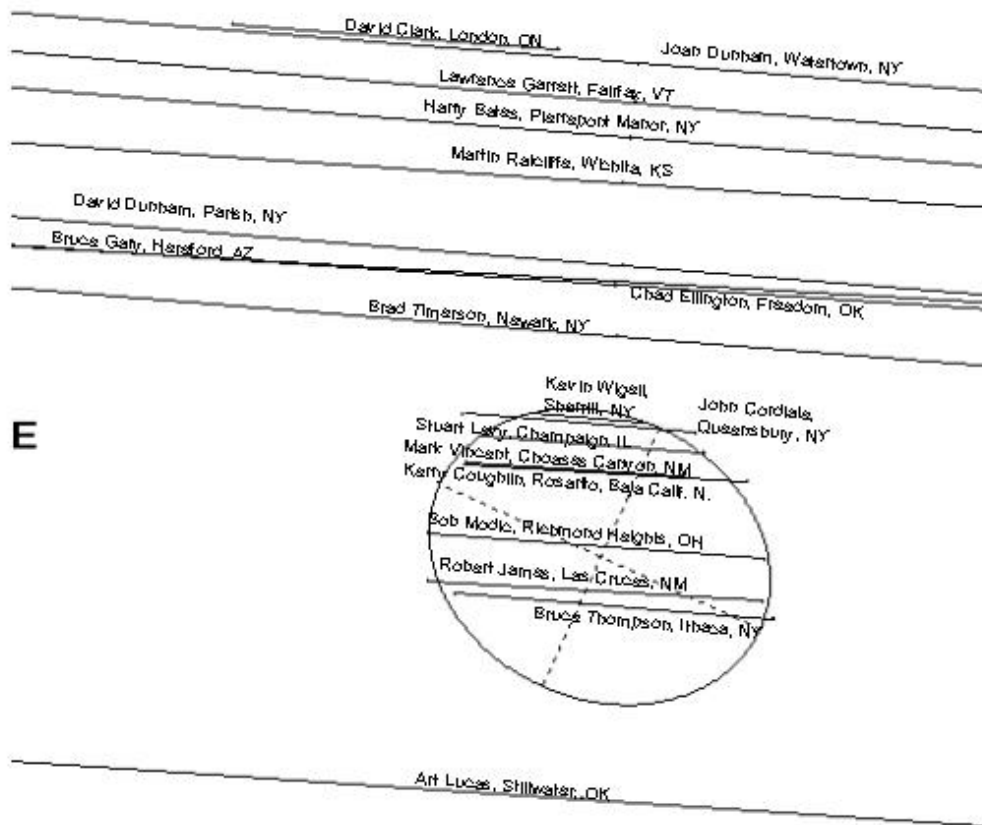




(914) Palisana 2004 Sep 12 102.2 ±1.2 x 82.5 ±2.9 km PA 65.7 ±5.4  
Geocentric X -3819.7 ±0.4 Y -530.4 ±1.5 km



**A Preliminary Analysis of the Occultation Of 7.0-Magnitude Sao 36280 = Hip 1642A by (914) Palisana on 2004 September 12**

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**In this Issue**

Articles

	<u>Page</u>
Minutes of the 22st IOTA Annual Meeting, 2004 . . . . .	4
In Memoriam - Prof. Dr. Hans Ehrenberg . . . . .	11
The February 10, 1977 Near Lunar Grazing Occultation Of Uranus . . . . .	11

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Resources

	<u>Page</u>
What to Send to Whom . . . . .	3
Membership and Subscription Information . . . . .	3
IOTA Publications . . . . .	3
The Offices and Officers of IOTA . . . . .	9
IOTA European Section (IOTA/ES) . . . . .	9
IOTA on the World Wide Web . . . . .	Back Cover

