIS
3. R. BONINSEGNA
4. J. DABOURDEB
5. M. BULDER
6. R. DUSSER
Reduction by: J.SCHWARENEN
Organized by: R.BONINSEGNA
Date : 1989 Aug 17
Star : ZC 3181
Magnitude : 5.9 (6.2-6.2)
Limit : South (lunar eclipse)
Place name : Novalaise Savoie (F)
W.A
159.4°
163.4°
167.4°

NEW DOUBLE STARS

David W. Dunham and Tony P. Murray

Unfortunately, Dunham has not had time to prepare an article in the "New Double Stars" series since August, 1980, when the last of the series appeared in O.N. 2 (9), p. 98-100. Fortunately, three people responded to my appeal for a coordinator to resume this important work (p. 359 of the last issue), and the first of these will resume the series starting with the next issue. If you have observed stars to disappear or reappear in steps, or in a distinctly gradual manner, and this has not been reported in a previous issue, please send a report of this to Tony P. Murray; Route 1, Box 67; Georgetown, GA 31754; U.S.A.; telephone (912) 334-2845. Report the star's SAO (or DM, if not in the SAO) number, the date, the place of observation, the method of observing the occultation, the duration of the step or gradual event, an estimate of the magnitude drop or increase for step events, the position angle and cusp angle of the event, % of the Moon sunlit, steadiness and visibility of the star (atmospheric seeing and transparency), your certainty of the step or gradual phenomenon, and any other conditions that might affect the observation (such as altitude of the Moon, if relatively low). Dunham will send Murray several reports that he has received during the past decade, but some of these may have been misplaced. Consequently, you are encouraged to send a copy to Murray, even if you have previously sent it to Dunham.

Murray has access to an IBM PC machine, so he will be able to directly update IOTA's zodiacal double star dataset, created in its current form by Don Stockbauer for graze predictions a few years ago. We will have important help from others in working on the double star dataset, which includes data only up to 1974 for most visual doubles. David Herald will compare the dataset with a copy of an up-to-date version of the master double star database maintained by Charles Worley at USNO, to update our information; he will also use recent speckle interferometric observations, given in the Center for High Angular Resolution Astrometry's (CHARA's) 2nd interferometric catalog. Don Stockbauer will work to correct errors in the current dataset, and possibly add some information from earlier datasets that I had maintained at USNO. CHARA, at Georgia State University, hopes to give some support to our efforts and, using our updated files, to publish a comprehensive catalog of occultation doubles sometime during the next several months.

REPORTS OF ASTEROIDAL APPULSES AND OCCULTATIONS

Jim Stamm

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

(324) Bamberga and SAO 138118, Mar. 18,1989: [O.N. 4 (14) 370]. The ". . . other observer . . ." who confirmed Koppl's observation was Bruce Levin at Albuquerque, New Mexico. He recorded a disappearence at 04:07:50.56, and a reappearance at 04:07:57.69. Koppl's observation was at Paradise Hills, New Mexico (near Albuquerque). The occultation was also recorded photoelectrically at Lowell Observatory where the event was nearly central.

(9) Metis and SAO 190531, Aug. 6, 1989: Five chords were obtained by observers in the R.A.S.N.Z., and Graham Blow has published a preliminary paper showing that Metis probably has a reasonably elliptical shape. Both Edwin Goffin and David Dunham had separate predictions for this event, the former placing the path across the northern North Island of New Zealand, and the latter across the southern South Island. Bob Hindsley at Black Birch Astronomical Observatory obtained two update plates showing a substantial southward shift from Goffin's prediction. Observers throughout New Zealand and southern Australia were notified. As it turned out, the actual path fell between the two nominal predictions. Despite the 0.8 magnitude drop, good timings were submitted by Peter Daalder and Martin George in Launceton, Tasmania; and by New Zealand observers John Priestley (Pukerua Bay), Philip Riley (Tawa), and William Allen (Blenheim). Other observers who turned out to be within the path, but who could not report times due to the difficulty of the event were Jack O'Kane (Upper Hutt), Gordon Hudson (Pukerua Bay), and Graham Blow (Pukerua Bay). Negative observations closest to the positive observers came from Robert Watson, Kym Hill, and S. Dieters (Hobart, Tasmania); and Noel Munford (Palmerston North, NZ), who had poor conditions and couldn't be certain that there was no event. Other negative observers were Australians Charlie Smith (Woodridge, Qld.), Jim Blanksby (Wandin, Vic.), Alfred Kruijshoop (Mt. Pleasant, Vic.), Steve Hutcheon (Sheldon, Qld.), Peter Anderson (The Gap, Qld.), and Phillip Kearney (Bundaberg, Qld.); and New Zealanders Mervyn Thomas (Dunedin), Alan Gilmore (Lake Tekapo), Wayne Orchiston (Gisborne), Ray Lee (Wanganui), and Lou St. George (Auckland). Thus this becomes the best observed minor planet occultation from Australasia. Look for a full report from Graham after the analyses is completed.

(369) Aeria and AGK3 +07° 0405, Nov. 21, 1989: Jim Blanksby at Wandin, Victoria, Australia reported a "certain" disappearance at 16:57:15.1 and reappearance at 16:57:19.0, along with an associated flicker that he did not believe was due to sky conditions. His observations correspond to a 45 km chord length, as compared to a predicted diameter for Aeria of 62 km, as well as a south shift of 2". Peter Anderson (The Gap, Qld.), reported a close pass. Charlie Smith saw nothing at Brisbane ("with cloud").

As of June 4th, the only reports that I have received from coordinators for 1989 events are from Graham Blow/RASNZ, and Roland Boninsegna/GEOS (through September 9th).

THE PLEIADES PASSAGE OF 1990 AUGUST 14

David W. Dunham

From 5^h to 8^h U.T. Tuesday morning, August 14th, the 43% sunlit Moon will cross the center of the Pleiades as seen from the U.S.A., producing one of the best passages of the current series for North Americans. Much information about this passage, including predicted Universal Times of reappearances of stars down to mag. 8.4 and other data, are included in my article, "A Spectacular Pleiades Occultation", on pp. 175-176 of the August issue of Sky and Telescope. A minor error is in the table at the top of p. 176: The first event for Austin (Au) at 6:04 is a reappearance, and should be one line below its published position. Also, S&T did not have room to publish some notes about the table, given here: The following reappearances are visible from only one of the cities in the table and are not listed there: At Tampa, SAO 76164, magnitude 6.5, 6:03 UT, cusp angle 37N; and at Vancouver, SAO 76225, mag. 6.6, 7:20, 19S; SAO 76264, mag. 6.8, 7:57, 7S; and SAO 76350, mag. 6.4, 10:50, 29S. The event listed for SAO 76228 for Kansas City is a grazing occultation that will be visible from the southern part of the city, not just a disappearance. Similarly, the following unlisted events will be grazes: At Halifax, SAO 76119, mag. 8.5, 5:33, 7N; and at Tampa, SAO 76159, mag. 5.8, 5:48, 7N.

Chart. The chart of the Pleiades shows the topocentric paths of the Moon's center for several cities, like the one described in O.N. 4 (7), 158. Use of apparent-place (equinox of date) coordinates for the chart facilitates use with the detailed USNO total occultation predictions, which list the apparent R.A. and Dec. for each occulted star. The motion is from right to left, with integral hours of Universal Time indicated by small numbers above tickmarks along the paths. The paths start at moonrise with a circled "A". The chart shows stars down to mag. 11, with stars brighter than 10th mag. numbered to the right. Numbers below 510 are USNO P-catalog numbers, 536-562 are Zodiacal Catalog (ZC) numbers, and numbers greater than 4000 are USNO XZ-catalog numbers. Underlined stars are known or suspected doubles. SAO numbers and named stars are indicated on the chart in Sky and Telescope. The Moon diagram, produced by Bob Bolster using a modified version of John Westfall's MOONVIEW program, is oriented with north up. The position angle of the north cusp will be 348° and the P.A. of the center of the bright limb will be 78°.

