Occultation Newsletter

Volume 11, Number 1 January 2004 $5.00 North Am./$6.25 Other

ESOP 2004

In this Issue

ON THE COVER:

ESOP 2004

The XXIII European Symposium On Occultation Projects was held at the Paris Observatory, August 27-29, 2004. We hope to be able to bring you some of the papers presented in upcoming issues of O.N.

The next issue, Volume 11, Number 2 will be published in December. Please send submissions for that issue to editor@occultations.org no later than 1 December 2004.

Publication Date for this issue:
October 2004

Please note: The date shown on the cover is for subscription purposes only and does not reflect the actual publication date.

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Art Lucas
Secretary & Treasurer
5403 Bluebird Trail
Stillwater, OK 74074 USA
Email: **business@occultations.org**

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

John A. Graves, Editor for *Occultation Newsletter,*
3120 Hydes Ferry Road
Nashville, TN 37218-3133 USA
Email: **editor@occultations.org**

Send Lunar Grazing Occultation reports to:

Dr. Mitsuru Sôma
V.P. for Grazing Occultation Services
National Astronomical Observatory
Osawa-2, Mitaka-shi
Tokyo 181-8588, Japan
Email: **SomaMT@cc.nao.ac.jp**

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Richard P. Wilds
2541 SW Beverly Court
Topeka, Kansas 66611-1114 USA
Email: **astromaster@cox.net**

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

International Lunar Occultation Centre (ILOC)
Geodesy and Geophysics Division
Hydrographic Department
Tsukiji-5, Chuo-ku
Tokyo, 104-0045 Japan
Email: **iloc@jodc.go.jp**

Send Asteroidal Appulse and Asteroidal Occultation reports to:

Jan Manek
IOTA V.P. for Planetary Occultation Services
Stefanik Observatory
Petrin 205
118 46 Praha 1
Czech Republic
Email: **JManek@mbox.vol.cz**

Send observations of occultations that indicate stellar duplicity to:

Henk Bulder
Noorderstraat 10E
NL-9524 PD Buinerveen
The Netherlands
Email: **h.j.jbulder@freeler.nl**

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Occultation Newsletter subscriptions (1 year = 4 issues) are US$20.00 per year for USA, Canada, and Mexico; and US$25.00 per year for all others. Single issues, including back issues, are 1/4 of the subscription price.

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IOTA Publications

Although the following are included in membership, nonmembers will be charged for:

Local Circumstances for Appulses of Solar System Objects with Stars predictions US$1.00
Graze Limit and Profile predictions US$1.50 per graze.
Papers explaining the use of the above predictions US$2.50
IOTA Observer's Manual US$5.00

Asteroidal Occultation Supplements will be available for US$2.50 from the following regional coordinators:
South America--Orlando A. Naranjo; Universidad de los Andes; Dept. de Fisica; Mérida, Venezuela
Europe--Roland Boninsegna; Rue de Mariembourg, 33; B-6381 DOURBES; Belgium or IOTA/ES (see back cover)
Southern Africa--Brain Fraser - fraserb@intekom.co.za
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Alpha Librae 2003 June 11 - A European Summer Occultation

Dietmar Büttner, Germany

A campaign to observe the disappearance of this wide double star at the dark lunar limb (DD) was organized by the author. A total of 89 timings made by 45 observers from five countries was received. This is regarded to be a positive response. The number of observations reported from the particular countries is as follows: Czech Republik 38, Poland 18, Spain 17, Germany 14, Slovakia 2.

Among the 80 usable DD observations, 48 timings were made visually and 32 timings were made with video equipment. Eight video observations of the primary, ZC 2118 (2.9m), displayed gradual events with 0.04-0.08 s duration. Two other video observers reported step events 0.04 and 0.06 s apart. One visual observer saw a gradual event. Seven video observations of the companion ZC 2117 (5.3m) showed a gradual disappearance with typical durations of 0.02-0.04 s. One video observation indicated two steps 0.05 s apart. Two visual observers reported gradual events.
All other video and visual observations didn't reveal any indication for gradual or stepwise events.
ZC 2118 is a spectroscopic binary with 0.01" separation. According to the XZ80Q catalogue ZC 2117 also might be a close double star itself with components of equal brightness about 0.1" apart.

