Occultation Newsletter

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Joan B. Dunham-Editor

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FROM THE PUBLISHER

For subscription purposes, this is the first issue of 1993. It is the eleventh issue of Volume 5. IOTA annual membership dues, including **ON** and supplements for U.S.A., Canada, and Mexico $25.00
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Local circumstance (asteroidal appulse) predictions 1.00
Graze limit and profile predictions (per graze) 1.50
Papers explaining the use of the predictions 2.50

Asteroidal occultation supplements will be available at extra cost: for South America via Ignacio Ferrin (Apartado 700; Merida 5101-A; Venezuela), for Europe via Roland Boninsegna (Rue de Mariembourg, 33; B-6381 DOURBES; Belgium) or IOTA/ES (see below), for southern Africa via M. D. Overbeek (Box 212; Edenvale 1610; Republic of South Africa), for Australia and New Zealand via Graham Blow (P.O. Box 2241; Wellington, New Zealand), and for Japan via Toshio Hirose (1-13 Shimomaruko 1-chome; Ota-ku, Tokyo 146, Japan). Supplements for all other areas will be available from Jim Stamm (117891 N. Joi Drive; Tucson, AZ 85737; U.S.A.) for $2.50.

Observers from Europe and the British isles should join IOTA/ES, sending DM 40.-- to the account IOTA/ES; Bartold-Knaust Strasse 8; 3000 Hannover 91; Postgiro Hannover 555 829 - 303; bank-code-number (Bankleitzahl) 250 100 30.

IOTA NEWS

David W. Dunham

IOTA/ES and Dutch Business Meeting: The annual business meeting of the European Section of IOTA met on Saturday, November 21st, in Hannover, Germany. Also, the same day, members of Werkgroep Sterbedekkingen and NADIR, two occultation organizations in the Netherlands, met to find ways to cooperate better on various projects. Both meetings were successful; a joint note written by the Dutch organizations follows the report of the 11th European Symposium on Occultation Projects report in this issue.

IOTA/ES Extraordinary Meeting: The 1993 extraordinary meeting of IOTA/ES will be held on May 22nd at the Volkssternwarte Hannover; Am Lindener Berg 27; Hannover, Germany. Besides IOTA/ES business, there will be discussions of the scientific program for 1993 (including Pluto and Jupiter), and planning for the November 29th lunar eclipse, including grazes from Scandinavia to Mauritania (possibly including grazes at both northern and southern limits to measure the Moon's polar diameter). For more information, contact Hans-Joachim Bode at the IOTA/ES address on the back page of this issue.

Organizing a Safe Expedition: See Paul Maley's article on this topic later in this issue, and some comments by me in a following article, since they constitute IOTA's policy on expeditions.

E-Mail Correction: My "more robust" e-mail address on p. 255 of the last issue is wrong; it should be: David.Dunham@jhuapl.edu

IOTA Occultation Manual: During recent airplane flights, when I couldn't use computers to work on this issue of **ON**, I completed review and mark-up of Wayne Warren's printout of the updated IOTA Occultation Manual. He is now editing my several changes and additions. When he is done with this, we will mail copies to some of the IOTA officers for a final review. Once any changes from that effort are made to Wayne's Script file, the result will be copied for distribution to IOTA members. A related effort is the updating of the U. S. Naval Observatory (USNO) total occultation papers that we have inherited. These papers may be incorporated into the IOTA manual if their updates are finished soon and if time permits. In that case, a draft of the manual without the USNO material will be sent to new members and those who request it, with the full distribution to all members postponed until the USNO material is added. The status of the manual will be reported in the next **ON**.

Next Issue: The main purpose of this issue is to include important but not extremely time-critical articles that we did not include in the last issue, which dealt primarily with IOTA's predictions of planetary and asteroidal occultations during 1993, and some other interesting recent news relating mainly to asteroids. The next issue will contain information about occultations during the June 4th total lunar eclipse. If you plan to submit an article for that issue, we should have it by the second week of April.

ESOP-XI MEETING

David W. Dunham

With assistance from Hans Bode and Ebarhard Riedel, I was able to attend the 11th European Symposium on Occultation Projects held at the Vatican City's Mondo Migliori retreat near Castel Gandolfo, Italy, a short distance south of Rome. IOTA/ES member Claudio Costa, with much help from his wife, Claudia, and Father G. V. Coyne, Director of the Vatican Observatory, did a superb job with the local arrangements for this very useful and enjoyable meeting on European occultation activity. Seventy-six people registered for ESOP-XI, including 29 from Italy, 18 from Germany, 15 from Poland, 4 from Belgium, 4 from the Netherlands, 3 from Portugal, and one each from Finland, the United Kingdom, and the U.S.A.

Titles and authors of all papers presented at the meeting are listed below, with a few comments added by me for some of the papers. Some papers need no comments because their subjects have been covered in other articles in this or previous issues of **ON**. Abstracts for most of the papers were distributed at the meeting and are available from IOTA/ES.

W. Beisker, "Report about the New IOTA Occultation Camera" This is not ready yet; a preamp was to be completed by the end of 1992. The camera is to have 165 x 192 pixels and integration times from 20 ms to 1 second. It should reach 9th mag. with a 0.2-second integration using an 8-inch telescope.

—, "Data Acquisition with DAS V. 4.16 Implementation of an Analog/Digital Data Acquistion System" This is for analysis of light curves of occultations by objects with atmospheres, such as Titan.

—, "Results of the Occultation of 28 Sgr by Titan"

—, "IOTA and the Environment. Should We Introduce an European Environmental Monitoring Program (EEMP)?"

H. Bode, "The Annular Eclipse of January 4th-5th 1992"

H. Bulder, "Some Studies Upon the Use of a CCD Video Camera by Amateur Astronomers and the Way of Reducing the Tapes" This dealt largely with extracting light curves of Galilean satellite events.

—, "About the Group Purchase of the Philips Video Module" 16 observers in Europe were in this group purchase of the PAL version of the Philips CCD Video Module. One of the modules was lost in the mail.

—, "The Visibility of Occultations"

C. Costa, "Porting the EVANS Occultation Program to an IBM-PC"

—, "The μ Geminorium Graze Expedition of 23-24 August 1992: an Example of International Co-operation"

H. Cuno, "Video Time Inserter for DCF-77" His device can be constructed for less than $100, and he believes that a WWVB version for use in North America is possible.

D. Dunham, "Moving Towards a Distributed Occultation Prediction System"

J. Garcia, "Chronographs for Occultation Work" He pointed out that chronographs are not so expensive now. It is easier to determine timings from a chronograph record than from a tape recording., although verbal comments recorded with a tape recorder might be useful for interpreting events.

E. Goffin, "Preview of the Minor-Planet Occultations for 1993"

M. Kretlow, "The Last Minute Astrometry Network - Status and First Results"

J. Milczanowski and A. Trebacz, "Polish Solar Eclipse Expedition of 1991, July 11

E. Riedel and W. Zimmermann, "New Concepts in Grazing Occultation Calculations and Distribution"

M. Suhonen, "Some Experiences in Using the Lunar Occultation Prediction Programme Written by Gordon Taylor"

M. Zawilski and M. Borkowski, "The Programme for IBM-PC for Analyzing the Results of Lunar Occultations According to the ILOC's Statements"

M. Zawilski and P. Sobotko, "A Look Over the Past and Contemporary Techniques for Calculating the

Ephemeris of Eclipses and Occultations"
M. Zawilski, "The Catalogue of the Historical Observations of Solar Eclipses and Occultations for Europe and the Near East"

The logistics made it necessary for me to travel by air to Munich, where I was met by Eberhard Riedel. I rode in his car for the approximately ten-hour (one way) drive across scenic western Austria and northern Italy to Castel Gandolfo. During much of the round-trip drive, I used our old portable PC to type most of my contributions for **ON 5** (8). Since the PC battery is nearly dead, I used an inverter that I normally use for video applications to power the PC from Riedel's car cigarette lighter. Everything worked fine until the return trip in the Italian Alps when I tried to save the file before a dinner stop, encountered trouble with the PC main disk drive, and apparently lost everything. Wolfgang Beisker, who rode with us on the return trip, took me to his office when we arrived back in Munich, and we worked until 3 AM, when Beisker managed to use Norton Utilities to capture, from uncataloged parts of my diskette, virtually all of the information that I had typed for **ON**. Without his help, **ON 5** (8) would probably have been delayed considerably, and/or my contributions for it would have been much shorter.

An announcement about ESOP XII is in a separate article in this issue. The location for ESOP XIII in 1994 has not been decided. ESOP XIV in 1995 will be in Plzen, Czech Republic, to celebrate the city's 700th anniversary; Bohumil Maleček will be the local organizer.

MU GEMINORUM, A SPECTACULAR GRAZE IN MORE THAN ONE RESPECT

H. J. J. Bulder

This graze of August 24, the brightest one in Europe in 1992, was combined with ESOP XI in Italy. Claudio Costa prepared for a graze site near Minturno, a small village not far from the Mediterranian Sea some 150 km south of Rome.

When I arrived at Mondo Migliore, a Vatican institute at Rocco di Papa, one day in advance, the quiet atmosphere formed a big contrast with the chaotic events that would take place the day after. The next morning arrivals of several participants formed the first indication something was about to happen. Before noon Claudio arranged a small meeting with me to see if everything would work out fine and to call for my assistance as he turned out to be a newcomer in this line of work. A first glance at the charts showed that we would fall at least 2 kilometers short to the south, being blocked by a river. It was a great comfort, though, to hear he had informed local police authorities.

In the afternoon the number of participants steadily grew and a meeting was set to start at 15:00. This meeting was shifted several times as participants were still arriving at the airport and by train. Several people expected to arrive by car arrived by public transport leaving us with a transport problem to the observing site. Mr. Hartmann, one of the German observers with a special drivers license (Murphy was still in the closet), managed to rent a large van at one of the airports to solve this logistic problem.

Around 16:00 more than 30 observers were present in the hall of the institute, some of them without telescopes. Claudio had only been able to arrange one extra telescope resulting in a final count of 34 observers with 22 telescopes. This meant we would at least not fall short of assistants. The atmosphere in the hall was like at a market place, somewhat chaotic. A last minute route description was manufactured and distributed with copies of charts to ensure every driver would be able to find headquarters after a 150-km drive. The meeting time at headquarters was set between 19:00 and 19:30. At 17:00 the first observers were seen leaving the main gate after loading up their cars.

Everybody arrived without accidents. Actual headquarters was shifted to a nearby restaurant while Claudio and I were looking for suitable observing sites. Darkness was about to fall in half an hour, severely hampering our efforts. Our first attempts to find alternative roads failed when we got lost near the river and decided to go back to the original road to find as many sites as we could. We ended up with 8 stations. Our continued explorations on this side of the river was stranded in swampy terrain. Time was running out when we arrived back at the restaurant at 22:00. Except for us everybody had dinner.

After some discussion we decided to go for the other side of the river, near a nuclear power plant that was no longer in use. Although we found some suitable observing sites, we were halted by security officers. We were not able to convince their boss of the scientific value of this international expedition and failed in getting permission to use the sites. We once again returned to the original road and decided to look for some additional stations toward the north (outside the graze path). To minimize risks for misses we only prospected for 3 additional stations. It was past 23:00 when we arrived back at the restaurant. The atmosphere was getting better the more wine was served.

Due to the lack of suitable observing sites we decided to set up double stations. Taking into account some preferences of German observers a station list was made up. All stations inside the path (1-8) were equipped with CCD video cameras to ensure a maximum result. There had been some chaotic moments before, but after reading the station list and a very short instruction things really got out of hand when everyone went to his car simultaneously. However, less than one hour later each observer had been brought to his station. Although most inhabitants were informed when we prospected the stations, some worried local people had to be calmed down with the help of the police.