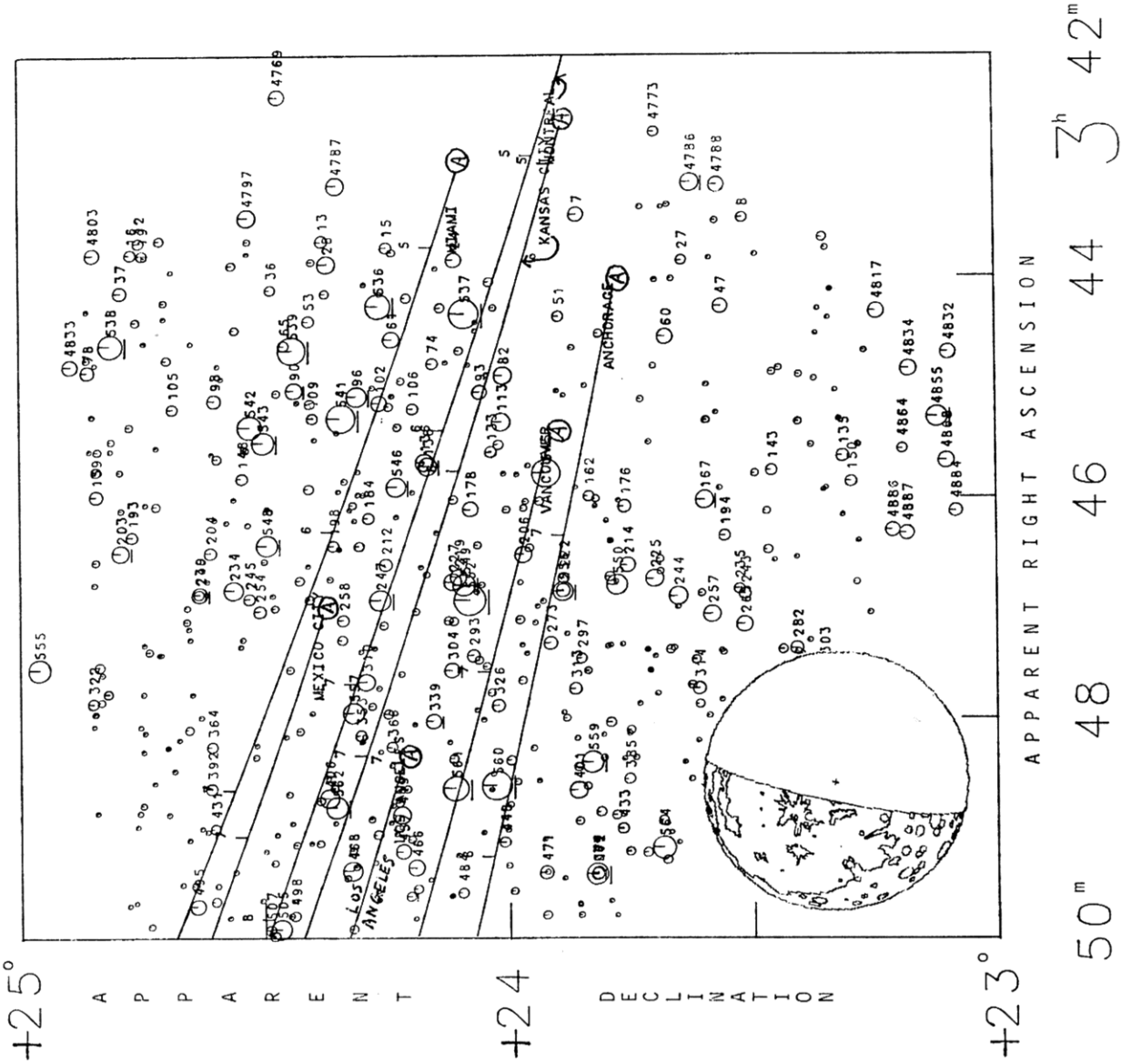
Priority. Remember that the main goal of observations of Pleiades passages is to time as many contacts as possible around the entire circumference of the Moon's disk. Hence, the priority for observing Pleiades passages should be: first, bright-limb grazes of Alcyone (and of other bright Pleiads, if conditions permit bright-limb timings); second, time as many total occultations as you can with the largest-available telescope; and third, dark-limb grazes. If your telescope is portable and there are no suitable bright-limb grazes nearby, and especially if trees or other obstacles make your home location unsuitable for observing total occultations, you may as well try the closest dark-limb graze.

Grazes. The most important graze will be that of Alcyone (Eta Tauri), at its southern limit, shown crossing the central Florida peninsula on p. 69 of the January issue of S&T. It is the only Pleiad bright enough to reliably time events on the sunlit limb, so this event presents the only opportunity to observe contacts in the bright south polar region of the Moon. For information on efforts to observe this graze, contact either Harold Povenmire, phone 407-777-1303 (near Melbourne) or Tom Campbell, 813-985-1842 (near Tampa). Both are also going to lead expeditions to Eulonia and south of Valdosta, Georgia, for the easier dark-limb graze of Taygeta (19 Tauri, SAO 76140, apparently a very close binary star). In Eulonia, which is on I-95, Povenmire can be reached at the Days Inn, which is in the Taygeta graze path. Georgia is the last landfall for the Taygeta graze until eastern Nova Scotia; the northern limit lies tantalizingly close to the Carolina beaches, passing only one mile south of Cape Hatteras! The paths for the grazes of 16 Tauri (Celaeno) and 20 Tauri (Maia) in the Midwest are also on the map on p. 69 of the January S&T. Expeditions for the spectacular Maia graze, the best during this passage, are noted in the article in the August S&T.

Grazes of three 6th-magnitude stars visible near Charleston, SC; Cincinnati (contact Basil Rowe, phone 513,561-4987, for a possible expedition) and Columbus, OH; Erie, PA; Miami, FL.; and the Outer Banks of North Carolina are shown in the 1990 RASC Observer's Handbook. There may be an expedition from the DC area for the Outer Banks graze, but another candidate for a DC-area expedition would be to try to observe the dark northern-limit graze of 8.6-mag. SAO 76149 and the sunlit southern-limit graze of 4.2-mag. Merope at their intersection about 20 miles north of Richmond, VA. If you have details of a Pleiades graze expedition in your area, send them to me at the Greenbelt address in the masthead, or phone them to 301,474-4722. During the week before the passage, information on all the expeditions that I know about can be obtained by calling the IOTA Occultation Line at 301,474-4945.

Daytime Passages. Observers should beware of crescent-moon Pleiades passages that occur in the daytime. Data for several stars during these events are given in USNO total occultation predictions, and predictions for grazes of the brighter members are given in IOTA's coverage. Don't get too excited about these events, since when the Sun is up, it may be possible to see occultations of only the 3rd-mag. stars, and then only if conditions are perfect. This is the situation for the August 14th passage for most of Europe, and was and will be the case for most of North America on June 20 and September 10 (the latter will be quite favorable before sunrise along the west coast).

Other Passages. Unfortunately, the passage of March 2-3, described on p. 367 of the last issue, was clouded out in eastern North America. Many observers in the Midwest, where only outlying Pleiads were occulted, had better luck. Similarly, the April 26th thin-crescent passage was foiled by extensive cloudcover in the U.K. and northwestern Europe. The good Mexican Pleiades passage of 1991 July 8 is discussed in the article about solar eclipses elsewhere in this issue.



ESOP IX

The organization "Kulturbund" e. V. is pleased to announce that the ninth European Symposium on Occultation Projects, sponsored by IOTA/ES, will be held from 24 to 28 August 1990 in Jena, German Democratic Republic. The symposium is open to everybody who is interested in the prediction, observation, or measurement of occultations between bodies of the solar system and the stars. The congress languages are German and English.

The conference fee is 50,- M/DM, or its equivalent. Please transfer the conference fee before 30 June to the account number 6651-53-30 144

cod. number 80 427
Staatsbank der DDR
Berliner Stadtkontor
Spandauer Str. 2
DDR-1020 Berlin

The organizing committee is Hans-Joachim Bode, Karl-Ludwig Barth, Dr. Eberhard Bredner, and Edgar Otto.