Residuals could be computed for a total of 80 timings. They were plotted against the Axis Angle. The visual inspection of the graphs shows that most observations seem to confirm each other, however seven observations resulted in very large residuals due to unaccounted errors.

Whereas the quality of the TIMINGS themselves seems to be good, the quality of the REPORTS is a catastrophe!

A considerable number of the reports were incomplete or wrong (false time scale, geodetic datum for station coordinates forgotten, personal equation for visual observations missed ...). Many report files contained format errors. Several observers didn't use the requested ILOC file format, but reported their results simply as prose text in their mails.

More than 60 such problem cases (67 % of 89 timings) were discovered and partly corrected by the author so that those observations could be processed. However, this caused many hours of additional unnecessary efforts to him!

Besides this, such incomplete and incorrect reports are a serious source of errors and reduce the value of the observations considerably.
Be aware that a good observation doesn't simply consist in deploying high tech video or GPS equipment, but also requires a considerable portion of astronomical know-how on the object or event that is observed.
Finally, please be conscientious in reporting your observations. Your report is your visiting card as an observer. A bad report leaves some doubt as to the reliability of the observations.■

Eric Limburg Receives Recognition

Henk Bril
President, Dutch Occultation Association

I am very pleased to announce that Eric Limburg, creator of LOW, Lunar Occultation Workbench, has received the 'van der Bilt'-prize.

The 'van der Bilt'-prize is a annual prize awarded by the KNVWS (Koninklijke Nederlandse Vereniging voor Weer- en Sterrenkunde) Royal Netherlands Association for Meteorology and Astronomy to an amateur astronomer who is member of the KNWS and whose work has proved to be of great value either for popularization of Astronomy or for scientific use. Although Eric graduated in Astronomy, he is not working as a professional astronomer, so he has to be considered as an amateur astronomer.

LOW has done both and it is a great honor for the Dutch Occultation Association (associated to the KNVWS) that Eric has received this important prize.

Other DOA members who have received the 'van der Bilt'-prize for Occultation related work are:

Arie Mak in 1950;

Johan C. van der Meulen in 1954 (deceased);

Berend J. Vastenholt in 1954 (deceased);

Dik Schmidt in 1978 (deceased);

Cor Booy in 1981;

Adri Gerritsen in 1994.

Our present secretary Harrie Rutten received the prize in 1989 for his work on telescope optics (most memorable: Telescope Optics – evaluation and design). ■

A Double, Simultaneous Grazing Occultation, Same Limb, Unrelated Stars

Hal Povenmire

Since grazing occultation observations are field work, strange things happen. In more than 400 successful grazes, this is one of the most unusual I have experienced.

On December 26, 2003, there was a favorable grazing occultation over Harleyville, SC The star was X30071, V magnitude 7.67, spectral class F6. This star is also known as SAO 164654 and HIP 107599. The Moon was 17% waxing and high in the sky with bright earthshine. Seeing and transparency were excellent. The star grazed 18.4° on the dark southern limb. The azimuth of the graze path was 49.5°. The telescope was a 13."1 Newtonian reflector at 150X. The optics were excellent and since the temperature was 35° F. and this occurred just after dusk, the mirror was just getting to temperature.

The set up position was just north of I-26 and all conditions were very favorable. At 23:18:34.8 U.T. the star snapped out as expected. All was normal until 23:19:41.0 when I realized that a faint star was blinking in and out rapidly nearer the cusp. I thought it must be an undiscovered companion of the primary star as it was very faint. Shortly, the blinking was over and the star could be followed. At 23:24:32 the faint star crossed the first illuminated peak. At 23:23:17.7 the primary star reappeared. This was a very confusing set of events, as the stars were too far separated to be related. Even with extremely favorable conditions, I had no hint that another star was near the graze star before the primary disappeared. The primary star crossed the terminator at 23:31:15.0 U.T.