From now on everybody was on his own and dependent on good weather and equipment. The humidity was steadily increasing, almost reaching 100%, while the temperature was slowly decreasing, ideal circumstances for fog to form or equipment to fail. After installing all my equipment, my first tests turned out perfect and the count down continued with slightly more than one hour to go.

Some extra instructions to the less experienced Polish observers at my station protected them against a complete failure. The small instrument they used came without any dewcap. I predicted that their objective would get completely wet. After checking the instrument my forecast was already reality. A 15-cm dewcap was improvised from white paper. Because the Moon was only 22% sunlit the white paper would not cause too much stray light while preventing the dew completely. Still no Moon was visible and only 45 minutes to go.

No fog either, although all equipment was getting wet, including the human resources. It was completely clear when an orange cusp of the moon slowly popped up from behind some distant mountains. This color formed proof of the damp atmosphere. Only half an hour to go.

The star was easily seen as a white golf ball on the LCD screen of my Philips monitor as it projected the pictures from the Philips module behind my C8 telescope. I spooled back my video tape to start it at 10 minutes before central graze. This turned out to be a major mistake. Although the recorder was running it stopped after a minute or so. It had only swallowed the tape, which was sticky from the humidity. Pushing the buttons desperately at 5 minutes before central graze didn't yield the desired result. Anxiously looking at the monitor where the star was approaching the last sunlit peak I started shouting some words that cannot be published here for obvious reasons. Meanwhile I was still pushing the buttons of the unwilling recorder. As a back-up provision I already had my stopwatch with printer in my hand when the first disappearance took place and was clocked too late in the disappointment that came over me. I only hoped the other CCD stations would be more successful. Concentrating on the screen of the monitor it was easy to time the next 9 events of this spectacular graze. Although this is only a record of one station I think it is representative for events taking place at other stations.

Returning to headquarters I learned that only four CCD stations were successful in recording the event. Three others had switched to visual observing with backup equipment in time, leaving only one station without any results. Even the northernmost visual stations timed a lot of events. Everybody was exchanging their happy moments in the pleasant chaotic atmosphere that characterizes headquarters after a successful graze. The success of this expedition was even better than anyone could expect at that moment.

After the last car had left for the journey to Mondo Migliore, Claudio Costa and I were left the tedious task of measuring the exact positions of all stations at 4:30 in the morning. It was only now when I realized that I was wet, hungry and exhausted.

Marching down the road and counting our footsteps we were cheered by a choir of barking dogs. It sounded to me as if they were trying to congratulate us, although Claudio clearly had another opinion. (Harold, we forgot the tear gas and the mace!). On the way back to our cars one dog was getting after us but only when we had passed the house he was guarding. This made me realize the dog was even more afraid than us.

At 5:30 we finally drove back. The early Monday morning traffic jam near Rome is quite something when you are tired, but I succeeded in getting to Rocco di Papa in one piece in time for breakfast. Feeling like a Zombie I drank the hot tea and was relieved to find my bed at 8:30.

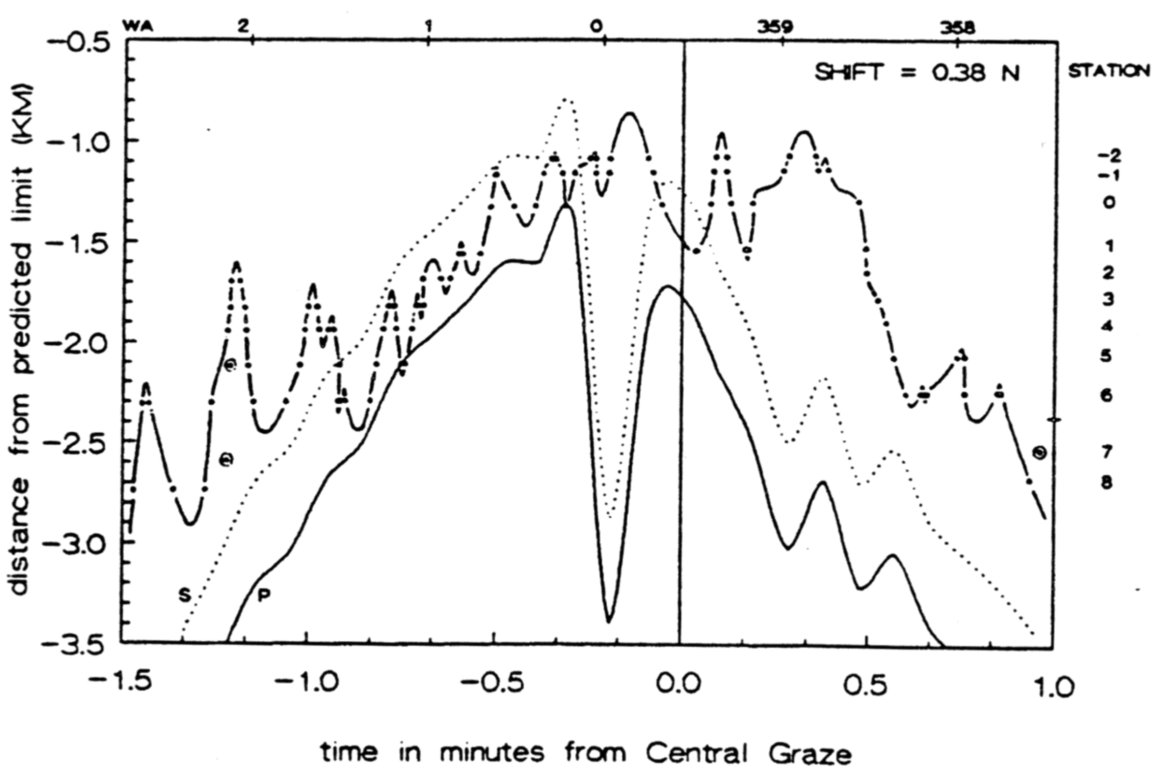
A few days later we had a small party in the evening with most observers present (except for the Italians, who had returned home after the graze). At this meeting I tried to give away some secrets about reducing observations. As we plotted the results on a flipover, station by station, one could almost feel everybody getting excited when we slowly reached the top of the profile. Except for some minor disagreements all observations were concordant. This graze had been a group effort and it was very much felt so in this room. At the beginning of the congress I received most Italian observations to complete the

Table 1

Participant	Country	Station number	Telescope type	D (cm)	Method	Timings accepted	Notes
Tozzi, Fabrizio	Italy	-2	R	9	visual	10	
Pasolini, Pasolino Dall'onda	Italy	-2	S	20	visual	6	
Zawilski, Marek and wife	Poland	-1	M	10	visual	13	
+ Liban, Klemens and Jacek	Poland						
Garcia, Joaquim	Portugal	0	N	10	visual	9	
Goncalves, Rui	Portugal	0	R	5	visual	9	
Orsi, Leano	Italy	1	S	20	CCD	8	record ok
+ Passerini, G.	Italy						
Brambilla, S.	Italy	1	-	-	visual	5	monitor
+ Serpilli, R.	Italy						
Costa, Claudio and wife	Italy	2	R	8	CCD	6	visual
+ Prosperini, Giuseppe	Italy						
Beisker, Wolgang	Germany	3	R	6	CCD	8	record ok
Frisoni, Carlo	Italy	3	M	10	visual	10	
Di Luca, Roberto	Italy	3	N	15	visual	10	
Guhl, Konrad and wife	Germany	4	R	8	CCD	8	visual
Jorczyk, Rainer	Germany	4	R	6	visual	10	
Bulder, Henk and Jessica	Netherlands	5	S	20	CCD	10	monitor
Mrs. Niedbala	Poland	5	R	5	visual	4	dcf error
+ Milczanowski, J.	Poland						
+ Niedbala, M.	Poland						
Wagenaar, Rob and Ineke	Netherlands	6	M	10	CCD	16	record ok
Vingerhoets, Pierre	Belgium	6	M	10	visual	14	
Bredner, Eberhard and Birgit	Germany	7	M	10	CCD	-	failed
Mr. Sinnreich	Germany	7	M	10	visual	2	dcf error
+ Mr. and Mrs. Gehrmann	Germany						
Cuno, Hans-Helmuth	Germany	8	S	13	CCD	4	record ok
+ Hartmann, Wolf	Germany						
Büchner, Reinhold	Germany	8	R	6	visual	4	
Total observers/assistents 37	nations 6	sta. 11	telescope 20		timings 166 (4 CCD 36 tim)		

Figure 1 MINTURNO (ITALY) / 24 AUG 1992

MU GEMINORUM (MAG 2.8)



profile. This was presented on the second day of the congress as a new European record. No fewer than 166 timings were recorded. It was the first time observers of 6 different nations participated in a graze and the first time 8 CCD video equipped stations were set up resulting in 4 successful video records. Due to the double station set-up a lot of timings were redundant, resulting in a final reduction with 98 timings plotted (Figure 1). The station set-up with all participating observers is listed in Table 1 together with the telescopes use and number of accepted timings. We were indeed very lucky to observe a considerable north shift of 0."38. The nearby river that prevented us from going farther south could be seen as a gift from heaven. Claudio's connections with the Vatican must have had something to do with it, or was it beginners luck after all?

The combination of a major graze event like this one with an ESOP meeting proved to be very stimulating. It formed a good opportunity to get acquainted with fellow amateur astronomers in other countries. I personally feel such a combination would be a good idea for future ESOP meetings.

COORDINATION OF OCCULTATION WORK IN THE NETHERLANDS AND NEARBY COUNTRIES

Henk Bril, WSB/DOA and Henk Bulder, NADIR

There are two organizations in the Netherlands active in the field of occultations:

Werkgroep Sterbedekkingen (WSB), or in English, "Dutch Occultation Association (DOA)", one of the working groups of the NVWS (Nederlandse Vereniging voor Weer-en Sterrenkunde, *translation: "Netherlands Association for Meteorology and Astronomy"*). This working group was founded in 1946; at present the chairman is Henk Bril and the secretary is Wim Zanstra. The coordinator for grazes is Adri Gerritsen (address: Uilenstede 154, NL-1183 AN Amstelveen) and Ton Schoenmaker (address: Mr Homanstraat 8, NL-9301 HP Roden) is coordinating the total occultations.

NADIR, founded in 1975 originally as a group of amateur astronomers in the Hague and suburbs is today a group that mainly observes all occultation phenomena. Henk Bulder (address: Mendelssohnrode 72, NL-2717 CS Zoetermeer), president since 1979 and secretary since 1982, coordinates both total and grazing occultations.

Both organizations participate in a joint annual program of grazes (see next paragraph). Their graze activities are tuned in such a way that expeditions are regionally divided. If by accident one organization receives information intended for the other, it will be shared promptly.

Joint graze program: An initiative of NADIR in 1983 resulted in a border-crossing cooperation on graze expeditions in Belgium and the Netherlands. More and more organizations have joined this cooperative since, so that it now covers a large part of western Europe.

The main coordination is done by "Wergroep Bedekkingen van de Vereniging voor Sterrenkunde" (VVS) (*translation: Occultation Group of the Belgian Association for Astronomy"*). Pierre Vingerhoets, president of this group, organizes a special meeting in Belgium each year to prepare for the joint graze program.

Participating organizations are, in Belgium, VVS, APEX, CAB, CAA, ACG; in The Netherlands, NADIR, WSB; and VDS in Germany.

The main area for the joint graze program consists of Belgium, The Netherlands, Germany, and northern France. For spectacular grazes, other areas are involved, like southern France, Spain, Italy, Denmark, and the United Kingdom.

NADIR acts as an IOTA graze prediction computor for the organizations /in Belgium and The Netherlands. This includes all local unfavorable grazes. All other IOTA graze predictions for Europe are prepared by IOTA/ES.