Please address all correspondence on ESOP IX to:

Edgar Otto	Hans-Joachim Bode
Friedrichshohe 11	Bartold-Knaust-Str. 8
DDR-7208 Eilenburg	D-3000 Hannovr 91
(East Germany)	(West Germany)
Tel. 3043	Tel. (0511) 424 696

Considering that this ON will not be received before the registration deadline, I recommend those interested in participating contact Edgar Otto or Hans Bode directly. Also, late registrants may have difficulty finding hotel accommodations. - ed.

SOLAR ECLIPSE NEWS

David W. Dunham

1988 March 18. David Herald has performed a preliminary analysis of timings of dozens of Bailey's bead events observed at T. Berikat Nth and P. Matras, Sumatra. The events are well-distributed around the lunar circumference. The correction he derived to the standard solar radius was +0".22 ±005.

1990 July 22, total. There have been many changes in IOTA's plans for this eclipse since the article in O.N. 4 (14), p. 354. The rapidly-changing developments have been included in the messages on IOTA's Occultation Line at 301,474-4945. From west to east along the path, the current IOTA efforts are described:

Finland: There will be a major local effort to from both path edges; foreign observers are encouraged to join the effort. As noted in O.N. 4 (14), p. 356, those headed for Finland should contact Ursa Astronomical Association; Laivanvarustajankatu 3; SF-00140; Helsinki; literature is available in both Finnish and English. Dr. Eberhard Bredner, secretary of IOTA/ES in Hamm, German Federal Republic (phone 2381-31774) wants to meet anyone planning to observe near Joensuu. Meet him at the square (marketplace) of Joensuu on Saturday, July 21, at noon to exchange last information. He plans to stay there until 18h or 19h Finish Summer Time.

Chersky area, Siberia: Hans-Joachim Bode and three other German members of IOTA/ES will be joining a Kiev State University expedition to Kaperveem near the northern limit, with hopefully another effort to the southern limit, as guests of the U.S.S.R. Academy of Sciences, as described in O.N. 4 (14), p. 354. The academy has encouraged the effort by subsidizing the travel between Moscow and Yakutsk.

Markovo area, Siberia: The Bering Air charter flights between Nome and Provideniya were resumed shortly after the last issue went to press. On June 22, I received a call from Jim Stimpfle, of Stimpfle/Johnson Projects in Nome, saying that they had just received an invitation from the Anadyr Soviet District Committee for up to 30 Americans to observe the eclipse from Markovo, 900 miles west of Nome and a few hundred miles southeast of Chersky. The round-trip cost from Nome for the 6-day stay in Siberia is $1125 per person, significantly less than if we had tried to arrange it on our own. Since several American IOTA members had already bought tickets to Anchorage (see below), four of us, including myself, decided to pursue this "back-door" route to the eclipse. Two roads extending from Markovo cross the northern limit, one near a mountain village named Tytkum. There are no towns or roads near the southern limit in the Markovo area, so our small group will probably be able to travel only to the northern limit.

Aleutians: The Aleutians had not been considered because the weather prospects are worse there than at any other place along the path. However, Jim Vail and Glenn Schneider contacted pilots who fly in the area, and were told that the persistent cloudcover in July is usually low, with the cloudtops averaging about 3000 ft. Since mountains on Atka Island near the southern limit and Amukta Island near the northern limit are higher, they and several other IOTA members decided to try to get to these American mountaintops rather than go to the U.S.S.R. Seven or eight eclipse chasers have now made plans to go to Atka, which has an airfield, but suitable arrangements to get to uninhabited Amukta were not possible.

1990 August 6, partial lunar. Although this is a lunar rather than a solar eclipse, I thought that this would be the best place to mention it. See p. 174 of the August issue of S&T for information about this eclipse, the last lunar event until 1992. Eastern-hemisphere observers should attempt to observe occultations and southern-limit grazes during this eclipse. Since it is partial, very faint stars will not be visible, so a chart of the star field has not been prepared.

1991 January 15, annular. See O.N. 4 (14), p. 355. Contact Paul Maley; 15807 Brookvilla; Houston, TX 77059; phone 713,488-6871; e-mail sn::maley on SPAN for details about this eclipse, more information about which will be included in the next issue. A tour of New Zealand for about $2400 is being organized by Maley and Hanssen/Future Travel (phone 713,480-1988 or 800,544-4998).

1991 July 11, total. Again, see O.N. 4 (14), p. 355. Tours to Puerto Vallarta are being organized by Maley and Hanssen/Future Travel, and by Hans Bode for IOTA/ES. Maley will visit the area early this month, and Bode plans to do the same in August, to set up detailed arrangements for announcement in the next issue. Because Puerto Vallarta is a major resort with thousands of hotel rooms, there is not as great an urgency to make arrangements as for the more popular Hawaii and Baja, where resources are much more limited and already oversubscribed.

I have written letters to Jay Anderson and Joe Rao asking for weather prospects for Mexico for the spectacular July 8th Pleiades passage (See O.N. 4 (14), p. 355 and in O.N. 4 (13), p. 322). During the early morning hours, there is usually still extensive cloudcover from the daytime buildup of thunderstorms over most of mainland Mexico, but it is variable. More information is needed, but prospects may be best in Baja, where Harold Povenmire and/or Richard Nolthenius will probably lead expeditions for the Pleiades grazes (either Atlas and/or ZC 551, which is visible from parts of La Paz) and the northern eclipse limit. Again, more information about these arrangements later. The July 8th Mexican Pleiades passage was first pointed out to me by Isao Sato in Japan in 1987.

For Puerto Vallarta, the current Hanssen/Future Travel arrangement (total cost from Houston about $500) calls for departure from Houston on July 9th, which is after the Pleiades passage, and also may not allow enough time for the IOTA meeting that we plan to hold there between the 8th and 11th. Richard Wilds is trying to charter a bus (to allow transport of portable telescopes) to go from Topeka, KS to the eclipse, and perhaps also to the Alcyone graze near Acapulco on the 8th, with the estimated cost $600 - $800, including transportation and lodging. For more information, call Richard at 913,354-8771.

REPORT FROM THE SECRETARY/TREASURER

Greg and Terri McManus

Since we have taken over the office of secretary/treasurer, we have been extremely busy. We have finished entering all of the data base that was previously maintained by Derald Nye and are now able to supply all of the labels and information needed by the computors for graze predictions. Please make sure that all information concerning your graze predictions such as address changes and graze radius changes are sent to us as soon as possible.

Concerning the above, a huge debt of gratitude and thanks goes out to member REX EASTON for the many hours of time and effort that went in to making the data base that we are using work. He also has written programs that we are using to produce all the information needed to complete our jobs as secretary/treasurer. THANKS, REX!

Due to the 20% increase in postal rates that will take effect at the end of the year, we are going to have to raise the membership dues in all categories starting January 1, 1991. The increases that we are looking at now are greater than 20% for the following reason: Whenever we produce a newsletter, we cannot pay for it until after almost all of the memberships that need to be renewed for that quarter have done so. With the last two newsletters, we had to wait almost two months before we had enough money to pay the postage and the printer expenses. We feel that we need to have enough money in reserve to pay for all the bills that come in as they come in. The specific increases will be decided upon at the IOTA meeting in August.

HISTORY OF ON AND IOTA

Joan and David Dunham

This issue, the final issue of Volume IV, seemed an appropriate time for reminiscence. The issue marks the sixteenth year of ON publication and the fifteenth year of IOTA.

The first issue of ON was published in July, 1974 with Homer DaBoll as editor. The six objectives of this publication he listed were:

1) to publish quarterly, but with the flexibility to issue intermediate unscheduled important notices;
2) to inform observers regularly of newly-discovered double stars and of other occulted objects of particular scientific interest, including planets and asteroids;
3) to publicize new observing techniques;
4) to inform observers of progress with the analysis of observations, including summaries of published results;
5) to publish articles and notes contributed by observers, particularly those discussing observing techniques and unusual observations; and
6) to stay out of debt.