My friend, Walt Robinson, has been the celestial detective to hunt down and solve occultation and graze mysteries for me in the past. I called him for help. He found the second star was GSC 6371.981 which is magnitude 9.9. This star is also known as X180646, CPD –20 8216, SD –20 6292, TYC2 6371-00981-1u, and 2UCAC 24251481. The two stars are unrelated and it was just a chance alignment that put them on similar predicted limit lines. The GSC star was 3.05 minutes of arc southwest of the primary at P.A. 240.5°. To my knowledge, this is the first time that two simultaneous grazing occultations have been observed and recorded. ■

Visit IOTA on the WWW at:
www.lunar-occultations.com/iota/iotandx.htm

and IOTA · ES at:
http://www.iota-es.de

Welcome IOTA/South West Asian Section

David Dunham, President, IOTA

Arvind Paranjpye, at the Inter-University Centre for Astronomy and Astrophysics in Pune, India, announces the formation of a new section of the International Occultation Timing Association, the South West Asian section, or IOTA/SWA. The officers of the main IOTA welcome this new section and will do what they can to encourage its growth. Arvind's message giving some details of the new section follows. This is fitting, because my own serious interest in astronomy began in southwest Asia, when I was 11 years old and my father was working on an aid project in Karachi, Pakistan. I taught myself the constellations there under the mostly clear, dark, desert skies (we lived at the edge of the city where there was little light pollution at the time).

From an email by Arvind Paranjpye:

This is an update on the SWAsian section of IOTA.
Col. J. E. S. Singh was in Pune and I had a long discussion with him. He has agreed to be Vice President, India, of the section. We may evolve the following strategy to launch the SWASection.

The founder member Office bearers

Arvind Paranjpye - President
Babak A. Tafreshi - VP Iran
Ali Matinfar - Treasurer Iran
- Editor, Iran (May I suggest mohaddesseh's name)
Col J E S Singh - VP India
Amruta Modani - Treasurer, India
Vinaya Kulkarni - Editor, India
In addition we need a publicity officer.
(We need similar posts for Pakistan and Bangladesh)

To begin with we propose to bring out ON (occultation newsletter) very similar to the main IOTA ON. Four issues of about 12 pages. The first issue will have an article by the President (we request you David) IOTA, Col Singh has agreed to contribute one, I am preparing predictions (bright stars and asteroid) for Iran and India using Occult 3.1 by D. Herald. We will put the newsletter on the web too.

We plan to post the first ON by mid September 04 and then the second one comes by mid December and so on. But hope to send the first draft to Iran by first week of September so that, if required some text can be translated.

The individual countries shall decide the membership fees.We in India plan to keep about Rs 150/- which is about $3.70 US per year. ■

Lunar Grazes By The Jovian System, December 7, 2004

Walter V. Morgan

Overview

In the early morning of December 7, 2004, Jupiter and its Galilean satellites will have very interesting lunar grazing occultations as viewed from southern Texas and southern Florida. Paul Maley and Richard Nugent described this briefly at the IOTA meeting in Apple Valley, CA. Later they solicited my assistance in describing the paths for these events because of the presentation I made at the Apple Valley meeting on mapping shadow paths.

Each of the components in the Jovian system has a very large angular diameter compared with a star, thus lunar occultations for them have slow transitions – and the transitions are even longer when the occultations occur near the lunar poles. Since the diameters for all of the Jovian objects are already accurately known, timing these transitions is generally considered to have little scientific value. However, they can be spectacular to observe, and good video recordings can make excellent teaching tools.

The Big Look

Figure 1 shows the path for the Jupiter graze as calculated using WinOccult Ver. 3.1.0. As with all lunar occultations, the action moves from west to east, beginning in this case with moonrise in Chihuahua, Mexico. Jupiter's elevation is about 10 degrees as the path reaches the Gulf coast, and 27 degrees for southern Florida. The sun will be well below the horizon.