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**ON THE COVER:**

The cover shows a preliminary analysis of the occultation of 7.0-mag. SAO 36280 = HIP 1642A by (914) Palisana on 2004 Sept. 12, the best-observed asteroidal occultation of 2004 in North America. Eight observers from New York to Baja California timed the occultation. The parameters of the ellipse fitted to these observations are given at the top of the figure. For making this fit, with rms of fit  $0.0 \pm 2.1$  km, I gave 0 weight to Mark Vincent's observation since he had multiple equipment failures and made only a very approximate eye-and-ear timing of the event; Kerry Coughlin's timings at essentially the same chord are certainly better. There is a puzzling discrepancy between Kevin Wigell and John Cordiale at the north end of the asteroid, even though both chords seem to be well-timed (Wigell with a PC164C video camera and WWV recorded to a PC, and Cordiale with a photoelectric recording, both with large telescopes that recorded the star well). They have been asked to double-check their coordinates and timings; the location reported by Cordiale is in Queensbury, according to my checking it with [www.topozone.com](http://www.topozone.com) (to obtain his height above sea level). For this plot, I have given Cordiale's observation 0 weight since Wigell's duration seems to be more consistent with the decreasing trend of the durations from Coughlin's to Stuart's. If Cordiale's observation is given full weight, the solution errors all increase, with major axis  $104.6 \pm 1.5$  km, minor axis  $81.5 \pm 3.5$  km, PA  $64.9^\circ \pm 6.3^\circ$ , geocentric X  $-3819.1 \pm 0.6$  km, geocentric Y  $-528.0 \pm 1.8$  km, and rms of fit  $-0.4 \pm 3.1$  km. Only a few of dozens of miss observations, nearly all on the north side of the asteroid since that's where the updated path was expected, are plotted in this preliminary view; we'll include all known observations in a more comprehensive plot in a future ON. David Clark thought he had an occultation at about the right time at his location near London, ON, with that chord shown at the top of the plot, but it must have been due to a cloud since Joan Dunham's video recording was very close to his chord and there is no variation in the star's light for a minute around the time of closest approach under good conditions at Watertown, NY. Phil McCausland observed from the north side of London, less than 4¢ north and 5¢ east of Clark's location, and had no occultation (McCausland's path not plotted here; will be next time).

*This plot courtesy of David Dunham and Jessica Yuan.*

**Publication Date for this issue: January 2005**

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

**The next issue, Volume 11, Number 4 will be published in mid March. Please send submissions for that issue to [editor@occultations.org](mailto:editor@occultations.org) no later than 12 March 2005. We do not currently have a large backlog of material, so please submit your articles for publication at your earliest convenience. Material submitted now will be published in only six weeks.**

## What to Send to Whom

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

Art Lucas  
Secretary & Treasurer  
5403 Bluebird Trail  
Stillwater, OK 74074 USA  
Email: [business@occultations.org](mailto: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](mailto: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](mailto:SomaMT@cc.nao.ac.jp)

Send interesting stories of lunar grazing occultations to:

Richard P. Wilds  
2541 SW Beverly Court  
Topeka, Kansas 66611-1114 USA  
Email: [astromaster@cox.net](mailto: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](mailto: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](mailto: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.bulder@freeler.nl](mailto:h.j.bulder@freeler.nl)

## Membership and Subscription Information

All payments made to IOTA must be in United States funds and drawn on a US bank, or by credit card charge to VISA or MasterCard. If you use VISA or MasterCard, include your account number, expiration date, and signature. (Do not send credit card information through e-mail. It is neither secure nor safe to do so.) Make all payments to **IOTA** and send them to the Secretary & Treasurer at the address on the left. Memberships and subscriptions may be made for one or two years, only.

*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.

Memberships include the *Occultation Newsletter* and annual predictions and supplements. Memberships are US\$30.00 per year for USA, Canada, and Mexico; and US\$35.00 per year for all others. Observers from Europe and the British Isles should join the European Service (IOTA/ES). See the inside back cover for more information.