Each organization sends its invitations for grazes on the program a month in advance to Pierre Vingerhoets. As a central coordinator, he distributes all materials to coordinators within the participating organizations. Each coordinator distributes all received materials to its observers.

ESOP - XII

The 12th European Symposium on Occultation Projects will be held at the Hotel "Het Wapen van Drenthe" in Roden, The Netherlands, from Friday, August 27th to Tuesday, August 31st, 1993. It will be hosted by the Dutch Occultation Association (DOA; see previous article). Registration and Lecture Specification forms have been distributed by IOTA/ES; copies are available from either IOTA or IOTA/ES at the addresses given on the back page of this issue, or from the secretary of the ESOP-XII organizing committee: Mr. W. T. Zanstra; Spijkerlaan 13; NL-9903 BB Appingedam; The Netherlands; Telephone (31) 5960-25617.

Roden is 15 km southwest of Groningen, which is served by hourly trains from Amsterdam Airport (Schiphol); carpools will be arranged from the Groningen train station to the hotel in Roden late the afternoon of the 27th. At 20:00, participants will be welcomed by the president of the DOA, after which the annual meeting of IOTA/ES will be held. Scientific lectures will be given from 10:00 to 18:00 on August 28th and from 10:00 to 12:15 on August 29th. In the afternoon, there will be a free excursion to Kapteyn Observatory in Roden. On the 30th and 31st, there will be excursions to the Westerbork/Dwingeloo radio telescopes and to the planetaria at Dwingeloo and Franeker. A payment of 90 Dutch guilders is due by May 15th; it covers tea, a dinner, and two lunches. Details and information about hotels are distributed with the forms mentioned above.

LUNAR OCCULTATION PREDICTION NEWS

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

Detailed Total Occultation Predictions: The distribution of 1993 predictions was described on p. 240 of the last issue. Judging from a steady flow of verification forms from all parts of the world, the distribution apparently was completed as planned. We received one complaint about non-receipt of predictions from one observer in Latin America, so a few who were sent predictions by surface mail from the International Lunar Occultation Centre (ILOC) in Japan probably received them after January 1st.

We have not had time to process individual requests for new observers, and those wanting predictions for new stations, during the last few months, since we felt that it was more important to generate and distribute all of the 1993 total and grazing occultation predictions, asteroidal occultation information, and related **ON** articles, that are needed by all IOTA members, **ON** subscribers, and active observers on USNO's occultation prediction mailing list. After this issue of **ON** is completed, we will try to catch up on the backlog of new requests, and answer delayed correspondence and e-mail messages. Since time to do this is limited with other urgent jobs mentioned below that still need to be done, we will not compute predictions for new stations if an observer already has predictions for a station within 15 km of the new station, and predictions for fainter stars (lower O-code) are not needed.

IOTA's future role with the detailed total occultation predictions will depend on final verification of Claudio Costa's PC version of the EVANS program, and our ability to find volunteers in different nations and various regions of North America who can run the program with its large data sets that require over 50 megabytes of memory. If this can be completed in time for the 1994 prediction distribution, which should start in August, IOTA may try to offer one free set of predictions for each member who has supplied accurate geographical coordinates. Those wanting data from IOTA for more than one station, and non-members, can receive them for payments that will be determined later, assuming that the work can really be distributed this way. ILOC also hopes to use the PC version of EVANS, and once they have it operational, they will supply the predictions upon request to those who supply, or have supplied, accurate coordinates.

1993 Grazing Occultation Predictions: The IOTA grazing occultation predictions for regions A (Jan. - June only), K, R, W, XB, XG, and XO were mailed in mid December. At the end of November, David got the OCC program running on his CMS account and was then able to process the "profile" card images sent to him to generate the limb correction (lccard) data sets needed by the ACLPPP program to produce the IOTA graze profiles. The limb correction data were created for all regions except those with active observers in Latin America, including regions J, L, and XR, and sent to the graze computors, mainly by e-mail.

Graze Supplements for 1993: Eberhard Riedel used the coastline/border data supplied by David to generate maps and tables for 1993 hemispheric grazing occultation supplements in a form very similar to those that David has produced during the past few years. The tables did not include Z.C. numbers or double star data, but David wrote small programs to read the tables (that were supplied as ASCII files on disk) to add these data. So you will probably receiv the graze supplement for your hemisphere with this issue, or before it. Riedel's supplement does not include grazes during lunar eclipses, but he will work on his program to generate these, with the goal of producing a graze map of the region of visibility of the June 4th total lunar eclipse for distribution to subscribers in that region with the next issue. A similar map will be created later for the November eclipse. Riedel is also working on a European graze supplement for 1993, and will be able to generate other regional graze maps, to replace my software system for doing this, which became defunct last September. He has already produced maps covering grazes in the A-region (northeastern USA and southern Ontario) that David distributed with a local expeditions notice last month.

Riedel, as a by-product of his grazing occultation selection calculations, says that with little additional work, he expects to be able to also select total occultation data and create the Besselian element files (befiles) needed as input for the EVANS program. There is not a big rush to do this, since we generated the befile for 1994 at USNO the night before their mainframe computer was shut down last year.

Grazing Occultation Software News: As noted above, OCC is now operational, except that, for some as yet unknown reason, the unit 6 main printout data set is not generated. This is usually not a problem because most applications use the card-image files that are generated. These have been verified by comparison with test data that were generated at USNO before their IBM mainframe was shut down and removed.

Mitsuru Sôma has successfully generated lccard data with his OCCRED program at the National Observatory in Mitaka, Japan, and sent test cases to me recently for verification. He calls his prediction basis "85A" since his last comprehensive analysis of lunar occultation data that determined the empirical corrections used by OCCRED was performed in 1985. Since most of the lccard data for 1993 have already been generated using OCC versions 80M and 80N, we plan to continue to use them for all 1993 graze predictions for consistency. For the predictions for 1994, the lccard data will be generated with OCCRED, and tests will also be made with OCCRED on 1993 data for final verification and determination of empirical corrections that might be added to ACLPPP. Sôma plans a new comprehensive analysis of occultation observations, for determination of new empirical corrections for OCCRED, later this year when new star catalog data can be used (see the star catalog news section below).

Eclipse Software Developments: Mitsuru Sôma has added code to his OCCRED program to produce the SECLDADD.DAT files needed for precise prediction and reduction of total and annular solar eclipse Bailey's bead phenomena. After final verification of Sôma's test data, OCC will no longer be needed for this function, either. Alan Fiala at USNO is nearing completion of a reduced and much-modified version of OCC for use on a work station for solar eclipse calculations only.

Star Catalog News: During the past two years, two J2000-based new astrometric catalogs have been released for the purpose of replacing the aging, and B1950-based, SAO and AGK3 catalogs. The PPM (Positions and Proper Motions) catalog was released in two parts by the Astronomische Rechen-Institut (ARI) in Heidelberg, Germany, first the northern part (PPM-N) and recently (last October) the final version of the southern-hemisphere part (PPM-S). The U. S. Naval Observatory also produced a new catalog, intended for a new reduction of the old Astrographic Catalogs, called the Astrographic Catalog Reference Stars (ACRS) catalog. PPM and ACRS together include about 400,000 stars, a little more than SAO plus AGK3. The new catalogs are better than the XZ and David's combined catalog (for planetary and asteroidal occultation predictions) used for IOTA's predictions, so we want to use them with the new J2000-based software being developed in Germany and in Japan for IOTA's new prediction system (replacement of OCC, etc., that has been described above and in previous issues). So the question is, which catalogs should IOTA actually use? Wolfgang Zimmermann in Hannover is working on this problem. Mitsuru Sôma in Japan also wants a better catalog for his lunar occultation OCCRED program.

David recently discussed the above issues with Tom Corbin, the main author of ACRS. Corbin conceded that PPM-S is probably the better catalog to use for current epochs for southern-hemisphere stars, as it contains high-quality data from the Russian/Ukrainian Fokat catalog that includes measurements of astrometric plates taken at their southern-hemisphere observatory in Bolivia in the mid-1980's. The ACRS is generally the better catalog for the northern hemisphere, especially for the Zodiacal regions, because it incorporates Harrington's Zodiacal Zone (ZZ) catalog data which includes astrometric observations made in the early 1980's from Washington, DC (the preliminary ZZ catalog data were included in the XZ and David's combined catalog a few years ago), and most PPM-N stars do not include such recent data in their proper motion determinations. However, the high-precision subset of PPM-N incorporates data from observations made in the early 1980's with the Carlsburg Meridian Circle on La Palma, Canary Islands, so these stars will usually have more accurate data than those given in ACRS. So for IOTA's purposes, involving mainly recent and near-future epochs, we believe that the final PPM-S should be used for the southern hemisphere and ACRS should be used for the northern hemisphere, except that northern high-precision subset PPM-N data should be used in place of ACRS. Of course, FK5, its extensions, and International Reference Star (IRS) data should be used instead when they are available, but these are available for perhaps only about 10% of the ACRS/PPM stars. For stars neither in PPM nor in ACRS, either XZ, AGK3, SAO, or Yale data, transformed to J2000, might be used.

About 2 years from now, USNO expects to complete its northern astrographic survey covering the entire northern sky (the ZZ was the first part of this project, completed early for the needs of the Galileo mission); the plates are now being measured. These data, plus the southern Fokat data, will then be incorporated to produce a greatly improved version of ACRS. About two years after that, Hipparcos data are expected to become available; the Tycho catalog that it will produce will include about 4 million stars, nearly ten times the number in PPM, and with an accuracy of better than 0".01.

On p. 227 of **ON 5**(9), David had a short article about bright stars missing from E. Goffin's charts that were based on PPM. In response, he received the following message from ARI:

Subject: PPM bright stars
Dear Dr. Dunham,
In the latest edition of ON you raised the problem of bright stars missing in the final PPM (North and South) in connection with the star charts produced by E. Goffin. We were aware of this fact. Especially in preliminary PPM South most of the bright stars were missing. Final PPM South has been corrected for this disadvantage. For the purpose of star charts, we produced a Bright Star Supplement to PPM, containing all stars brighter than V=7.6 that we could find in various sources, esp. BSC, HIC and SAOC. The total number of these stars is 321. This is a small number compared to the perhaps 20000 stars on the sky down to 7.6. Only 5 stars brighter than 3.5 were missing in PPM. We produced a file in the same Format as PPM, and will send it to you and Goffin. [It has been sent by e-mail to Wayne Warren, who is now adding cross-reference information to it; we will then distribute it to others. Most of the stars are close doubles that cause problems for astrometric catalogs. David] By the way, is ACRS claiming to be complete to 7.5, or so? [Corbin says no, ACRS was meant only to provide a reasonably dense astrometric network of stars, but not to be complete to any magnitude. Mitsuru Sôma notes that almost all FK5 stars are not included in ACRS, whereas they are in PPM. David]
Best regards, Siegfried Röser

114 Tauri: Matthew Delevoryas, Houston, TX, discovered that Z. C. 817 is called Omicron Tauri in the XZ, when Omicron Tauri is equal to 1 Tauri, which is not occulted by the Moon and not in the Z.C. Z.C. 817 is actually (small Roman) o Tauri; it is better to use the Flamsteed designation 114 Tauri. In Robertson's 1940 Z.C. (now out of print), "o" and "omicron" look almost identical, but if one looks closely, they are slightly different. Over 20 years ago, a volunteer (whom I lost track of; he was at Ft. Huachuca, AZ, at the time) keypunched all of the names in the Z.C., and for Z.C. 817, he typed "OMICRON TAURI". These names were added to USNO's Z.C. file, which in turn was used for the XZ when it was created in 1977, so the error has been with us for a long time. The error also occurs in Isao Sato's J2000 Z.C. A good occultation of 114 Tauri will occur in the eastern USA on April 26 U.T. Unfortunately, for this event, the star is called omicron Tauri on p. 74 & 75 of the January issue and on p. 78 of the April issue of **Sky and Telescope**. I corrected the error in the 1993 hemispheric grazing occultation supplement lists, and in my XZ80N file. I think that the other omicrons in the Z.C. and XZ are alright, but someone might want to check them to be sure:

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X02454 ZC0257 +08° 0273 Omicron Piscium
X03662 ZC0403 +14  0457 Omicron Arietis
X13615 ZC1336 +15  1945 Omicron 1 Cancri
X13619 ZC1337 +16  1864 Omicron 2 Cancri
X14636 ZC1428 +10  2044 Omicron Leonis
X21196 ZC2193 -15  4083 Omicron Librae
X26345 ZC2779 -21  5237 Omicron Sagittarii
X28500 ZC2994 -19  5831 Omicron Capricorni
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ROBERT S. HARRINGTON

We regret to report that Robert Harrington, astronomer at the U. S. Naval Observatory, died of cancer on January 23rd. His greatest contribution to IOTA was his creation of the Zodiacal Zone catalog, which greatly improved the positional information, and consequently the accuracy of occultation predictions, especially the grazing occultation predictions, for most of the stars in the XZ catalog in 1987. Most asteroidal occultation predictions were also improved when ZZ data were added to David Dunham's Combined Catalog, and its use in ACRS has strengthened that catalog, especially in the zodiacal regions of interest to IOTA.