The masthead for the ON appeared in the second issue. It was designed by Raymond F. DaBoll, Homer's father, and a well-known designer and calligrapher. The first issue asked for suggestions for a better name than Occultation Newsletter; the second issue reported that a majority of those who replied wanted the name to stay as orginally suggested. The present format, of two columns, was settled upon in the third issue of volume 2, of April 1979. The type font from the very first issue was the Letter Gothic 12-pitch font, chosen in part because both Homer and David had access to IBM typewriters with that font.

Issue number 4, published in May, 1975, announced the formation of IOTA, with ON as the official publication of IOTA and Homer DaBoll handling the financial and secretarial duties. Homer first suggested "International Occultation Timing Association" as the name of the organization. The formation of IOTA was necessary due to lack of success in obtaining funding to support the costs of distributing grazing occultation predictions and papers. The ON subscribers were not required to join IOTA, but IOTA membership included an ON subscription. By the fifth issue, August 1975, IOTA had 79 paid members. IOTA was incorporated in the state of Texas in 1983. The IRS then granted IOTA status as a tax-exempt organization under section 509(a)(2) of the (USA) Internal Revenue Code in January, 1984. Our tax number is 36-3254326.

In June, 1976, the formation of a European section, IOTA/ES, was announced. It has been led by Hans-Joachim Bode since its inception.

The IOTA officers have been
July 1975:
President - David Dunham
Vice President - John D. Phelps, Jr.
Secretary - Berton L. Stevens, Jr.
Treasurer and ON Editor - Homer DaBoll
July 1977:
President - David Dunham
Vice President and ON Editor - Homer DaBoll
Secretary - Berton L. Stevens, Jr.
Treasurer - John D. Phelps, Jr.
November 1978:
President - David Dunham
Vice President and ON Editor - Homer DaBoll
Secretary - Treasurer - John D. Phelps, Jr.
October 1983:
President - David Dunham
Executive Vice President - Paul Maley
Executive Secretary - Chuck Herold
Treasurer and ON Editor - Homer DaBoll
Corresponding Secretary - Mark Allman
V. P. for Grazing Occultation Services - Joe Senne
V. P. for Planetary Occ'n Services - Joseph Carroll
V. P. for Lunar Occultation Services - Walter Morgan
May 1986:
Secretary- Treasurer and ON Editor - Homer DaBoll
Other officers were unchanged from 1983.
In 1988, Gary Nealis took over as Acting Executive Secretary, as Chuck Herald took a job in Venezuela.
December 1989:
Executive Secretary - Gary Nealis
Secretary- Treasurer - Craig and Terry McManus
ON Editor - Homer DaBoll
Other officers were unchanged from 1983.

IOTA Meetings:
July 1975 Organizing Meeting - in Highland Park, Illinois, in the Bixby family residence.
August 1977 First Meeting - at the University of Colorado in conjunction with a convention of the

National Amateur Astronomers, Inc., the Association of Lunar and Planetary Observers, the Western Amateur Astronomers, and the Astronomical League.
Regional Meeting - Cocoa Beach, Florida, in conjunction with the June 15-17, 1978, meeting of the Southeast Region of the Astronomical League.
First Annual Meeting - at the Lunar and Planetary Institute in Houston, Texas, November 11, 1983
Second Annual Meeting - at the Lunar and Planetary Institute, October 20, 1984
Third Annual Meeting - at the Lunar and Planetary Institude, November 16, 1985
Fourth Annual Meeting - in conjunction with the Texas Star Party at Prude Ranch, Fort Davis, Texas, on May 10, 1986
Scientific Meeting - at Astrocon '86 held in Notre Dame College, Baltimore, Maryland on August 5-10, 1986.
Universe '87 - at Pomona, California in July 11-18, 1987, with the Astronomical Society of the Pacific, the Western Amateur Astronomers, the Astronomical League, the Association of Lunar and Planetary Observers, and Problicom
Fifth Annual Meeting - at the Lunar and Planetary Institute, October 10, 1987
Sixth Annual Meeting - at the Lunar and Planetary Institute, November 12, 1988
Seventh Annual Meeting - at the Lunar and Planetary Institute, December 16, 1989.

Prediction Computations

A major feature of the history of IOTA has been the increased use of microcomputers. When IOTA was organized, all prediction computations were done on large computers. Berton Stevens described the Automatic Computer Lunar Profile Plotting Program (ACLPPP), which he had nearly completed, in the second issue of the ON. This program originally ran on IBM 360 mainframe computers, and became a major component in the predictions process. The ACLPPP was run in conjunction with the GRAZE program that computed the grazing occultation prediction limits. Both ACLPPP and GRAZE depend on the US Naval Observatory data generated by the OCC program written by Tom Van Flandern. The ACLPPP and GRAZE programs were converted to run on PC's by Don Oliver. Today, predictions for regions with the most observers (USA northeast and west coast, and midwestern USA) are generated on mainframe IBM computers. Predictions for Japan and the Philippines are also generated on a mainframe computer. Predictions for the rest of the regions are done on PC's.

International Lunar Occultation Centre

In issue 5 of ON Vol 2, November 1979, the announcement was made that the Royal Greenwich Observatory planned to terminate most of its work with lunar occultations at the end of 1980. HMNAO had assumed this responsibility in 1943, and had for many years collected and keypunched all occultation observations reported to it and distributed residuals to the observers. In issue 10 of Vol 2, January 1981, Leslie Morrison announced that the Astronomical Division, Hydrographic Department in Tokyo, Japan was the new International Lunar Occultation Centre (ILOC). The design of the ILOC occultation report form was the result of a cooperative effort between IOTA and ILOC.

Satellites of Asteroids

One of the more exciting events in IOTA's history was the discovery of satellites of asteroids from occultation observations. The occultation that Paul Maley saw when trying to observe (6) Hebe occult g Ceti A was far from the path defined by other observations, as reported in ON 1 No. 11. More dramatic were the anomalous occultation observations of a 6th magnitude star by (532) Herculina reported by Jim McMahon in California, and Ted Bowell and Mike A'Hearn at Lowell Observatory. This was discussed in ON 1 No. 15. The cause of this event, as well as other reported secondary timings, is still a matter of controversy. These observations are real, in that the star did disappear momentarily for the observers. But what has not been resolved is whether the disappearance was caused by an occultation of the star by a celestial object, or by something closer to home, such as a seeing event or a momentary failure of the electronics. The event was at a low elevation for McMahon and very low at Lowell Observatory, but the observing conditions were reported as being good. Attempts to recreate the event by having the star drift out of the detector field of view did not produce the same data as observed. The electronics were not found to be prone to failure. No explanation for these observations that is generally recognized as matching the observations, and is generally accepted, has been found.

We have noticed that the frequency of reported secondary occultations has diminished in recent years. The best observed asteroidal occultation, the (2) Pallas occultation of 1 Vulpeculae, produced no anomalous events. A few reported events that might have been caused by a satellite were contradicted by other observers on the same tracks who saw no anomalous events. It was suggested that perhaps observers are afraid to report secondary events, but that seems unlikely for two reasons. One is that most observers reporting events have very little knowledge of what other observers are reporting, and would not know if their event was inside or outside the occultation path being reported by others. The second reason is that observers freely report flickering or seeing events, often labeling them as dubious. (They should be reported, particularly if they were timed by the observer. Even if the observer thinks they are seeing events, they provide a means of gauging the atmospheric conditions at the time of the observations.)

We had hoped that the Hubble Space Telescope would be able to image some of the asteroids directly and see if companions could be detected. Unfortunately, the recent discovery of problems in focussing the HST means that we cannot expect a resolution of this issue for many years.

ON Volumes

Vol 1, first issue - July 1974; last (sixteenth) issue - August 1978
Vol 2, first issue - November 1978; last issue - June 1982
Vol 3, first issue - November 1982; last issue - June 1986
Vol 4, first issue - July 1986; last issue - June 1990

IOTA Eclipse Trips

Members of IOTA have organized several eclipse trips as a part of the continuing experiment to determine the diameter of the Sun from eclipse observations, and to monitor the changes in the diameter from eclipse to eclipse. The trips organized so far are:

1976 - David Herald organized observations in southeastern Asutralia

1977 - The Dunhams attempted to observe in Colombia, but last minute clouds interfered.