## 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](mailto:fraserb@intekom.co.za)  
**Australia and New Zealand**--Graham Blow; P.O. Box 2241; Wellington, New Zealand

**Japan**--Toshiro Hirose; 1-13 Shimomaruko 1-chome; Ota-ku, Tokyo 146, Japan

**All other areas**--Jan Manek; (see address at left)

## ON Publication Information

*Occultation Newsletter* (ISSN 0737-6766) is published quarterly by the International Occultation Timing Association, Inc. (IOTA), 5403 Bluebird Trail, Stillwater, OK 74074, USA. IOTA is a tax-exempt organization under sections 501(c)(3) and 509(a)(2) of the Internal Revenue Code USA, and is incorporated in the state of Texas. First class postage paid at Stillwater, OK, USA. Printing by Tony Murray of Georgetown, GA, USA. Circulation: 400

## Minutes of the 22st IOTA

### Annual Meeting, 2004

Richard Nugent, Executive Secretary

RNugent@wt.net

The 22nd annual meeting of the International Occultation Timing Association was held Friday and Saturday July 2-3, 2004 at the Luz Observatory building at the Lewis Center for Educational Research in Apple Valley, California. This location was chosen to coincide with 5 asteroid occultations occurring over California during the week surrounding the meeting. The asteroids were 522 Helga, 559 Nanon, 64 Angelina, 524 Fidelio, and 491 Carina. The meeting location was arranged and hosted by Dave Meyer of the Lewis Center and High Desert Astronomical Society.

Twenty Seven members and attendees were present at the meeting:

President David Dunham from Maryland,  
Vice President Paul Maley from Texas  
Executive Secretary Richard Nugent from Texas,  
Secretary Treasurer Art Lucas from Oklahoma,  
Wayne Warren, Jr. from Maryland  
Derald Nye, Gene Lucas and Randy Peterson from Arizona,  
Steve Preston from Washington,  
Hal Povenmire from Florida  
Don Stockbauer from Texas  
Greg Lyzenga, Derek C. Breit, Frank Anet, Daniel Falla,  
Sandy Bumgarner, Jim Stoffaire, Walt Morgan, Lampert  
Levy, Richard Nolthenius, Gary Witt, Dave Meyer, Hank  
Sielski, Norm Sperling, Bob Jones, Bill Walsh, and Ralph  
Megna from California.

At 10:10 AM, President David Dunham opened the meeting and asked the attendees to introduce themselves. Following the introductions, Dave Meyer briefly described the Lewis Center for Educational Research and how it came to be. The Lewis Center was funded from donations from local power companies, corporations and NASA funding. The Luz Observatory has a fully equipped 15-inch Cassegrain telescope on the roof with a motorized dome. This telescope was also used for the 64 Angelina occultation early Saturday morning July 3, 2004. A smaller-than-expected asteroid size resulted in a miss for the observatory; however, this was the first asteroid occultation attempt at the Lewis Center, and thus a new field has opened up for future asteroid and other occultation events there.

#### Business Meeting, Friday, July 2

President David Dunham motioned the floor to open the business meeting and was seconded by Art Lucas. Secretary/Treasurer Art Lucas gave a report of IOTA's financial status. Summary of balances are:

Starting Balance: June 18, 2003	\$6,274.88
Ending Balance: June 28, 2004	6,302.56
Net Increase in Bank Balance:	\$ 27.68

Total Income	\$2,960.00
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#### Expenses

Printing Costs	\$1,245.63
Web Service	\$ 394.60
Mailing costs	\$1,286.10
Fees and interest	\$ 5.99

Total Costs	\$2,932.32
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The net balance was reduced over the previous 12 months due to the increased printing schedule of Occultation Newsletter (ON). ON has been back printing again, hence the reason for the net reduction in the bank balance compared to the previous year.

Lucas reminded everyone to check their mailing labels for their own dues expiration date. Lucas explains this in the page that he encloses with each ON, but many don't read it far enough and just assume that they need to renew when they see the "renewal" page. Some members are way ahead on their dues, and the credits will not be refunded. Lucas remarked that every mailing of ON results in a flurry of membership dues payments.

Lucas also mentioned that Occultation Newsletter (ON) editor John Graves has a lack of material for publishing and encouraged IOTA members to submit their articles and observations, since this is the medium where IOTA maintains a permanent record of its continuing activities. Overall, IOTA seems to be in good financial shape.