Harrington was well-known for other important accomplishments in astronomy and celestial mechanics, such as his work with Tom Van Flandern on the existence of a possible tenth planet and the origin of Pluto. He was a leader in the search for brown dwarfs. He calculated the orbit of Charon about Pluto, and determined Pluto's small mass in the process. Dr. Harrington received the Simon Newcomb Award from USNO for his work on Solar System dynamics. Minor Planet 3216 was named for him.

ORGANIZING A SAFE EXPEDITION

Paul D. Maley

There are two objectives for any occultation expedition. First and foremost is the safety of all participants, while second is the successful collection of data. These priorities should never be reversed.

When possible, the graze organizer(s) should always conduct at least one site survey of the areas in which an expedition is to venture prior to the date of the expedition. The sites should be marked in ways that can be seen at night and that can survive a number of days unattended. If desirable locations for observing sites are not public property, the organizers must have the owner's permission before entering onto private property. When possible the organizers should contact local law enforcement to let them know a number of observers and their vehicles will be in the area at the date and time of the occultation. If homeowners are near some observing sites, it is always a good idea to leave a note in their mailboxes or directly contact them, especially in a rural area.

Sites should be checked for the possibility of retaining water, especially if rain is likely near the date and time of the graze. Also check for the presence of power lines and for obstructions such as trees and lights that will be in the direction of the Moon at the time of the graze. The organizers should also determine if the road the sites are on is heavily traveled at night by vehicular traffic or pedestrians. Nighttime pedestrian traffic is normally not a concern for US observers, but it can be in other countries.

Observing sites along roads should be clearly OFF THE ROADWAY. Observers should use orange reflectors or reflective road cones that can be seen by approaching cars. Also, the observers can position their cars so that approaching cars will see the reflective tail lights. The cars can also be used to shield the observers from the headlights of oncoming traffic. Observers should be encouraged to wear light colored clothing that can readily be seen at night, and of course, observers should have flashlights to aid in maneuvering in the darkness.

Observers should never be sent to a station alone, but should have an assistant or companion whenever possible. If the observers own citizens band radios, they should use them for communications. This is especially useful when a line of observers is traveling to the site in a caravan. Observers traveling to meeting points or observing sites should always be provided with a clear map well ahead of time. The site survey can determine road hazards in the area, such as culverts, swampy areas, blind curves, or other potential hazards, which can be noted on the maps. The planned route to and from the graze site should be a safe one.

Where it is legal to carry firearms or other forms of self protection, these should be considered for observer safety. If the graze is to be located in an area that is reputed to be unsafe at night, the sites should be relocated to a safer area. If this is not possible, multiple persons should be stationed at each site, or the sites should be located within visual range [of one another]. Observer telescopes and vehicles should be positioned close to one another [at a given site] in case a quick exit is needed. If sites are located in a potentially unsafe area and this cannot be avoided, local law enforcement assistance at the occultation site should be requested will ahead of time, preferably in writing.

The organizer should always take responsibility for the safety of each person in the expedition, verifying where telescopes will be set up and confirming their locations just prior to the graze in order to prevent inadvertent mistakes in the dark. While a site placement can result in a non-optimum location, observers should not move from a designated site once in place without the knowledge and approval of the organizer. After the event the organizer should verify that all observers have left the area and that none of the sites has been "trashed". Observers should be instructed to removed everything that they brought with them, including garbage.

Organizers should also know something about each observer's competence and likeliness to act in a responsible manner. If there is any doubt about these characteristics, the organizer should consider deleting that individual from the graze roster. The organizer should also be aware of observers who are handicapped, minors, elderly, or female, and assign observing locations with their needs in mind.

It is highly recommended that organizers have personal liability insurance coverage. Insurance carriers can provide information on these types of policies. Also, some insurance companies offer these at lower rates to their automotive and fire insurance policy holders. [Organizers who provide rides to observers should be sure they carry sufficient coverage on their automotive insurance as well. Ed]

Observers who participate in an occultation expedition in which they thought safety was not the primary consideration of the organizer are requested to inform IOTA immediately after the event so that appropriate action can be taken. Occultation organizers and participants must act responsibly when on an expedition. While occultation expeditions are a unique and valuable method of collecting important scientific data, participants must be plainly aware that this is a voluntary activity undertaken purely for the enjoyment of each participant. All organizers and participants are volunteers and do so freely. IOTA, its officers, and members cannot be held liable for any accidents, injuries, or other problems associated with an expedition.

COMMENTS ON ORGANIZING EXPEDITIONS

David W. Dunham

As one who has led many expeditions, few of which rigorously followed the advice given by Paul Maley in the article above, I still must agree with him on nearly all points. IOTA as an organization must protect itself, so with a few exceptions discussed below, I endorse his recommendations as policies to define what IOTA considers a safe expedition.

Some thousands of expeditions for grazing and asteroidal occultations have now been conducted, and so far we have been fortunate; there have been few serious problems. I think that the most dangerous part of an expedition is going home afterwards. I know of two cases where automobiles were destroyed in accidents during the drive home; in the one case with injuries, the driver of another car (not an expedition participant) was at fault. Be careful during the drive home; stop at a motel if you are too tired.

The next most serious problem has been traffic coming too close while trying to observe; I know of two cases where observers (and some of their equipment) had to jump into ditches to avoid being hit. Observing sites must be completely off the roadway, as Maley demands. Many roads otherwise ideal for expeditions have no useful shoulders; in these cases, use a driveway, with the resident's permission.

If you can find a safe site well off the highway near (within sight and sound of) a house with the resident's presence, knowledge, and permission, then you can observe "alone" (that is, without a friend or another observer nearby). Otherwise, observers should have a companion, or observe in pairs within sight and sound of each other (no more than 100 meters apart). This often has some scientific value, for obtaining details about close stellar duplicity or resolving fine lunar structure. If an organizer and other expedition participants are confident that the area is safe, they might decide to have more single-observer stations, but if the sites are not close to habitations as noted above, they must all understand that they are not following IOTA expedition guidelines.

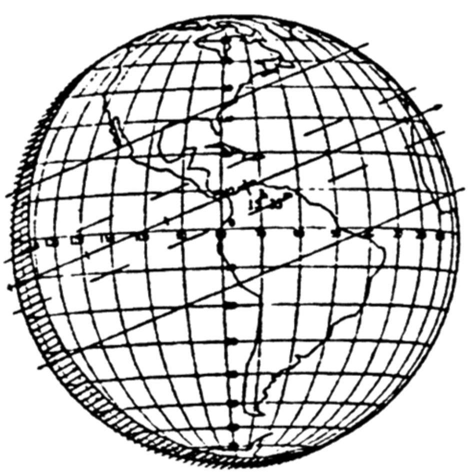
Maley suggests firearms or other forms of self protection. I have not heard of any occultation expedition conducted to date where a firearm would have helped. My experience has been that, when contacted, most local residents have been very supportive of our efforts. Most States of the USA require that firearms be prominently displayed in vehicles; this could send the wrong signal to local residents, who generally have more fear of us than we of them, and, I believe, would more often lessen the support that we usually get. I think that a better form of self-protection are small personal alarms that have been advertised recently. Whistles have served this purpose for a long time, but the new devices are much louder, important for occultation observers who usually select sparsely-populated areas. Two devices that I have seen advertised include the PAAL Personal Attack Alarm by Quorum, sold for $29 by Pacesetter Marketing, phone 1-800-374-8338, and Soundmate, available for $129.95 by calling 1-800-882-5778, ext. H122. The PAAL alarm is activated by pulling a small pin, which can be attached to a briefcase so that the alarm sounds when the briefcase is taken. The Soundmate emits a 120-decibel alarm that can be heard up to a km away in the open when squeezed. I do not have any experience with these devices, and would welcome comments about them by readers. Another more expensive, but becoming more commonplace, device is a car phone for calling 911. But many rural areas where distant expeditions are conducted are not yet covered by a cellular phone network.

Copies of the CSC grazing occultation description (see article on following pages) might be distributed with a cover letter explaining when and where you plan to observe. This would be useful for advance work for an early-morning or late-night event. Maley suggests placing notices in mailboxes, but in the USA, this is illegal (using a postal facility without paying postage) and postmasters will sometimes complain or take action against someone doing this. Placing the notices in stamped envelopes may help, but without a postmark, there is still a possibility for a complaint. You can send several stamped, sealed envelopes to the local postmaster along with a copy of a detailed map showing where the envelopes are to be delivered. This has the advantage that you don't have to go to the area before the night of the event, for the purpose of notifying residents, but if you do this, I recommend phoning the postmaster a few days after sending the package to see that he/she understands what you want done, and to verify that the job is accomplished (more envelopes may be needed if many more houses have been built along the target road since the latest map of the area was issued). In general, except for planned very large expeditions for exceptional events, I find it best to perform the site survey the day or early evening before a graze, after it has been determined that weather prospects are good. In the mid-Atlantic States where I live, the weather often does not cooperate, and a lot of effort would be wasted if site surveys were made for every predicted event. But if you do wait until the last minute for a site survey, be sure that your maps show the possibilities for alternate sites nearby in case the main sites turn out to be unuseable. Another advantage of late site surveys is the fact that station markers need to last only a few or several hours. I find that large numbers written with a wide felt-tipped black marker pen on a piece of cardboard or manila file folder, stapled to a telephone pole or fence post, is more legible than a number spray-painted on the asphalt at the edge of the road. Staked signs and stiff triangular uprights are even better. For small expeditions, in general with 5 or less stations, a copy of the detailed map of the area with the site marked, and a description of it, can usually be used in place of marking the sites.

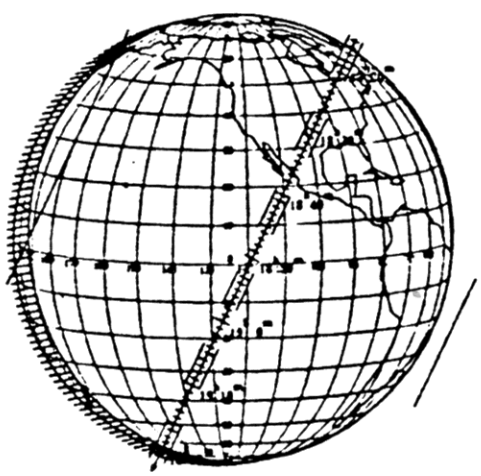
For evening grazes, I find a quick way to inform someone is just to tell them, "An hour from now, there will be an eclipse of a star by the edge of the Moon that will be visible only in this area. We have travelled from the Washington, DC area to try to record this rare event. Could we set up a telescope beside your driveway (or mention another protected place) with a view of the Moon? We will be done, and will leave, in about an hour and a half; if you want, you can look through the telescope at the Moon after the eclipse." I've almost always had a positive response to this; in the rare negative cases, a neighbor has been cooperative. This could also be done for late-night grazes (instead of written notices discussed above), if the expedition organizer or an assistant (perhaps an observer who lives nearby) arrives in the area early enough in the evening to catch most residents while they are still awake.