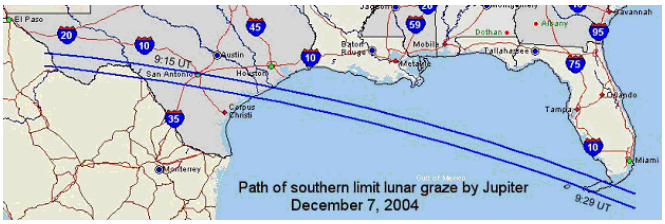

Figure 1. Path of the southern limit lunar graze by Jupiter, December 7, 2004, across southern U.S

Graze Paths

The path for Europa is near Jupiter's southern limit, and the paths for Ganymede and Callisto are somewhat north of Jupiter's northern limit. WinOccult also calculates a path for Io, but David Herald has pointed out that Io will be occulted by Jupiter throughout all of the grazes. WinOccult does not test for this special circumstance, so, even though it superficially looks like Io should be at the party, the party will actually proceed without it. The two limit lines for Jupiter are separated by about 60 km, the apparent diameter of Jupiter in the plane of the moon. (Jupiter's apparent diameter is obtained by taking the known diameter of Jupiter and reducing it by the ratio of the distances to the moon and Jupiter.) The apparent size changes slightly from Texas to Florida.

Interpretation of Graze Paths

The geometric interpretation for the two limit lines is given in Figure 2. Since the moon will be to the east during the December 7 graze, the perspective used in Figure 2 is looking east, with north to the left and south to the right. WinOccult automatically calculates "inner" and "outer" limit lines for Jupiter and its satellites, where "inner" means that the observer is closer to the center of the moon's shadow. Since this is a graze at the southern limit of the moon, "inner" can be interpreted as the northern limit of the Jupiter graze path, and "outer" can be interpreted as the southern limit of the Jupiter path.

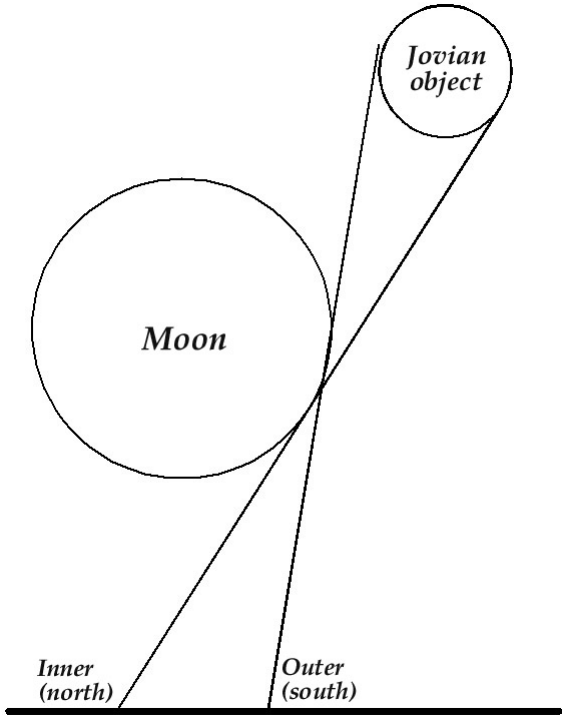

Figure 2. Relationships of Jovian objects, the moon, and observers during a graze.

Referring to Figure 2, note how the appearance of Jupiter at central graze will change as the observing position changes. An observer at the northern limit line will see all of Jupiter disappear during the graze, except that some small part may remain visible, depending on the exact terrain of the moon. For an observer at the southern limit line Jupiter will not be occulted at all, except that a very small part at the northern edge of Jupiter may disappear behind some lunar peaks. At intermediate positions, different fractions of Jupiter will be occulted.

Path Positions Relative to the Lunar Profile

The apparent sizes of the satellites, and the separations of their limit lines, are: Europa 1.3 km; Callisto 2.1 km; Ganymede 2.3 km. Since these dimensions are similar to the heights of the lunar features, the appearance of any of the satellites will be very dependent on observer location. This is illustrated in Figure 3, the predicted lunar profile for southern Texas. Europa has been drawn on the profile using the correct height scale. Since the profile has a vertical exaggeration of about 20:1, Europa should be shown as an ellipse with 20:1 aspect ratio, but that would just look like a fat vertical line. Using an over-wide ellipse instead is hopefully more descriptive – if less accurate.