1979 - IOTA organized observations made in the northwestern USA and Saskatchewan.

1980 - Observations were made in India by the Dunhams, Alan Fiala of the US Naval Observatory, and David Herald.

1981 - David Herald organized observations in Tasmania. Alan Fiala's attempt to videorecord Baily's beads was foiled by clouds.

1983 - Observations were made in Java, mostly by David Herald (and others) at the northern limit and Alan Fiala near the southern limit.

1984 - Dozens of video recordings were made of this annular eclipse, most of which are still unreduced.

1987 - IOTA, through the efforts of Paul Maley, organized expeditions to Gabon (March) and China (September). The Japanese Lunar Occultation Observers' Group observed the September eclipse from the islands Aka and Fukaji, southwest of Okinawa. Astronomers from Shanghai Observatory also observed at both limits.

1988 - IOTA/ES led a group to the southern limit in Kalimantan (Borneo), and David Herald led a group to Bangka Island.

1990 - Expeditions are planned to Finland, Siberia, and the Aleutian Islands.

1991 - Expeditions are planned for points in Mexico and Hawaii.

Occultations by Comets

Predictions of occultations by comets have been produced for objects of interest (Giacobini-Zinner, West, Wilson). To date, only one person, Richard Nolthenius, has succeeded in observing an occultation by a comet. He saw an occultation by Comet IRAS-Araki-Alcock, in May 1983. Cometary nucleii are very small relative to their comas, and it is exceedingly difficult to predict the location of a nucleus.

The success of ON and IOTA was possible because of the efforts of many observers and members. The contributions of Homer DaBoll, especially his many years of service as editor, are particularly noteworthy.

PALLAS OCCULTATION ARTICLE IN ASTRONOMICAL JOURNAL

David W. Dunham and Joan Bixby Dunham

Our paper, "The Size and Shape of (2) Pallas from the 1983 Occultation of 1 Vulpeculae", was finally published in Astronomical Journal 99 (5), pp. 1636-1662 (1990 May). The list of 46 authors is a new record for the A.J. We ordered 1000 reprints, so that one could be distributed to each O.N. subscriber and each observer mentioned in the paper, with still a good supply for the authors. A copy of the paper is enclosed with the mailing for this issue, along with a small sheet of errata.

VIDEO NEWS

David W. Dunham

In April, IOTA decided to make a group purchase of the Phillips CCD imaging module discussed on p. 362 of the last issue. Ten members sent payments of $397 to the McManuses, who coordinated the purchase. $390 of the price is the unit price that Amperex Corp. charged to buy the top grade module for a purchase of 10 to 99. The other $7 covers the shipping charge from Amperex, and to the individual purchasers. The units were received by the McManuses in late June, and sent on to those who had sent in their payments. One of the purchasers, Peter Manly, will box his unit with manual gain control and give advice to the others on how he did it. We will start collecting names of others who may want to buy the module in a second group purchase later this year.

It turns out that CCTV Corp. in New York sells the Philips module in a box as a ready-to-use camera, selling it for $395 with only automatic gain control (item GBC500), and for $460 with either manual or automatic gain control (item GBC505). The camera weighs 12 ounces, is 2 1/2 inches high, 1 1/2 inches wide, and 3 3/4 inches long. It has a separate gain control box and power supply, attached by cables. The power input is either 117 or 220 volt AC, or 12 volt DC. One of our members ordered the $460 unit from CCTV late in May, and it still had not arrived after 4 weeks.

A problem that I did not address last time is recording time signals with a VCR. If you are going to buy a VCR for an occultation video system, try to get one with microphone input. Nearly all of the inexpensive AC VCR's on sale now have audio line (RCA jack) input, but not microphone input. Glenn Roark informs me that Panasonic has a unit with microphone input, model AG-1240 VCR, available for about $300 from 47th St. Photo.

For VCR's that have only audio line input, you can't just use a microphone-to-RCA adaptor to plug a microphone into the audio line input, since the impedances are not matched. Wayne Warren and I have found that this problem can be solved by use of the Omnitrac mixer by Arkon, sold for $59 as item B-353-125098 by Damark in Minneapolis (phone 800-729-9000). Gene Lucas said he has solved the problem by using a $27.95 stereo microphone mixer, item 32-1105 from Radio Shack. I bought one of these units. Since it uses 1/4" microphone female jacks for both input and output, I had to also buy a special cable

(Radio Shack part 42-2440) and an adaptor (part 274-325C), as well as a 9-volt battery for the mixer, for a total of $36.04. I was able to record sound with this setup with the RCA audio input on a cheap AC VCR at a usable level only by holding the microphone right next to my mouth, or right next to the speaker of a Timekube. The Omnitrac mixer works much better, and no special adaptors are needed.

A good video-quality microphone (Electro-Voice model 635A, cost about $75), although the recorded volume was slightly greater with the latter. I have found that a good-quality microphone, such as Electro-Voice model 635A (cost about $75), is essential for recording with my old portable VCR that has microphone input, and for triggering Peter Manly's video time inserter with WWV; the cheap audio cassette microphones did not work for these purposes.

I WILL NEVER SEE LE CATEAU-CAMBRÉSIS

Dr. Eberhard Bredner

At the end of 1989, I received information about a spectacular grazing occultation from two sources. The first notice came from my old friend Pierre Vingerhoets of Belguim. He imformed me that Jean Meeus had calculated an outstanding grazing occultation in April 1990. The star was Maia (20 Tauri, mag. 4.0, a Pleiades star), being grazed by a 4 per cent sunlit Moon at an extremely low altitude, only 4 degrees above the horizon. I have never seen a grazing occultation of such an event. The distance from my home to the graze limit should be about 430 km (270 miles), with most of the road a very good Autobahn. So I began to prepare for this.

A few days later, predictions from Dr. David Dunham arrived. As usual, the graze limit differed a bit from the calculations of Jean Meeus. We would have Belgian, Dutch, and German observers, and would have the opportunity to compare these predictions. I transferred the graze limit to a map, looked for a good observing site, and ordered a new map. I found a good site, a hilly place with a good horizon.

A profile calculated by Jean Schwaenen from Belgium came, with a second letter from Pierre with the statement that he would go at any reason. Then an invitation came from Schwaenen to join the Belgian/Dutch group in the place they had picked. I remembered two wonderful grazing occultation expeditions, one to observed a graze of Regulus in November 1987 with Kyril W. Fabrin and other Danish friends, where we had outstanding results. The other was in England with Bert Carpenter, Dick Chambers and A. J. Elliot where we observed a graze during the lunar eclipse on August 17, 1989. The night was as outstanding ad the bottle of champagne we had. Remembering all of this, I decided to join Schwaenen's group.

I ordered a new map, large scale, **2607 le cateau**! I chose as my personal observation point an old road near the crossing of N43 (route national) and D98 (route departmental), near station number 5 in Jean Schwaenen's plans.

Meanwhile, nobody from our local Astronomical Association (ASTRAG VHS Hamm) was able to go, and my girl friend had a chemistry laboratory day at the university. So I could put my telescope (focal length 1.64 m) in the car instead of in my luggage trailer.

The forecast was bad the day before the graze. A call to the national center of the meteorological service showed only a slight chance at the French/Belgian border location of the graze site. Clouds were moving from the Atlantic to Europe. Maybe they wouldn't arrive before the graze. A call to Pierre Vingerhoets wife said: We will go, the weather will be fine.

The day of the graze was cloudy, the rain moved faster than predicted. Pierre was still confident, but he had only half the distance to travel that I had to go. At noon, I cancelled and never went to Le Cateau-Cambresis.

Postscripts:
Nobody tried to observe. The rain arrived at the Vingerhoets' before they were to leave, so they stayed home as well.

From the money I saved not buying petrol for a 900 km trip, I bought a second hand ski-box with carrier for the roof of my car. If you see such a box on top of a car in the summertime, it might be an amateur astronomer transporting a telescope, not a playboy returning from summer skiing. We are planning an expedition August 16/17 near Frankfurt, and the ski-box, and maybe Pierre Vingerhoets, will come too.