Following the financial report, Dunham motioned that the financial report be accepted, and the motion was seconded. An original copy of the Annual Financial Statement is on file with the Executive Secretary.

Executive Secretary Richard Nugent presented the status of the new IOTA Observer's Manual. This project was approved at the 2003 Annual Meeting. Advances in equipment and techniques have resulted in a flurry of observations not possible 10 years ago and with so much scattered information about occultations in books, magazine articles, the Internet and miscellaneous sources, a comprehensive treatise on occultation and IOTA activities is needed. With Nugent as the Editor in Chief of the project, in July – September 2003, Nugent and Vice President Paul Maley wrote the chapter headings and subsections. Nugent then solicited the IOTA membership to write individual chapters and sections. The initial response was good and chapters and contributions were made by Paul Maley, Walt Robinson, David Dunham, Arvind Paranjpye, Mitsuru Sôma, Roger Venable, Guy Nason, Jim Young and Richard Nugent.

*Occultation Newsletter*, Volume 11, Number 3, July 2004

At the meeting, Hal Povenmire handed Nugent one of the remaining chapters on grazing occultations. Povenmire is well suited for this chapter - he has led over 400 graze expeditions and has written 2 books on grazes.

Still needed to complete the text portion of the Manual are chapters on Solar and Lunar Eclipses, (limited to IOTA solar radius research and lunar polar diameter measurements), IOTA history, plus some miscellaneous Appendices, and an index. Nugent suggested the inclusion of a CD-ROM that would include videos of total, grazing and asteroid occultations, plus occultation animations and photos, etc. An included CD would show the reader what the occultation observer really does and what the observations really look like.

Following the completion of the text portion of the manual will be chapter assignments for editing. Nugent remarked that the manual will be written to introduce occultations to the reader at an elementary level and expand to more advanced levels. The manual will also contain sections useful for the more experienced observer. It will also include many of the concepts and ideas involving advanced GPS measurements and the causes of their errors, unattended video stations, how to use the latest versions of the OCCULT and LOW programs (just a summary, since the detailed documentation and help files with those programs is quite comprehensive), a glossary of IOTA terms, graze profiles, asteroid profiles, how to deal with law enforcement, time signal frequencies around the world and much more. One of the problems with different authors writing different chapters and sections is the varied writing styles. One of the more important jobs is that the Editor in Chief will have to edit and amend the chapters to have them flow as if written in a single easy to understand style.

Following the editing phase, will be work on figures, tables, diagrams and photos to be included. Astronomy is a 3-dimensional science and many such diagrams will be used to assist the reader in learning the important geometry of occultations.

Nugent has also been in contact with Willmann-Bell, Inc. a well-known astronomy publisher, and they gave a positive indication of interest in publishing such a book. Other publishers are also being contacted. Nugent estimated the manual will be ready to go to a publisher in the next 6-9 months, but this again is an estimate only. The creation of such a comprehensive manual is a very huge task (much larger than Nugent originally estimated), however the task is made much easier by the same concept that occultation observers have been using for many decades – teamwork and cooperation. Without this devoted teamwork, this project would be many years in the making. The latest version of the IOTA Manual is available on line at:

<http://web.wt.net/~RNugent/IOTAManual.htm>.

Dunham then remarked about the tax-deductibility of expenses related to the Venus transit on June 8, 2004. In order to qualify for a tax deduction you should have at the very least a recording of the transit. One of IOTA's goals is the measurement of the Solar radius variations over time. Data has been acquired for this experiment during solar eclipses, but in 1882, astronomers used the Venus transit to determine the Solar radius and astronomical unit. Data gathered by observers should be individually archived and should be reported to John Graves, ON Editor for publication. Sky and Telescope magazine is also archiving Venus transit reports.

Dunham mentioned that with the recent huge increase in asteroid occultation activity in the past 4-5 years, he suggested that IOTA may need an additional position to be known as Vice-President for Asteroid Occultation Predictions. The creation of such a new IOTA position would probably not affect the current asteroid occultation activities – predictions, observations and data reductions. Dunham considered this idea before this year's elections, but decided to wait. This idea will be considered for IOTA's future, possibly as a recommended change to the bylaws at next year's meeting.