Referring again to Figure 2, an observer at the northern limit of the graze path for any of the satellites will see the southern edge of that satellite appear to move along the profile's limit line (on Figure 3). For Europa this will result in a total occultation of about 2.5 minutes, in addition to transitions of the order of 20 seconds at beginning and end. For an observer at the southern limit of the graze path of one of the satellites, the northern edge of that satellite will appear to move along the profile's limit line, and the resulting observation will be only a few seconds less than for the observer at the northern limit. In Figure 3 Europa has been placed with its northern edge about 2 km south of the profile limit line, the position that applies to an observer 2 km south of the southern limit of the graze path. From that position, as Europa appears to move parallel to the profile's limit it will fade out, and back, in relation to how much of its disk is occulted by the detailed structure of the moon. Video-recording this with a fixed gain system will obtain a signal that is directly related to the lunar structure. Second and third observers placed a short distance north or south will obtain similar signals, with somewhat different baselines and dynamic ranges, and it should be possible to combine all of these signals in a post-event data processing procedure to obtain a high-quality record of the lunar profile in the form of a signal amplitude versus time. The record from any one well-placed observer, however, will be comparable to what might be obtained by a dozen or so optimally-placed observers recording a stellar occultation.

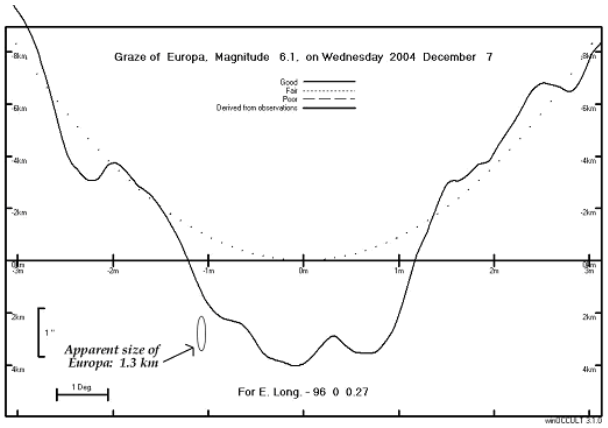

Figure 3. Lunar profile for southern Texas, December 7, 2004.

Callisto and Ganymede are significantly larger than Europa, and larger than the features in the lunar profile, so similar recordings will show less variation in signal amplitude. Again, displacing two or more observers slightly should make it possible, through post-processing, to obtain a combined signal that has better dynamic range than any one signal by itself.

Figure 4 is the predicted lunar profile for Florida observers. As before, observers at the northern and southern graze limit lines of a particular satellite will expect to see the southern or northern edge of the satellite, respectively, move along the profile limit line. In Figure 4, Ganymede has been drawn to the correct vertical scale, and positioned for an observer approximately 1 km north of the southern graze limit line. From that location, and from locations slightly to the north and south of that, Ganymede will appear to fade and brighten in response to the presence of lunar peaks. An observer about 2 km further south (1 km south of the southern graze limit line) will expect to see only part of the satellite pass behind one lunar peak, and an observer another kilometre or so south should expect to observe minimal fading of the satellite, or even a miss. The same expectations will hold for Callisto, relative to its graze path.

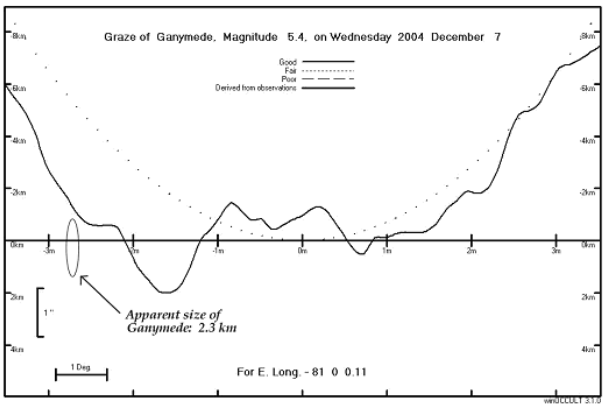

Figure 4. Lunar profile for southern Florida, December 7, 2004.