There may be enough time during my next trip to Paris to make a slight detour. Then I could see the place I had in mind for so many hours, the N43/D98 crossing near Le Cateau-Cambrésis!.

SOLAR SYSTEM OCCULTATIONS DURING 1990

David W. Dunham

This is a continuation of the article with the same title that starts in O.N. 4 (14), p. 341 and was continued on p. 373 of the last issue. The quarterly maps in this issue show all events that will occur during October, November, and December.

EMP 1991. The Institute of Theoretical Astronomy in Leningrad is starting to offer their annual Ephemerides of Minor Planets for sale to professional and amateur astronomers, starting with the 450-page volume for 1991. It will be available for $30.00, plus shipping and handling, from White Nights Trading Co.; 520 N.E. 83rd St.; Seattle, WA 98115; telephone 206,525-8399; fax 206,523-0851. It contains orbital elements and opposition ephemerides for all numbered minor planets, with special longer ephemerides for unusual objects.

Comet Austin. I calculated predictions for numerous occultations by Comet Austin (1989c1) that occurred from late April into June, 1990, using the hyperbolic orbital elements given in IAUC 4985. I sent

information about the better events by e-mail to the IAU Central Telegram Bureau. Information about several of the events was included in IAUC 4997 (1990 April 18). I have not learned of any observations, although I did get a request for detailed predictions from B. Foing at the European Space Agency, which I filled. Graham Blow asked for more information about a very good event possibly visible from New Zealand, but I had no new data to provide. I also received a bill from the Central Bureau for $250 for line charges. With those prices, I doubt that I will distribute predictions of future occultations by comets on IAU circulars. In fact, with the large amount of effort and, to date, no return on predictions by comets, I expect to predict future cometary occultations only upon request, and then only if my time is not taken by more pressing work.

Notes about Individual Events.

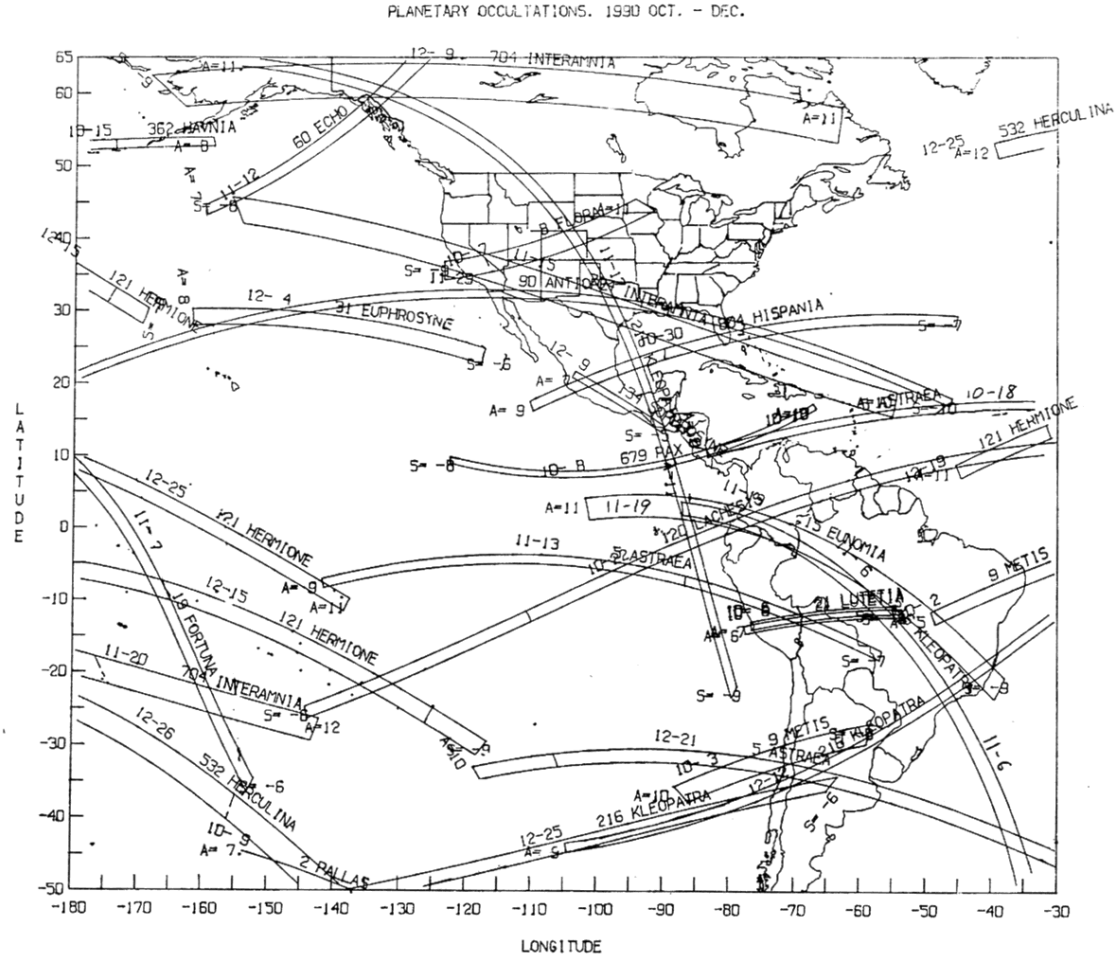
July 28-29: Four stars will be occulted as (8) Flora transits the open cluster M21, identified previously as NGC 6531. Edwin Goffin expanded his charts for these events, making them quite legible, so I will not modify my star-chart plotting program, as mentioned last time. The path of Flora is shown in an article on p. 60 of the July issue of S&T, which, however, does not mention the occultations.

Aug. 1: The possible occultation by Triton is described on p. 172 of the August S&T. I have no world map for the event.

Aug. 5: An occultation of (12) Victoria by (11) Parthenope, possibly visible from Japan or New Zealand, is discussed on p. 173 of the August S&T.

Aug. 9, (679) Pax: The star is ZC 2618.

Aug. 20: Radar observations show that (216) Kleopatra is probably a contact binary. This is the first of a rich series of occultations by this intriguing object; see ON 4 (14), p. 351. Hopefully, light-curve observations earlier in the month will enable determination of the rotational phase for each occultation. The suspected dumbbell shape can be revealed from occultations near maximum light, when Kleopatra will be presented broadside to the Earth. Kleopatra has one of only two "confirmed" secondary occultation extinctions, when two separated visual observers in CA, well outside the main path of the 1980 October 10th event, both saw the star fade momentarily in a manner similar to that reported in the main path.



Aug. 22: (243) Ida was originally a possible candidate for a close approach by the Galileo spacecraft, but it will not be reachable with Galileo's actual trajectory.

Sep. 2: At some location, nominally in northern CA, the (679) Pax and (9) Metis occultations can both be seen, 8 hours apart.

Sep. 7, Jupiter: Since the occultation is nearly central, an occultation by Jupiter's ring is possible in Greenland or Iceland.

Sep. 15: The star is Psi Scorpii = 15 Scorpii.

Sep. 24: According to the nominal predictions, occultations by (19) Fortuna and (184) Dejopeja will be visible from virtually the same paths across southern Europe 62 minutes apart.

Sep. 30, (51) Nemausa: The event occurs near a stationary point, where occultations are generally hard to predict. E. Goffin's north-to-south path across CA is entirely possible.

Oct. 2: The star is ZC 1161.