The annual IOTA meetings are currently summarized by the Executive Secretary and published in ON. Dunham suggested that rather than have meeting minutes, the same task could be accomplished by publishing "Proceedings of the IOTA Meetings". In this scenario, ON could publish abstracts of the talks made at the meetings. Proceedings would include publishing of the full paper of a presentation followed by a brief discussion following the paper. Such proceedings could be published by the Astronomical Society of the Pacific or similar organization. This could result getting the word out to a much larger audience about IOTA activities and research.

Gene Lucas asked if IOTA members could opt-out of the Goffin asteroid charts (North American Supplement) that are currently mailed out once or twice per year. This topic has been talked about before in 1998 when IOTA's dues structure was modified for "paper subscriptions" at a higher annual rate compared to non-paper subscriptions at a reduced rate, since much of IOTA's mail outs were already online. Vice President for Lunar Occultation Services and webmaster Rob Robinson suggested (through Dunham) that next year IOTA discontinue putting on-line the annotated asteroid charts. Art Lucas is currently working on getting a single website to post the asteroid supplement to continue its online availability. This could save hundreds of dollars in printing and mailing costs per year, but several members like the supplement as a long-range planning tool. Lucas will modify the treasurer software to accept opt-outs. Dunham Motioned the floor we have an opt-out provision and reduce the IOTA dues by \$5. The Motion was seconded. Lucas also Motioned that we increase the Library subscription rate of ON by \$5/year which still makes it a substantially lower

price than the typical library journal. The Motion was approved.

Richard Nugent presented the results of the 2004 IOTA election of Officers. As of the meeting, 49 email votes were received. A call for votes was made of the attendees and 12 more votes were counted, all in favor of the straight slate of Officers and Director positions, making the total 62 votes. (This compared to 96 votes from 2001). The elected positions are for a 3-year term and they are:

President	David Dunham
Vice President	Paul Maley
Executive Secretary	Richard Nugent
Secretary/Treasurer	Art Lucas
V.P. Grazing Occultation Services	Mitsuru Soma
V.P. Planetary Occultation Services	Jan Manek
V.P. Lunar Occultation Services	Walt "Rob" Robinson
Editor Occultation Newsletter	John Graves

With no further business, at 11:18 AM, Dunham motioned that the business part of the meeting be closed, and Art Lucas made a 2nd on this motion. A short 20 minute break was taken.

#### Technical Sessions

Note: As per a new format, starting this year Meeting Minutes will only briefly cover the Technical Sessions. Abstracts of presentations by speakers will appear in a later issue of ON. A full write up of presentations by speakers will be in the form of technical papers to be published as "Proceedings of the 22nd Annual Meeting of IOTA" in a separate publication. But exactly what we will do is not yet determined; it will be based on what the authors actually provide.

President David Dunham began the technical sessions with a report of the expedition he led to observe the transit of Venus in Springs, Pennsylvania on June 8, 2004. With him was Becky Sydney from Maui and her friend Alicia from New Jersey, plus Sandy Bumgarner and Danny Falla from California. There they met Jared Zitwer. During the transit, a photo was taken of a horse and buggy passing right by their site off the road! This might have been the scene back in 1882 during the last Venus transit. Another image showed a 17-year cicada crawling near the monitor that showed the transit in progress. Overall it was a successful expedition of this rare transit considering there was some routine last minute maneuvering to reach clear skies.

Continuing with the transit of Venus of June 8, Paul Maley led an 11-person expedition to the island of Mauritius in the Indian Ocean east of Madagascar. Maley reported that some 15,000 persons gathered at Belmont, the 1874 site of the expedition funded by Lord Lindsay (Earl of Crawford) and led by Sir David Gill. The great-great grandson of Lord Lindsay (Alex Lindsay) was in attendance, himself an amateur astronomer and film maker whose most recent accolades includes a production on the recovery of the Titanic. The site had been accidentally found by the administrator of Belmont, Roland Rambert, some years earlier when he noticed columns sticking up from the soil. Work since that time has enabled the government to establish the site as a historic monument.