Notification of local residents is most important. Don't be shy; the best sites are often well off the highway beside someone's driveway with their permission obtained. Observers often think that they can find sites where they won't be detected. However, dogs have good ears and will alert their owners to a stranger's presence from amazingly long distances.

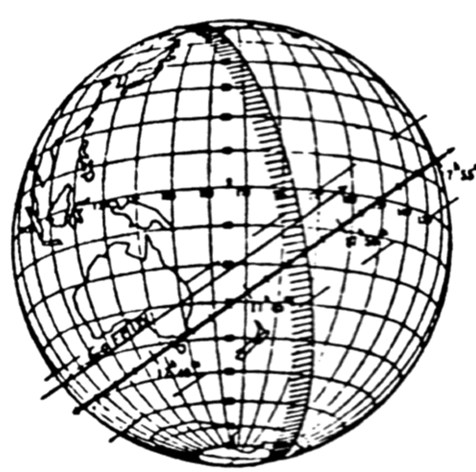
Nobody has yet tried to take legal action against IOTA for any reason, and we hope that they never will. The guidelines that Paul Maley and I have spelled out should be followed on all IOTA expeditions. They should reduce risk, and show that IOTA has written standards that address safety issues. But we can not foresee everything that might happen in the course of an expedition. As Paul notes, IOTA, its officers, and members can not be held liable for any accidents, injuries, or other problems associated with an expedition.



SAO 147015 by Mercury 93 Apr 14



SAO 109027 by Venus 93 Apr 15



SAO 162256 by Sappho 93 Apr 26

SOLAR SYSTEM OCCULTATIONS DURING 1993

David W. Dunham

This is a continuation of the article started on p. 257 of the last issue. Finder charts for events potentially observable from North America or Europe that were not included in Edwin Goffin's coverage, and selected world charts (see p. 259 of the last issue), are included in this issue where space allows.

Priority List: In Table 4 below, EAON is the European Asteroidal Occultation Network and I (IOTA) usually refers to attempts that will probably be made at Van Vleck Observatory in Middletown, CT (with plates usually measured by John Lee at Yale). Arnold Klemola often helps by providing measurements of secondary faint reference stars from existing Lick Observatory plates. The EAON events are from their "observation programme"; astrometric updates might not be attempted for all of them. EAON events that are not in the tables on pages 260-263 of the last issue are not included in Table 4. Similarly, most events in the "I" column constitute an "observing program" of events on which North Americans should concentrate. A "2" in the "I" column indicates an event of secondary importance for North Americans. Events before March are past and are not included.

Table 4. Priority List for Astrometric Updates

1993 Date	Asteroid	EAON	I	1993 Date	Asteroid	EAON	I
Mar 12	18 Melpomene	x		Oct 9	27 Euterpe		x
Mar 13	88 Thisbe		x	Oct 13	24 Themis		2
Mar 18	176 Iduna		2	Oct 15	30 Urania	x	
Mar 24	141 Lumen		2	Oct 25	87 Sylvia	x	2
Mar 27	P/Sm-Wm-1		x	Nov 1	171 Ophelia	x	
Apr 2	624 Hektor		2	Nov 23	19 Fortuna		x
Apr 2	24 Themis		2	Nov 23	407 Arachne	x	x
Jul 3	24 Themis		x	Dec 13	419 Aurelia		x
Jul 6	638 Moira	x		Dec 17	30 Urania	x	x
Aug 8	354 Eleonora	x		Dec 26	78 Diana		x
Aug 18	19 Fortuna		x	Dec 26	203 Pompeja		x
Sep 11	709 Fringilla		2	Dec 30	27 Euterpe		x
Sep 28	89 Julia		x	Dec 31	144 Vibilia	x	x
Oct 3	Pluto		x				

680 Genoveva: Edwin Goffin found that he had made an error in typing the orbital elements for Genoveva. He has corrected the error, and confirms that there will be no occultation of SAO 207178 on August 24, as I noted on p. 259 of the last issue. With the correct orbit, he found two more occultations. They will occur on May 10 (9.0-mag. PPM 294821, maximum duration 8 seconds, path passing south of Japan, north of Mindinao, over northern Borneo, and central Sumatra) and on August 11 (8.0-mag. SAO 206905, duration 7 seconds, path over northern Madagascar, southern Sumatra, and northern Borneo). Another event that Goffin predicted for northwestern South America, an occultation of 9.4-mag. FAC 352811 by 52 Europa on October 6, will probably not happen. The star is SAO 97689, a star with significant proper motion; use of the SAO data for the star yields a path that misses the Earth's surface to the north.

Local Circumstance/Appulse Predictions: Unfortunately, these have been delayed for IOTA members, since Joe Carroll, who computes them, had to concentrate on another project in his office due in late February. Hopefully, that is completed by now so that IOTA members might soon start to receive his predictions. I have not had time to get the program running on the computers to which I now have access, so although I generated the input occultation data set needed by the program, I could not help with the prediction calculations myself. It's the continuing problem of too much work for too few people.

Error: Rick Hill, Tucson, AZ, found an error in the supplement (available on request to IOTA, for photoelectric/video and narrow path events) to the 1993 Asteroidal Occultation Supplement for North American Observers. A page giving a prediction for an occultation of 11th-mag. L 2 3519 by 53 Kalypso on 1993 December 16, with nominal path crossing Canada, was not in chronological order, but was mistakenly placed between events occurring on June 29 and July 18. The December 16th occultation was not included in the summary list of events on pages 2 and 3 of the Supplement.

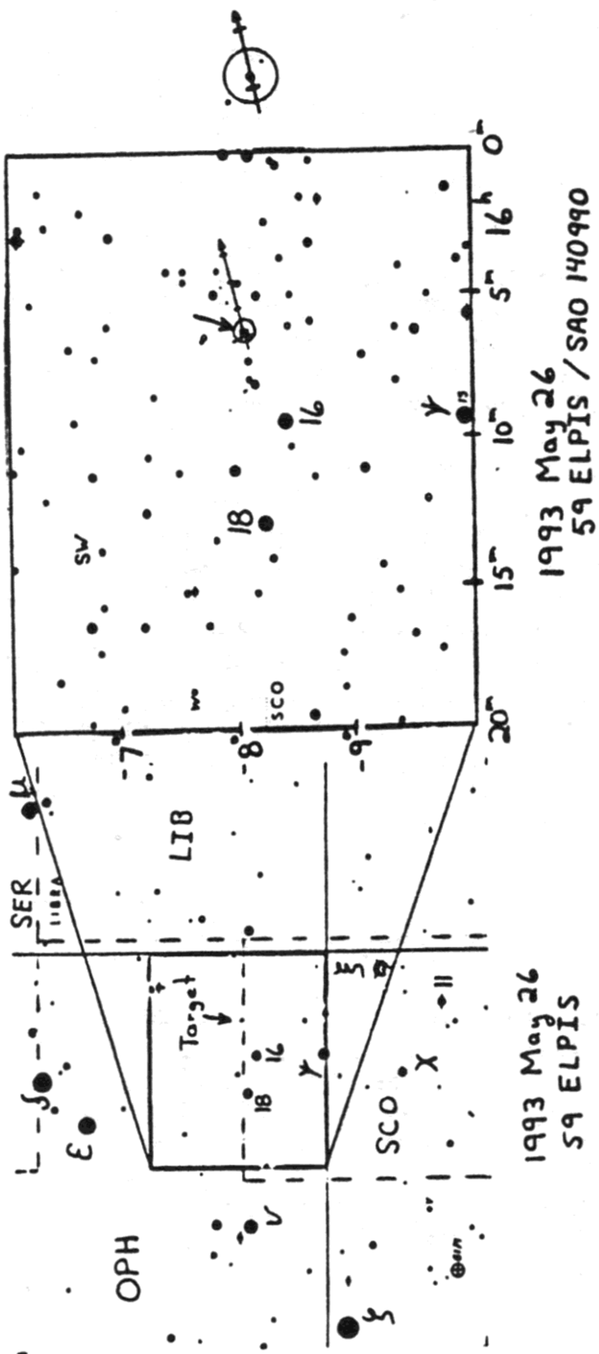
Notes about Individual Events: Notes for events in June and later months will be in the next issue.

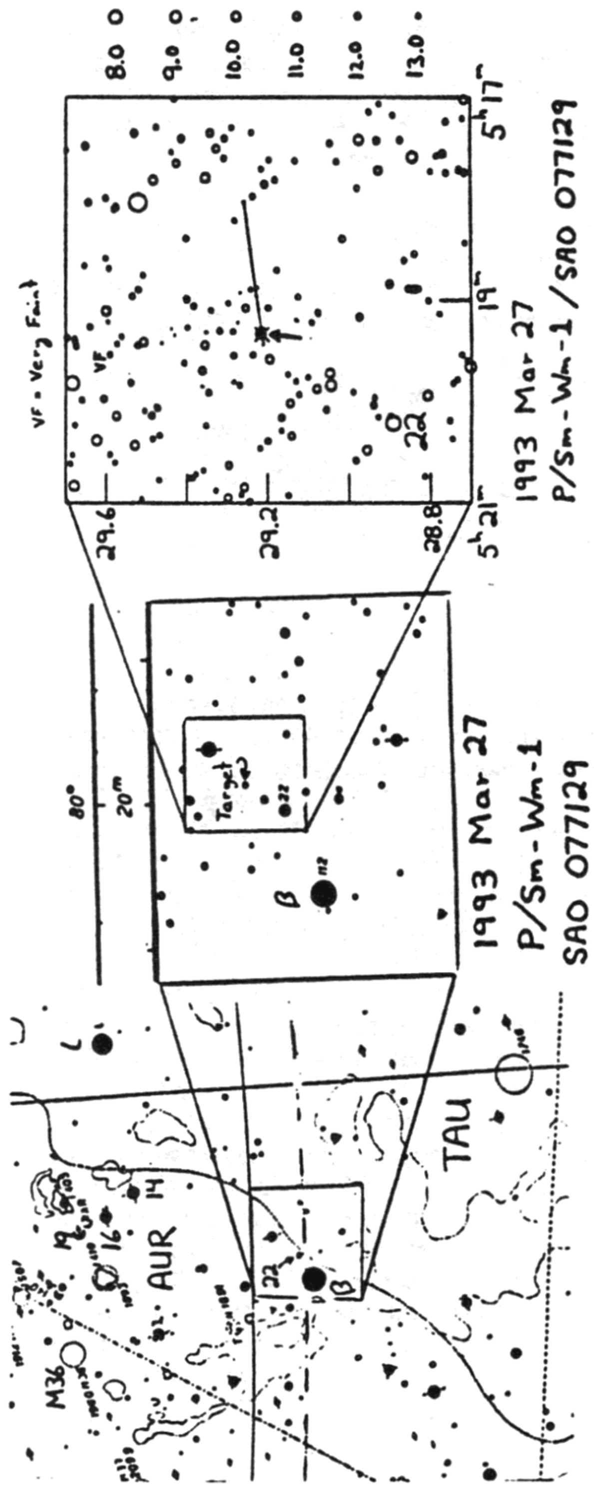
Feb. 4: The occultation of Comet Schwassmann-Wachmann-1 was discussed on p. 267 of the last issue. The day before the event, Jack Hunt and I managed to produce an FAC-based 1° chart for this occultation. Fortunately, it wasn't necessary to fax copies of the chart, since the target star was only about 90" away from 9.0-mag. SAO 57742, so that star's coordinates plus a description of the target star's location relative to it, was enough to locate the star. Also, Dan Green updated the orbit for the comet and provided a Guide Star Catalog position for the target star. Larry Wasserman's path calculated with these data was only about 100 miles north of my nominal path, but considerable errors could still remain. This information was sent by e-mail to a few dozen observers. Curt Roelle monitored the star with a 20-inch Dobsonian near Westminster, MD and saw no dimmings, except some caused by cirrus clouds that thickened shortly after the updated closest approach.