Detailed Paths

Figure 5 shows the more detailed graze path locations for southern Texas. The time between events is only a few minutes, so it will not be possible for one observer to take in more than one graze. There is, however, a bonus waiting for well-placed observers of the Ganymede or Callisto events: the path of a rather good lunar graze by a magnitude 7.2 star crosses the Ganymede and Callisto paths about 1-1/2 hours after the Jovian events.

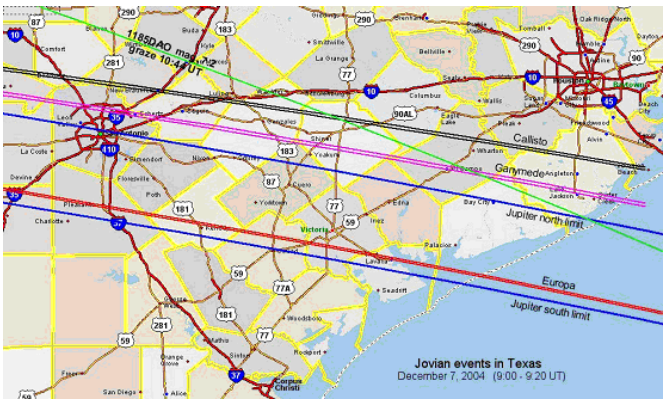

Figure 5. Graze paths for southern Texas, December 7, 2004. The green line is the graze path for a 7.2 magnitude star about 1-1/2 hours after the Jovian events.

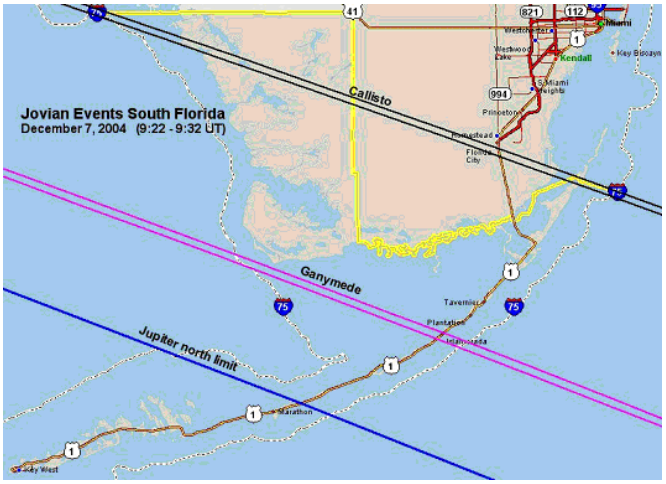

Figure 6. Graze paths for southern Florida, December 7, 2004. The path for Europa is about 10 km southwest of Key West.

Figure 6 shows the graze paths for Ganymede and Callisto in southern Florida. The Europa path is not shown because it is about 10 km southwest of Key West. Similarly, the southern edge of the Jupiter graze path is not shown because it is about 15 km southwest of Key West.■

The Discovery and Confirmation of the Duplicity of ZC 3340

Hal Povenmire

On Saturday evening, November 22, 1974 a favorable lunar grazing occultation was predicted to go just south of Rockledge, Florida. A number of amateur astronomers from Jacksonville, Florida joined the Brevard Astronomical Society along the famous U.S. Route One.

The graze conditions were favorable. The Moon was waxing and 60% sunlit. The star grazed 15° on the dark southern limb. The Moon's altitude was 59°. The transparency and seeing were good. The time of central graze was 0:21 Universal Time (UT).

The star, Zodiacal Catalog 3340, has a measured V magnitude of 7.70 and is spectral class F5 on the Henry Draper system. It has no two-dimensional MK spectral type thus far. This star is also known as SAO 146307, SD -03 5505, GSC 5813.25, PPM 206764, HD 215708, HIP 112494, and Tycho 5237-70-1.

After the first Disappearance, most of the observers noted that many of the Disappearances and Reappearances were fading events. This is usually a strong indication that the star is a previously undiscovered double. Since many of the fading events showed a pattern, it was suspected that this star was multiple. A total of approximately 37 events was recorded.