At 2nd contact, Maley was anxiously searching for Venus to possibly see the "blackdrop" effect reported by several 1882 transit teams. No such effect was visible, but Paul did see a faint ring around Venus before 2nd contact. Neither was the blackdrop effect seen at 3rd contact. Dunham mentioned that the optics of instruments used in the 1882 transit were not of the higher quality that they are today and this might have been the reason for no blackdrop effect sightings in 2004. Maley was privileged to be invited to meet with the Prime Minister of Mauritius, a time honored tradition which was accorded British expeditions in 1874 who observed the transit at that time. NASA-JSC Houston prepared a special plaque containing a Mauritius flag flown in space and also a print of the best Space Shuttle photo of the island. He presented it to the Prime Minister on behalf of the 'people of Mauritius' to commemorate the JSC Astronomical Society expedition of 2004 for the historic Venus transit. Maley buried a time capsule at the 1874 site to commemorate the 2004 expedition by the NASA JSC Astronomical Society group.

In addition to this momentous trip, Maley also arranged to have a roadside Historic Marker placed in San Antonio on December 6, 2004 to commemorate the 1882 Venus transit Expedition by the United States Naval Observatory. To achieve this Maley researched the history of the expedition led by Asaph Hall and in May, achieved permission by the commanding officer of Fort Sam Houston (the site of the USNO team) to have the U.S. Army fund the marker. A ceremony is planned 122 years to the day following the 1882 Transit. Coincidentally, the morning after the dedication, the Moon will graze Jupiter and its Galilean moons in a path that passes over San Antonio, Texas.

President David Dunham received the prestigious AAS Dirk Brouwer Award in February 2004, in Hawaii for his lifelong contributions to the field of spaceflight mechanics and astrodynamics. In receiving the award he presented a talk "Exploring the Cosmos by Trying Something Different"; this talk was also presented at the Applied Physics Laboratory (APL) where Dunham works. In this talk, Dunham talked about his early history of occultations, plus his time at Yale University as Brouwer's student in the 1960's. Dunham's 1971 Ph.D thesis was on "Motions of the Satellites of

Uranus". Dunham also talked about many of his orbital trajectory calculations for spacecraft over the years, including the ISEE-3 mission to the Earth's Libration points, Clementine's Moon mapping mission and the NEAR Shoemaker mission to the asteroid 433 Eros, including the spectacular first ever asteroid landing on Eros in February 2001.

The Dirk Brouwer Award's first recipient was in 1972. Some other recipients of the Dirk Brouwer award known by Dunham were John Breakwell (1973), Paul Herget (1980), Victor Szebehely (1981), Guisepe Columbo (1983), and Robert Farquhar (1984).

Richard Nugent announced that Hal Povenmire was recently honored by having an asteroid named after him. 15146 HalPov was discovered by Brian Skiff on March 11, 2000 and named after Povenmire for his lifelong contributions in the field of tektites. Povenmire has written numerous articles on his own original tektite research and published two books on tektites, in addition to hunting down numerous tektite specimens. This is the second asteroid named after Hal Povenmire; 12753 Povenmire honors Hal and his wife Katie for their lifelong contributions to planetary astronomy.

-----LUNCH BREAK-----

Steve Preston presented how he computes asteroid occultation predictions and makes them available on his website. Preston begins with Edwin Goffin's worldwide predictions that include asteroids usually larger than 40km and uses stars from the Tycho-2, TAC, FK6 and some stars from the Hipparcos catalogs. The magnitude limit used is generally +12.

Additional specialized searches for asteroid occultations are done by Scott Donnell and Derek Breit (10km and up searches worldwide) with a 3-month window and post the predictions two months in advance.

In Japan, Takashi Setoguchi searches for asteroids 15km and up and computes his own orbits. He has a one-month search window and posts his results one month in advance of the event. His predictions are for Japan only.