March 15, Peraga: Separate predictions are given for the occultations of the components of SAO 98690 [Zodiacal Catalog (ZC) No. 1423 = Aitken Double Star (ADS) 7471], separated by 8"4 in position angle (PA) 102°. The secondary PA is only 6° different from the PA of motion, resulting in paths relatively close to each other.

March 27: Mars will be 90% sunlit with a defect of illumination of only 0"8, less than the expected extension of the terminator due to irradiation.

March 27, P/Sm-Wm-1: See Feb. 4 above. The finder chart for this event was prepared by David Werner using basic charts supplied by me.





April 14: Mercury will be 62% sunlit. Since the PA of the center of the bright limb (PACBL) will be 61°, the reappearance will occur on the dark side.
April 15: Venus will be only 7% sunlit. Since the PACBL will be 80° and Venus is in retrograde motion, the disappearance will occur on the dark side. In the northern 20% of the path north of New Zealand, both disappearance and reappearance will be on the dark side.
April 29: Jupiter will have a negligible 0".1 defect of illumination.
May 2: This is the southernmost star for which I have ever predicted an occultation. Comet Swift-Tuttle is the brightest periodic comet whose motion we can predict. The path for the May 2nd occultation may change significantly after the comet is recovered and its orbit updated later this month. Predictions for later returns have the comet passing much closer to the Earth. Although we are safe in 2126, expecting a very good Perseid meteor storm, on August 12, 3044, the comet's extrapolated error ellipse is large enough to include the Earth.
May 7 and 9: Mars will be 90% sunlit with a defect of illumination of 0".6.

CHEAP IMAGE INTENSIFIERS

David W. Dunham

STANO Components; P.O. Box 2048; Carson City, NV 89702, phone 702,246-5281, has advertized first-generation image intensifiers for $350 in recent issues of **Sky and Telescope**; for example, p. 46 of the January issue. In a similar ad on p. 72 of the February issue, it also states, "Now Available for Export". So those who have purchased the Phillips modules or other CCD video cameras might now be able to extend the sensitivity of their systems by 3 or more magnitudes.

Coupling the image intensifier to a video camera will now be a bigger problem than just getting the image intensifier. Astrolink used to sell couplers for $275, and said that they might be able to make modifications for other cameras and intensifiers [**ON 4** (12), p. 292 and **ON 4** (15), p. 362], but they apparently are no longer in business. They were in Spring Valley, CA, near San Diego; perhaps someone in the area could contact their former personnel to see if any capacity for making similar couplers exists. I bought my coupler from Litton Industries in Arizona for $650, but there are probably cheaper alternatives, especially for someone with access to a machine shop and/or an optical shop. Peter Manly wrote a paper, "Coupling Image Intensifiers to Television Sensors", for the 8th IAPPP Symposium in February 1987; his address is 1533 W. 7th St.; Tempe, AZ 85281; phone 602,966-3920. Let the editor or me know of any other ideas or recent information you may have about intensifier-to-camera couplers and we will publish them in a future issue.

AMATEUR ASTRONOMY RESEARCH BOOK

The Proceedings of the Symposium on Research Amateur Astronomy have been published by the Astronomical Society of the Pacific (ASP); 390 Ashton Ave.; San Francisco, CA 94112; USA. It is available from the ASP for $40.00 ($36.00 for ASP members) plus postage ($4.50 in the USA, $15.00 for overseas airmail). The Symposium was held in La Paz, Baja California, Mexico, before the 1991 July solar eclipse; Papers include "The Observation of the 1984 Annular Eclipse in Mexico" by Guillermo Mallen; "Some Tips on Video Recording Solar Eclipses" by Derald Nye; "The July 3, 1989 Occultation of 28 Sagittarii by Saturn, its Ring System, and Titan: ALPO Visual Observations" by Julius Benton; "RPHOT Release 2.0: A UBVRI and Occultation Photometry Acquisition and Reduction Software Package for PC-Based Observatories" by Richard Nolthenius, and others not so directly related to IOTA's work. Overall, the papers offer suggestions on research topics needing investigation or additional observations, report on research conducted, discuss and make recommendations on observational methods, offer approaches to education and communication, and consider the history and sociology of the science.

Steve Edberg notes that the Corp. for Research Amateur Astronomy plans symposia in conjunction with future eclipses, in Paraguay in 1994 November and in India in 1995 October.

CORRECTIONS AND BUGS

A review of Jean Meeus' **Astronomical Algorithms** is in **ON 5** (7), pp. 170-171. James Van Nuland; 3509 Calico Ave.; San Jose, CA 95124; has found some bugs in the software distributed with the book, mostly related to calculation of calendar dates of holidays, but also of Jupiter's central meridian longitudes and captions for Ganymede and Callisto in the JSATS program. Send him a self-addressed (in

USA, stamped) envelope to obtain a list of the corrections. Van Nuland notes that he has not done extensive testing of the programs, so he expects that there are more bugs to be discovered, "it's the nature of the first version of such things."

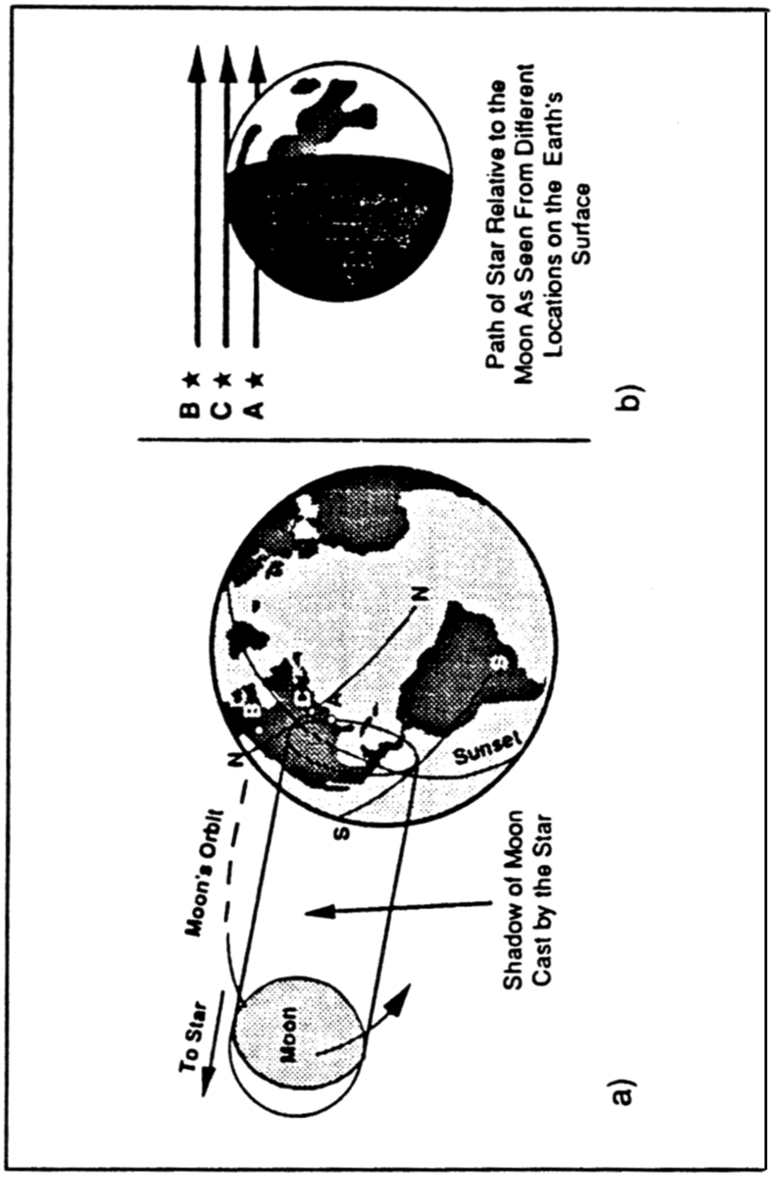
On p. 187 of the same issue, Francis Graham notes some corrections to his article about Mercury occultations near the Sun. In the equation as a multiplicative factor and in the 4th line under the equation after the word "angle" should appear "ϕ". At the end of the article, after the word "ruin", add "your eyes or most other detectors". In the 12th line of the right-hand column, change "Ohio" to "Pennsylvania". Graham also adds in a letter sent after he submitted the article: "I have discovered an observation of Mercury done with a coronograph at a phase of zero at an elongation of 28′ from the Sun (G. Ratier, **Icarus 16**, pp. 318-320). I missed it in my first literature search because it was in French."

On p. 272 of the last issue, in Stamm's Reports of Asteroidal Appulses and Occultations, Jim Blanksby says, referring to his observation, that Note 6 should read "Blk recorded a D at 18:03:17.6", not "18:03:07.6"; the duration was 5.8 seconds, not 15.8 seconds.

GRAZING OCCULTATIONS EXHIBIT AT CSC EXPO

David W. and Joan Bixby Dunham

Last October 17th, the System Sciences Division of Computer Sciences Corporation, our employer (former employer for David) held an open-house at its GreenTec-2 facility in Lanham-Seabrook, Maryland, to explain some of the technical work performed at the facility. Although grazing occultations are not part of CSC's work, the company does encourage outside research activities by its employees, their support of page charges for our paper on the 1983 Pallas occultation in the 1990 May issue of **Astron. J.** being a good example. Since education was a theme for the open-house, called CSC Expo, our managers thought that grazing occultations might be a suitable subject for a display. This was approved, and CSC's Technical Publications Department worked with us to create a large poster display for the exhibit, which also included a VCR and TV that we used to play tapes made during the grazes of δ Cancri in northeastern Maryland in May 1981 and of α 2 Librae in Sudan during the total lunar eclipse of May 1985. A one-page (2-sided) hand-out was also prepared, with enough spare copies to enclose one for all subscribers of this issue. It might be useful for your own promotional efforts. A few minor mistakes were made in Figure 1: In part **a**, the southern edge of the Moon's shadow on the Earth is not quite touching the southern-limit curve S-S; and in part **b**, the path C is not quite tangent to the Moon's disk, which also shows the half of the terminator on the back side of the Moon. Corrected versions of the figures are given below; you can make copies of them to paste over the ones in the hand-out. Also, at the bottom of the back page, under "For further information, contact:", you should replace "Candace DeFelice (301) 572-3863" with either your, your organization's, or IOTA's name and telephone number.



INTERPRETING DOUBLE STAR PROFILES

David W. Dunham

Some observers recently have been confused about ACLPPP profiles for grazing occultations of double stars. The problem seems to arise when one looks at a profile and tries to think of it as a direct view of the situation, looking at the Moon. But that is not the intention of the ACLPPP profiles. The profiles are to be used to locate observers relative to the predicted limits, and consequently they show the shadows as they are projected on the ground, with north always at the top of the profile (the actual direction being measured perpendicular to the limit line). Because of the parallax effect (hold your finger steady and move your head, noting that the finger's location relative to the background moves in the opposite direction), the shadow for a companion north of a primary star is south of the shadow for the primary, and vice versa. A horizontal line drawn on the profile corresponds to a particular distance from the limit line, and the predicted times of events for the component stars can be estimated from where the horizontal lines intersect the profiles for the components (connected P's, S's, and sometimes T's for a 3rd star). Since the plot resolution is at best ± 0.05 mile or ± 0.05 km, components separated by less than that amount at the Moon's distance will not be distinguished on the plot.