During this period of time there was an active program to record lunar occultations photoelectrically at the University of Texas at Austin. On December 10, 1975 this star was recorded and confirmed to be double. The data were published in the University of Texas series of papers reporting photoelectric observations of lunar occultations (Evans and Edwards 1981).

References:

1) Povenmire, H. (1996) New Binary Stars Discovered During Lunar Grazing Occultations IAPPP Com. No. 65, 24.

2) Povenmire, H. (1999) Newly Confirmed Binary Stars Discovered By Lunar Grazing Occultations, IAPPP Com. No. 74, 33.

3) Povenmire, H. (2000) The Newly Discovered Binary Star 44 η Librae and Other Binary Stars Discovered By Lunar Occultations, IAPPP Com. No. 81, 10.

4) Evans, David S. and Edwards, David A. (1981) Photoelectric Observations of Lunar Occultations XII, AJ, 86, 1277.

Hal Povenmire
Florida Institute of Technology
215 Osage Drive
Indian Harbour Beach FL 32937

IOTA's Mission

The International Occultation Timing Association, Inc. was established to encourage and facilitate the observation of occultations and eclipses. It provides predictions for grazing occultations of stars by the Moon and predictions for occultations of stars by asteroids and planets, information on observing equipment and techniques, and reports to the members of observations made.

The Offices and Officers of IOTA

President	David Dunham, Dunham@erols.com
Executive Vice-President	Paul Maley , pdmaley@yahoo.com
Executive Secretary	Richard Nugent, RNugent@wt.net
Secretary & Treasurer	Art Lucas, ALucas0217@aol.com
Vice President for Grazing Occultation Services	Dr. Mitsuru Soma, SomaMT@cc.nao.ac.jp
Vice President for Planetary Occultation Services	Jan Manek, Jmanek@mbox.vol.cz
Vice President for Lunar Occultation Services	Walt Robinson, robinson@lunar-occultations.com
Editor for *Occultation Newsletter*	John A Graves, editor@occultations.org
IOTA/ES President	Hans-Joachim Bode, president@IOTA-ES.de
IOTA/ES Secretary	Eberhard H.R. Bredner, secretary@IOTA-ES.de
IOTA/ES Treasurer	Brigitte Thome, treasurer@IOTA-ES.de
IOTA/ES Research & Development	Wolfgang Beisker, Beisker@gsf.de
IOTA/ES Public Relations	Eberheard Riedel, E_Riedel@msn.com

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Observers from Europe and the British Isles should join IOTA/ES, sending a Eurocheck for EURO 20,00 to the account IOTA/ES; Bartoldknaust Strasse 8; D-30459 Hannover, Germany; Postgiro Hannover 555 829-303; bank code number (Bankleitzahl) 250 100 30. German members should give IOTA/ES an "authorization for collection" or "Einzugs-Ermaechtigung" to their bank account. Please contact the Secretary for a blank form. Full membership in IOTA/ES includes one supplement for European observers (total and grazing occultations) and minor planet occultation data, including last-minute predictions; when available. The addresses for IOTA/ES are:

Eberhard H. R. Bredner
IOTA/ES Secretary
Ginsterweg 14
D-59229 Ahlen 4 (Dolberg)
Germany
Phone: 49-2388-3658 (in Germany 0-2388-3658)

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

IOTA on the World Wide Web

(IOTA maintains the following web sites for your information and rapid notification of events.)

IOTA Member Site
http://www.occultations.org

This site contains information about the organization known as IOTA and provides information about joining IOTA and IOTA/ES, topics related to the *Occultation Newsletter*, and information about the membership--including the membership directory.

IOTA Lunar Occultations, Eclipses, and Asteroidal and Planetary Occultations Site
http://www.lunar-occultations.com

This site contains information on lunar occultations, eclipses, and asteroidal and planetary occultations and the latest information on upcoming events. It also includes information explaining what occultations are and how to report them.

IOTA's Telephone Network

The Occultation Information Line at 301-474-4945 is maintained by David and Joan Dunham. Messages may also be left at that number. When updates become available for asteroidal occultations in the central USA, the information can also be obtained from 708-259-2376 (Chicago, IL).