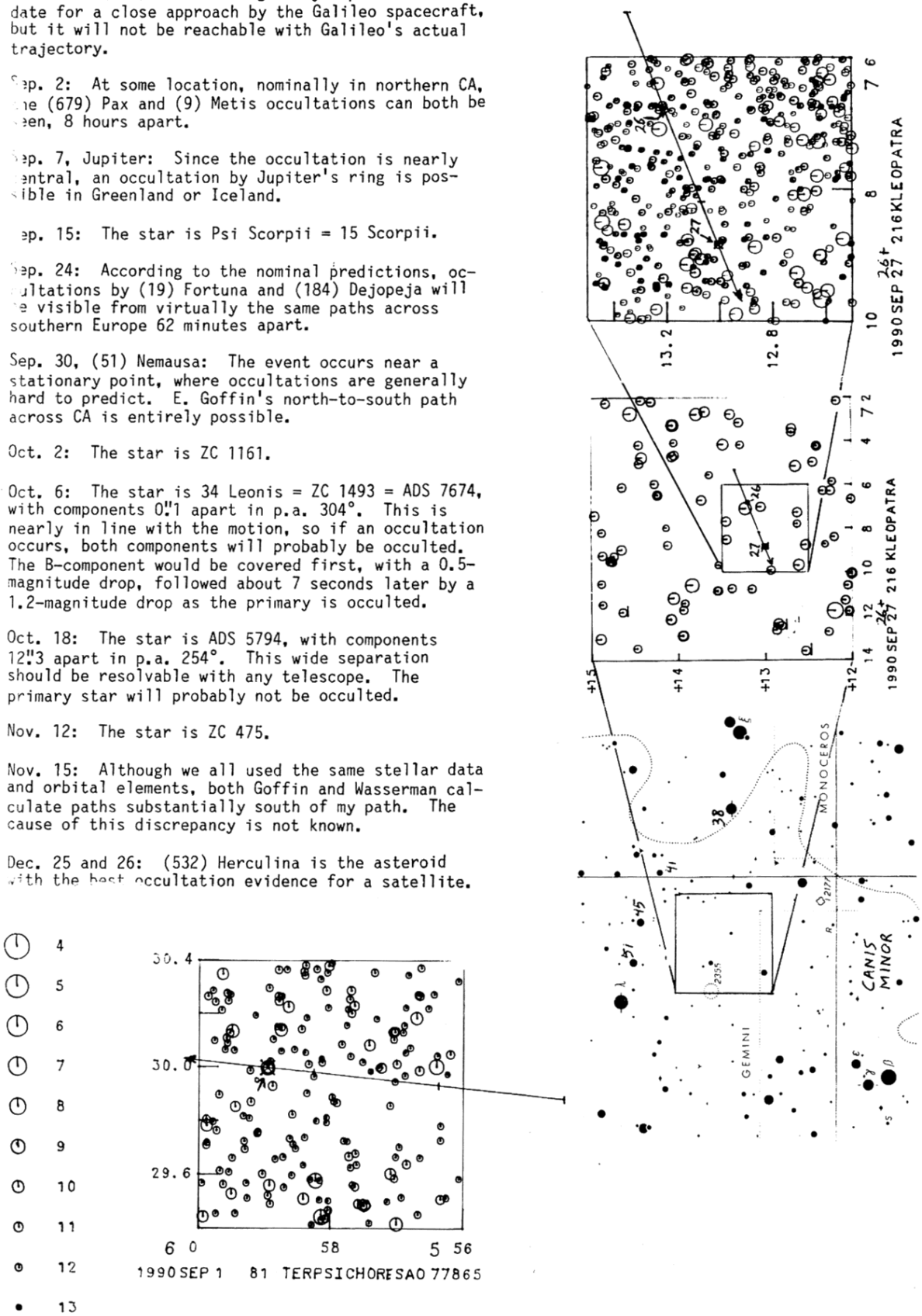
Oct. 6: The star is 34 Leonis = ZC 1493 = ADS 7674, with components 0".1 apart in p.a. 304°. This is nearly in line with the motion, so if an occultation occurs, both components will probably be occulted. The B-component would be covered first, with a 0.5-magnitude drop, followed about 7 seconds later by a 1.2-magnitude drop as the primary is occulted.

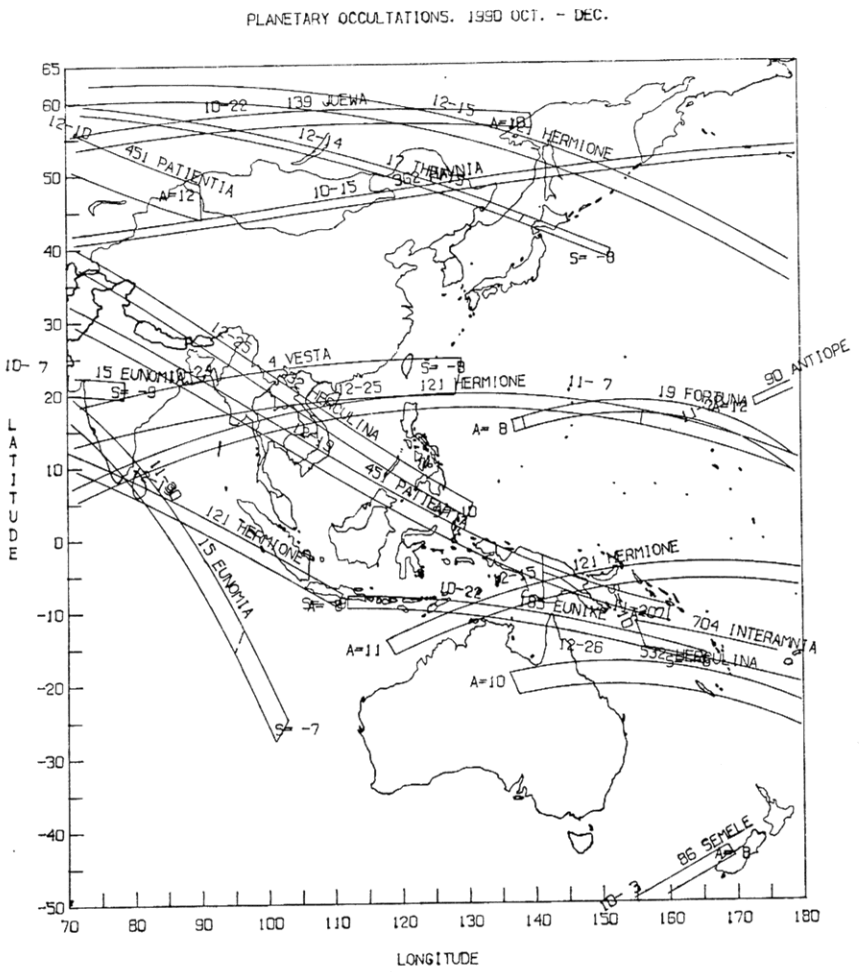
Oct. 18: The star is ADS 5794, with components 12".3 apart in p.a. 254°. This wide separation should be resolvable with any telescope. The primary star will probably not be occulted.

Nov. 12: The star is ZC 475.

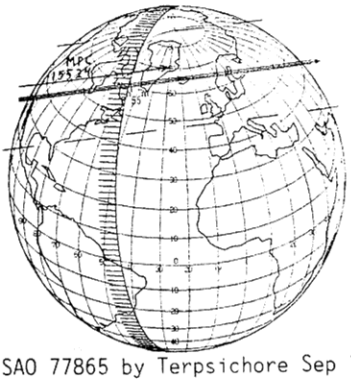
Nov. 15: Although we all used the same stellar data and orbital elements, both Goffin and Wasserman calculate paths substantially south of my path. The cause of this discrepancy is not known.

Dec. 25 and 26: (532) Herculina is the asteroid with the best occultation evidence for a satellite.