GRAZING OCCULTATION OBSERVATIONS

Richard P. Wilds

I received reports from three continents once again. One area that really struck me about this list was the number of different techniques used in recording the data. Observers used stopwatches, tape recorders, a chronograph, and a CCD video system. Such diversity in techniques should give new encouragement that there are new and even better ways of gathering the data we seek. C. Sauter and M. Kohl begin our 1991 list with a graze just off the crater de Sitter. Sauter timed a three-second occultation with a stopwatch. On 10/28 Don Stockbauer videotaped a graze around the mountain Epsilon Leibnitz. He reports that he would have had more events, but some timings were lost due to technical difficulty. B. Loader of New Zealand begins our 1992 list this time with a graze around the north polar crater, Byrd. Don Stockbauer reported the next two grazes from the same area of the Moon - between Byrd and de Sitter on 7/23 and between Byrd and Peary on 7/27. On the first graze his team used a mixture of video and tape recorders. On the second, they used tape recorders. On 8/06, M. Kohl and C. Sauter led their team through the near slope of the crater Drygalski armed only with their stopwatches. Don Stockbauer led his last graze of this reporting period in the area of the crater Le Gentil. The graze was very successful with a mixture of video and tape recorders. Craig McManus led the Needville, Texas graze as part of the 10th annual IOTA meeting. This was the most successful graze of the period and covered the crater Le Gentil.

Joaquim Garcia makes a fine return with his graze of 10/04 around the crater Boltzmann and the mountain Alpha Doerfel. Joaquim leads an active group out of Lisbon, Portugal. They frequently observe grazes, so it was very distressing when their 1992 predictions were lost in the mail. This was their first chance to get back into action. They did so with tape recorders and a chronograph. H.A.R.T. also returned to action on 10/18 with a successful graze around Epsilon Leibnitz. Our grazes were timed with tape recorders. The H.A.R.T. grazes of 10/21 were quite hectic. The first graze was about 3:00AM. I slept as long as I could, so I made it to my graze site, 50 miles away, with 10 minutes to spare. However, my landmark was gone, so I had to rush to a second site. I set up and put my eye to the telescope just as the star disappeared behind Beta Leibnitz. After the reappearance I packed all the equipment in the car and rushed off to see if I could make the 60 miles in one hour to join Craig McManus on his graze. I picked Craig up on my CB radio as I approached the graze path. He told me to hurry, because the 9.7-mag. star was crossing the terminator. He directed me to my site via radio. I set up my equipment and put my eye to the telescope just in time to yell "D". The graze area included Beta Leibnitz and the crater Scott. There is a nice drawing by E. A. Whitaker of this area of the Moon found on page 238 in the May 1954 **Journal of the British Astronomical Association**. Finally, Joaquim Garcia finishes our list with another successful graze in the area around the crater Boltzmann and Alpha Doerfel.

REMEMBER to apply a 0.3 second of arc south shift to your predicted path of northern limit, waxing-phase, dark-limb grazes. One should spread out, however, since star errors could increase this shift or reduce it to a 0 shift. See David Dunham's article on corrections that should be applied to both northern-limit and southern-limit grazes on p. 269 of the last issue. The graze list in the November, 1992 issue is in need of correction. The shift on the 920822 graze of Venus, AR should read ">0."2S.

Please report all grazes to:

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

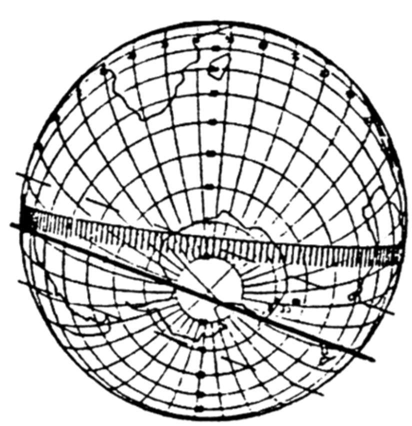
Please send a copy of your report to:

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

Graze List

UTDate YYMMDD	V P	Star #	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap Cm	Organizer	Sh	N S	WA	B
1998															
880519		79243	7.4	17+	13.2N	Bucelas, Portugal	1	0	1	15	Joaquim Garcia	?		11	-5.2
1991															
910411		146062	6.1	15-	7.0N	Neuhaus, Switzerland	1	2	1	10	C. Sauter/M. Kohl	?		354	-3.4
911028	V	78696	6.8	71-	9.0S	Paisano, Texas	1	3	1	36	Don Stockbauer	0.6	S	191	-0.2
1992															
920427		146166	7.8	24-	8.3N	Rangiora, New Zealand	1	3	1	20	B. Loader	?		358	-6.4
920723	V	92810	6.4	45-	6.0N	Bellville, Texas	2	16	1	20	Don Stockbauer	0.1	S	355	-4.9
920727		78094	7.4	8-	3.0N	Oyster Creek, Texas	2	8	1	20	Don Stockbauer	0.1	S	358	0.6
920806		183901	5.4	64+	7.0S	D-Munchingen, Germany	3	12	1	10	M. Kohl/C. Sauter	?		171	4.1
920809	V	186152	6.9	84+	16.0S	Connor, Texas	4	27	1	20	Don Stockbauer	0.2	N	163	0.5
921002		185374	6.3	35+	15.9S	Needville, Texas	7	41	1	20	H.A.R.T. C. McManus	0.2	S	163	0.9
921004		163060	6.0	62+	16.2S	Harinha Grande, Port.	2	16	2	15	Joaquim Garcia	0.8	S	164	-2.9
921018		96588	8.0	58-	10.0S	Sidney, Iowa	2	18	1	33	H.A.R.T. R. Wilds	0.0		192	2.9
921021		117986	8.3	25-	4.2S	Netawaka, Kansas	1	2	1	33	H.A.R.T. R. Wilds	0.0		182	6.3
921021		X14986	9.7	25-	7.0S	Willard, Kansas	2	8	1	33	H.A.R.T. C. McManus	0.2	S	185	6.3
921101		163474	8.3	45+	15.4S	Lourinha, Portugal	4	26	1	15	Joaquim Garcia	0.5	S	164	-3.9

S0° 1732 by Jupiter 93 Apr 29

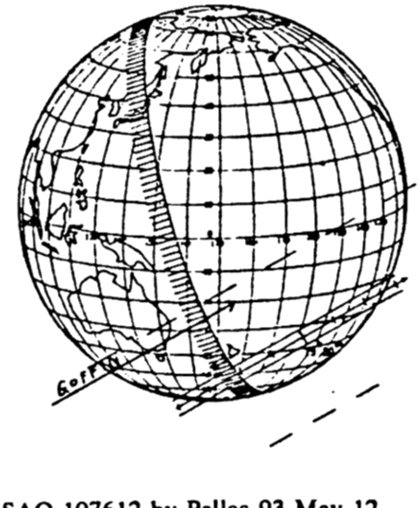


SAO 248548 by P/Swift-Tuttle 93 May 2

SAO 100735 by Tanete 93 May 4

SAO 80215 by Mars 93 May 7

SAO 80264 by Mars 93 May 9



SAO 107612 by Pallas 93 May 12

GRAZE OF 46 CAPRICORNI

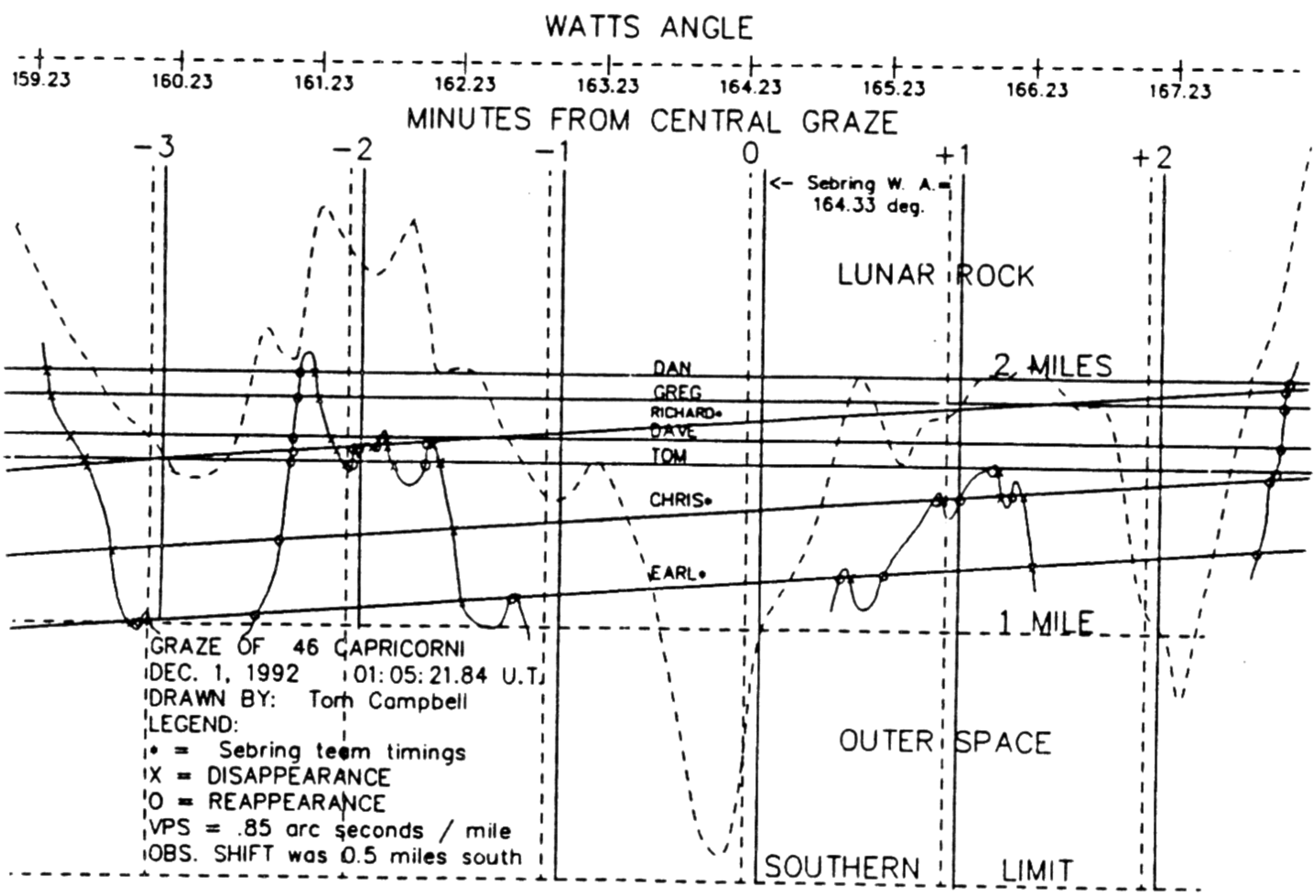
Tom Campbell

The graze of 46 Capricorni, December 1, 1992 UT, was the best observed graze in central Florida in about 3 years. Three experienced visual observers joined me just a few miles north west of the town of Arcadia. I timed 10 events with my video equipment and the other observers timed 14 more for a total of 14 events from my expedition.

Chris Stephan, of Sebring, Florida, organized a team of 4 observers that timed 36 events visually. We set up our stations so that we would not duplicate cords. His team was just 20-25 miles to the northeast of ours near Highlands State Park. Harold Povenmire led an expedition of 36 observers with three video stations. They timed around 140 events.

I found it easiest to draw a copy of the predicted profile and to plot the observations on that profile with a CAD program I have called Autosketch. I entered all the profile data manually, which does not take long with a mouse once the grid is established. The result is in the figure following this article. The graze shift looks like at least 0"4 south, depending on how the observed profile is matched to the predicted one. It is a judgment call, since the observed shape of the first valley is different from the prediction.

I made the mistake of showing the predicted profile to my observing team before the graze and they all wanted to observe from the area of predicted maximum events. I won't show the profile next time. The large south shift almost burned us except for the rugged profile that gave us some multiple events.



SOLAR ECLIPSE NEWS

David W. Dunham

Annular Eclipse, 1991 January 15: Friedhelm Dorst, from Witten-Bommern, Germany, sent some photographs showing Bailey's beads taken at his site at Chalk Hill Lookout at Medina, Western Australia, near the centerline. Unfortunately, IOTA expeditions to the limits in New Zealand were clouded out.

Annular Eclipse, 1992 January 5: See Derald Nye's photograph of Baily's beads taken during this eclipse on p. 112 of the February issue of **Sky and Telescope**.

Annular Eclipse, 1994 May 10: Paul Maley is considering an expedition to the southern limit near Oklahoma City.

Total Eclipse, 1994 November 3: Tom Van Flandern is organizing another Eclipse Edge expedition, to the Atacama Desert near Arica, Chile, to observe from the southern limit. He decided to go there after having some problems with altitude sickness during his scouting trip to Bolivia; some of the limit sites there are as high as 5000 meters, not a good situation for a large expedition. Since the northern limit does need to be covered, volunteers are sought for a small separate effort in Bolivia. Paul Maley is planning the 17th Johnson Space Center Astronomical Society solar eclipse expedition, to the centerline in Tacna, Peru, which he visited last month. The site is very safe and weather prospects are excellent His expedition will probably have to travel through Arequipa, which is on the northern limit, so possibly some observers could stay there. The price for his expedition, from Houston, TX, will be about $1700; from Miami, it will be about $1200.

Annular Eclipse, 1995 April 29: Paul Maley is considering a small expedition to the southern limit, probably to Iquitos, Peru. A GPS receiver may be needed to position observers. Some effort near the northern limit, perhaps in northeastern Brazil, should also be organized.

Total Eclipse, 1995 October 24: Paul Maley is planning an expedition to India. He states, "Looks like a good weather season that month from the Agra/Jaipur area and both limits could be handled fairly easily."

LETTERS

Dear Joan,

Thanks for the publication of our paper "Videographic Occultation Observation" in **ON 5** (8). [In that issue] Henk Bulder stated our method is wrong if we don't consider the effects of Fresnel diffraction. Actually we graphically checked our assumptions, and concluded we could do so, at least if we keep the system's bandwidth around 400 nanometer and if the occultation is far from being a graze.

The second Editor's note, which is concerning the correction to apply on reappearance timings, is right: a bad mistake occurred. Instead of " Tdis = ...", you should read:

$$Treap = Tins + Tcor$$

mag decrease	Tcor
1.5 mag	+0.01 sec
0.8 mag	0.0 sec
0.5 mag	-0.01 sec
0.0 mag	0.0 sec

These corrections are obvious when looking at Figure 2. Sorry for that mistake!

Now a comment on Cliff Bader's paper: He writes that, during frame freeze operation, his three-head Panasonic VCR alternates between the last fields of two consecutive frames. I use a two-head Panasonic NV-730E. I don't know exactly how the process works, but I can say it doesn't work like Bader's because, if that was the case, I should read two consecutive times at once on the frozen image. My VCR surely uses one or two fields of the SAME frame in its process. The corrections we proposed in our paper are right only if the TWO fields are used in the frame operation, of course. We were not aware of this problem and, thanks to Cliff, now have to check it.

Now a comment on Schaefer's MAGLIM: I have read David's comments and modifications he proposed to the **Icarus** Editor, and I agree fully. In my own version of MAGLIM, I define an observability code which seems to be useful. Jean Schwaenen uses it in his occultation predictions. This code is directly related to the minimum aperture needed for an occultation. The code "9" is used when the occultation needs a minimum aperture of 2.5 cm or less, the code "8" needs a minimum aperture of $2.5\sqrt{2}$ cm, and so on. The code "1" thus needs an aperture of 40 cm.

Jean Bourgeois
Belgium

OCCULTATIONS IN THE LITERATURE

David W. Dunham

"Occultations of Asteroids by the Moon in 1992 and 1993", B. Stecklum, **Astron. J. 104** (4), p. 1623 (October 1992).

"An Examination of the Change in the Earth's Rotation Rate from Ancient Chinese Observations of Lunar Occultations of the Planets", J. L. Hilton, P. K. Seidelmann, and Liu Ciyuan, **Astron. J. 104** (6), p. 2250 (December 1992).

"Starlight-1 High Speed Lunar Occultation Photometry", J. B. Gunn, **I.A.P.P.P. Communications 49**, p. 12 (Fall 1992). He states that USNO no longer supplies total occultation predictions, without mentioning IOTA's efforts to continue the service. He describes a cumbersome method to calculate predictions of low accuracy using a program called SuperStar. However, the TVOccult high-speed photometric occultation reduction software that he mentions, and his hardware using an IBM PC and Starlight-1 photometer, are very interesting and worthwhile for others wanting to record occultation diffraction patterns.

"Lunar Occultation Visibility", B. E. Schaefer, H. J. J. Bulder, and J. Bourgeois, **Icarus 100**, p. 60 (1992). A summary of this paper is given in the paper described next.

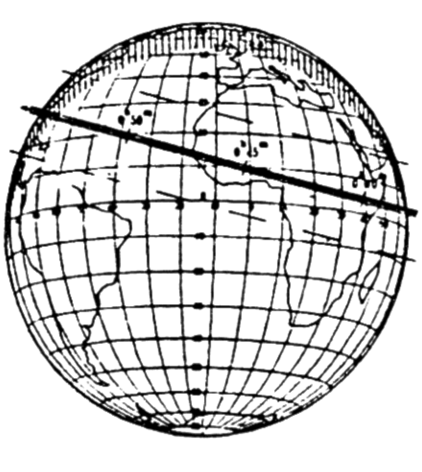
"A Star's Visibility Just Before Occultation", B. E. Schaefer, **Sky and Telesc. 85** (1), p. 89 (January 1993). Schaefer recommends that IOTA gives the minimum aperture calculated with his algorithms in their predictions, but does not mention that this is effectively done with the revised observability-code system of the IOTA/USNO total occultation predictions for 1993; see **ON 5** (8), pp. 206-207.

"Close Mutual Approaches of Minor Planets in 1993", E. Goffin, **The Minor Planet Bulletin 20** (1), p. 8 (January-March 1993). Only one event is likely to produce an actual occultation on the Earth's surface, on March 7, around 4:57 U.T., when 13.6-mag. (83) Beatrix can cover 15.6-mag. (1112) Polonia at J2000 R.A. $4^h\ 39^m.04$, Decl. $+27^\circ\ 02'.9$. Several other appulses are listed. Starting on p. 4 of the same issue, Goffin also lists more than 100 close approaches of asteroids to naked-eye stars during 1993.

"ICCD Speckle Observations of Binary Stars. VII. A Duplicity Survey of the Hyades Cluster", B. D. Mason et al., **Astron. J. 105** (1), p. 220 (January 1993). This paper supplements earlier papers about duplicity of Hyades cluster members based on occultation observations.

"A High-Speed Photometer in the Optical Region for Lunar Occultation Studies", T. Chandrasekhar et. al., **J. Astrophys. Astr 13**, p. 195 (1992). This describes an optical high speed photometer and results from its use.

SAO 100629 by Tanete 93 May 22



SAO 140990 by Elpis 93 May 26

SAO 143188 by Sappho 93 Jun 8

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

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

The officers of IOTA are:

President	David W. Dunham
Executive Vice President	Paul Maley
Executive Secretary	Rocky Harper
Secretary-Treasurer	Craig and Terri McManus
VP for Grazing Occultation Services	Joe Senne
VP for Planetary Occ'n Services	Joseph Carroll
VP for Lunar Occultation Services	Walter Morgan
ON Editor	Joan Bixby Dunham
IOTA/European Section President	Hans-Joachim Bode
IOTA/ES Secretary	Eberhard Bredner
IOTA/ES Treasurer	Alfons Gabel
IOTA/ES Research & Development	Wolfgang Beisker
IOTA/ES Public Relations	Eberhard Riedel

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

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

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 grazing occultations) and minor planet occultation data, including last-minute predictions, when available.

The addresses for IOTA/ES are:

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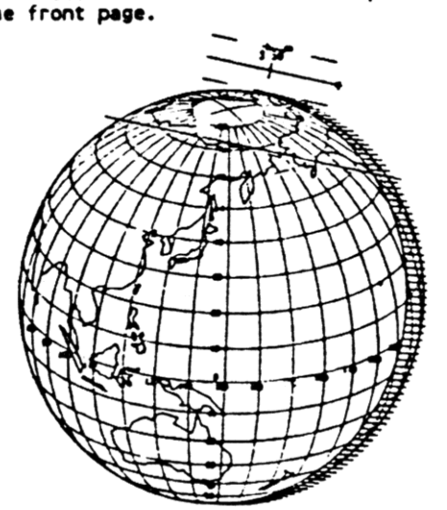
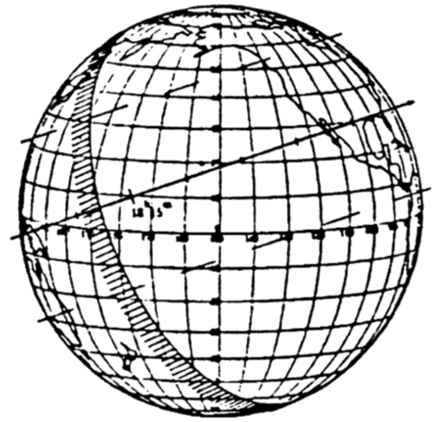
Ginsterweg 14	Bartold-Knaust-Str. 8
D-W-4730 Ahlen 4 (Dolberg)	D-W-3000 Hannover 91
Germany	Germany

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

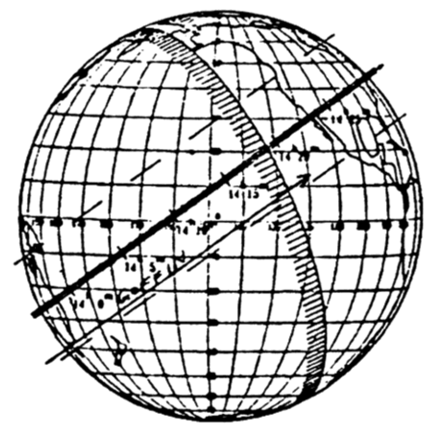
-2388-3658	-511-424696
Fax -2381-36770	-511-233112



SAO 78967 by Mercury 93 Jun 11



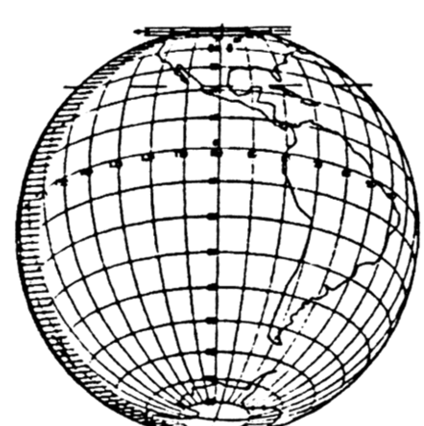
Anonymous by Glauke 93 Jun 11



+0° 4845 by Hypatia 93 Jun 19

16 Arietis by Julia 93 Jun 21

SAO 93286 by Venus 93 Jun 25



9 Sgtr. by Themis 93 Jul 3