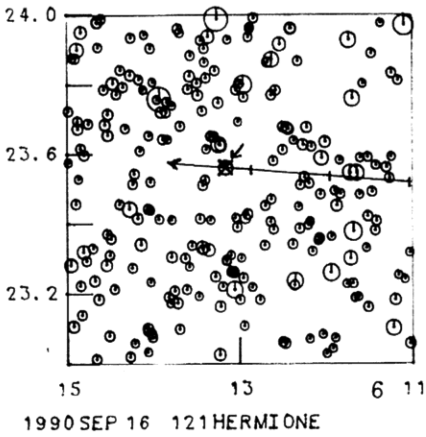


Anonymous by Kleopatra 1990 Aug

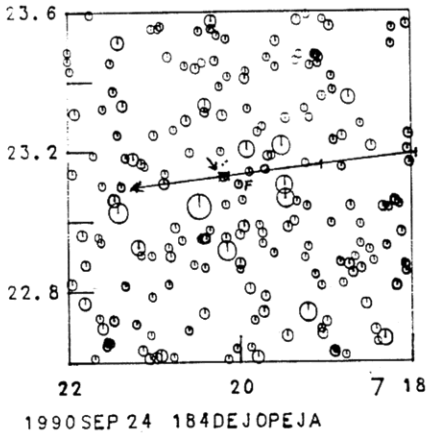


SAO 77865 by Terpsichore Sep 1

SAO 109317 by Campania 1990 Sep 6

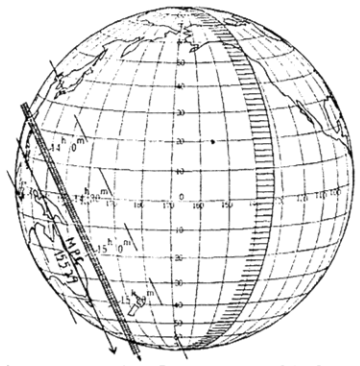


1990 SEP 16 121 HERMIONE

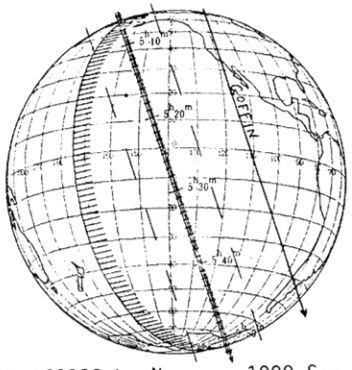


1990 SEP 24 184 DEJOPEJA

Anonymous by Kleopatra 90 Sep 7



Anonymous by Patientia 90 Sep 30



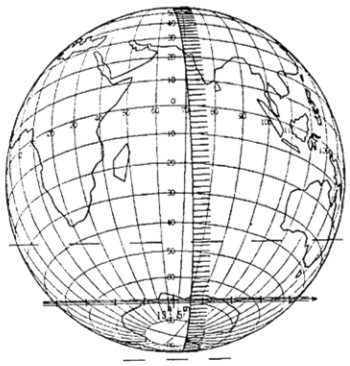
SAO 163983 by Nemausa 1990 Sep 30

Anonymous by Kleopatra 90 Sep 27

Anonymous by Kleopatra 90 Sep 21

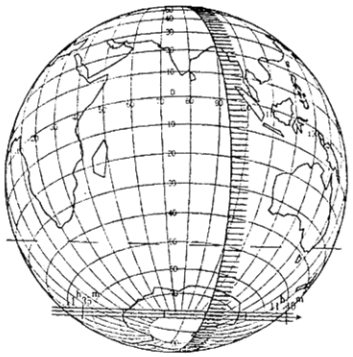
Anonymous by Kleopatra 1990 Sep 26

SAO 79607 by Metis 90 Oct 2

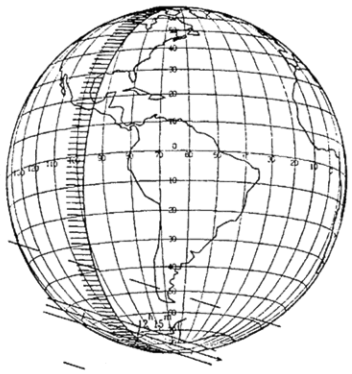


AO 186641 by Semele 1990 Oct 3

SAO 98891 by Lutetia 1990 Oct 6

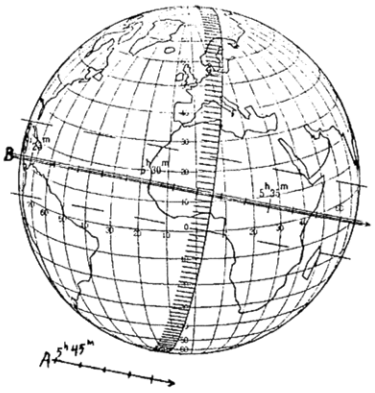


AO 185764 by Sylvia 1990 Oct 9



SAO 136625 by Pallas 1990 Oct 9

SAO 109356 by Havnia 1990 Oct 15



SAO 96505 by Astraea 1990 Oct 18

ASTRONOMY AND PERSONAL COMPUTERS

Joan Bixby Dunham

Consumables This is the term used for items that are "used up", such as paper, printer ribbons, floppy disks, batteries, mailing labels, envelopes, floppy disk mailers, and so forth. Consumables are the not-so-glamorous side of computing. We need these to use our computers, yet we often do not consider them when determining the costs of a computer, or when deciding which among many pieces of hardware or software to buy. I am always surprised, when I total the costs of these items in early April, to see how much can be spent on consumables without even realizing it. I now buy disks in bulk and look for savings in computer paper but, still, the incidentals can mount up. For example, one evening we noticed that we were out of printer ribbons and had to make a quick trip to the MightyBig office supply center to finish our plots by the next morning. We paid for our forgetfullness. One ribbon from MightyBig cost more than the last ribbon sixpack we had purchased via mail order. Neither store sold a name brand, although the mail order was the more generic (packaged in a plastic bag with no manufacturing identification). Both brands of ribbons, by the way, are of quite satisfactory quality.

One way of controlling the costs of consumables is to make them a factor considered when purchasing equipment. If the printer is a new design, does it use ribbons, ink cartridges, or paper of a special design only available from the manufacturer? Can these items be purchased from a second source, or is the manufacturer the only supplier? Is there a chance that the ribbons, paper, or batteries are so different that they will be hard to find at any price? For example, I once was considering purchasing an ink jet printer noted for its small size. While I was discussing this printer with a salesman, another customer rushed in and identified herself as someone who had called for the ink jet cartridges this printer used. It was soon obvious that the store had very few cartridges, and the customer had called many stores trying to find them. Not only was she paying a premium price for the few cartridges they could sell her; she also had spent several hours trying to find them for any price.

A more recent example is a special printer now made for printing mailing labels. It is about the size of a telephone and uses mailing labels arranged end-to-end along a tape, instead of the standard widthwise arrangement in one-up pinfeed labels. The special labels for this printer are several times the cost of the more ordinary labels. Several vendors were selling this new printer at a computer show I attended in January, but neither they nor any other vendors at that show had the labels. The selling point of this special label printer is that the printer is always there, ready to print labels when needed. I think that is an attractive idea. I frequently want to print a few labels, and find switching paper and labels a nuisance. Instead of buying the label printer, though, I purchased a very good printer. Our inexpensive older printer - still working and purchased at a cost much less than the label printer - will be dedicated to labels.

Physics Academic Software The May/June 1990 issue of Computers in Physics lists seven new software packages for education and educators. One of the packages is a gradebook program, but the other six are interesting programs on relativity, chaos, orbits, and dynamics. The one of most interest for astronomy is Orbits, which generates orbits of two heavy bodies and up to five "light" (massless, I assume) bodies. The user can change the initial positions, change the force law, change the value of the gravitational constant. Two programs (Chaotic Dynamics Workbench and Chaos Demonstations) help to learn about chaos and dynamics, and two (Spacetime and Relativistic Collision) are on relativity. All of these are for PC's or compatibles. The software is available for a relatively nominal cost from the American Institude of Physics, C/O AIDC, 64 Depot Road, Colchester, VT 05446, or call the toll-free phone number 800-445-6638 (802-787-0315 in Vermont). They offer a price reduction for members of AIP societies, and sell 10-copy site licenses.

Physics Academic Software is a project of the AIP, American Physical Society, and American Association of Physics Teachers, to help make good quality software available for education in physics. Individual authors submit programs which, if selected, are published and sold by the AIP. Software developers do not expect to become rich writing for PAS. It is more a matter of providing a public service and helping to develop the next generation of scientists. While all of the current offerings are for the PC family, they are reviewing Macintosh software. If you are interested in submitting software to the PAS, or you are an instructor interested in reviewing software, contact Dr. John S. Risley, Editor, Physics Academic Software, Department of Physics at North Carolina State University.

Anonymous by Kleopatra 90 Nov 6

SAO 93373 by Echo 1990 Nov 12