Dennis Denissenko searches for interesting events several months in advance in Russia and other parts of the world. Denissenko searches for events involving stars down to magnitude 13 using the Tycho-2 and UCAC2 catalogs, and also has posted on his Web site preliminary predictions for bright events (stars 6th mag. and brighter) for the next several years.

Preston updates the initial Goffin predictions as follows: He uses Minor Planet Center (MPC) astrometry after 1900, FASTT data (usually 7-10 days before the event) and other high-accuracy astrometry. He computes the orbit with OrbFit software (freeware from <http://newton.dm.unipi.it/orbfit/>). Next Preston obtains the star position from the best sources *Occultation Newsletter*, Volume 11, Number 3, July 2004

available, usually the UCAC2, sometimes the Hipparcos catalog. Preston takes the updated orbit and uses David Herald's WinOccult for the path predictions. Individual maps are computed and lat/long path info including the lat/long of the path uncertainty. With this information, the event and path summary data is uploaded to Preston's web page, <http://www.asteroidoccultation.com> along with star charts via Guide. In general occultation updates are posted one month prior to the event, and subsequent updates are posted about 1 week prior to the event.

Preston is currently working on making the prediction process more automated. Maps based on a "click" interface are being looked into so that an observer can click on a map of say the USA and out will come all of the events that are at or near that location. More automation = more productivity = easy access to events.

Steve Preston's outstanding work on asteroid occultation predictions for IOTA was held in the highest regard by the attendees.

David Dunham presented a paper "A Study of the Accuracy of Asteroidal Occultation Predictions" co-authored and assisted by Rohith Adavikolanu a local high school student in Greenbelt, Maryland.

The goal of this investigation was to see if there were any trends or patterns in the observed vs. calculated (O-C) in time (seconds) and path (km, cross track) that could be used to improve the asteroid occultation prediction process. Twenty-three events were chosen that occurred in 2002/2003 that had 4 or more observed chords. Microsoft Excel plots were shown of various parameters including the predicted 1-sigma values vs. Minor Planet #, Star magnitude, difference in days ahead of latest predictions, angular asteroid diameter, RA and Dec. The mean Dtime/sigma time for the 23 events studied was 0.0577 and the Dpath/sigma path was 0.1027. For the various star catalogs used for predicted events the Hipparcos catalog gave the lowest means and the Tycho-2 catalog had the highest means. The original theory that trends exist in these quantities gave a null result in this study. This result may be biased since a small sample was used for the study. Dunham and Adavikolanu's conclusion was that although no trends exist in the data set used, the predictions by the USNO and Steve Preston's site are the best we could hope for at the current time.

Walt Morgan showed how he currently maps shadow paths for asteroid occultations and other occultation events. Morgan, like many occultation observers, used the cumbersome USGS TOPO 7.5-minute quadrangle maps for drawing occultation paths. Now available are the GAZETTER books available for all 50 states have a scale averaging 1 inch = 6.3 miles and usually cover the entire state (except for California which has a north and southern edition) and cost about \$20-\$25. These again are paper maps upon which graze lines can be drawn for expedition purposes.

In order to automate the process, Morgan is now using the current software standard Precision Mapping Streets available for about \$50. He uses a shadow program written by Geoff Hitchcock (Kiwi Geoff) and WinOccult 3.0 by David Herald. Using WinOccult, Morgan creates a directory of latitude/longitude coordinates that is input into the Shadow program. The shadow program for an asteroid occultation prediction gives 5 sets of lines – 2 shadow limits, 2 error limits and the center line. The program allows the user to input the line width in pixels, line color and line style: dash, dot, dot-dash, etc.

Frank Anet demonstrated how he takes analog video and converts it to digital (mini DV) format using a Firewire into his Macintosh computer. This technique has wide application for the analysis of occultation videos. By creating a window around the target star, Frank can mathematically sum the brightness values of the pixels containing the star as compared to the background. The program he uses can detect very slight variations in brightness surrounding an occultation event, including diffraction effects, and is thus very useful for the detection of close double stars. Analysis shows that diffraction effects can last several video frames for bright stars and as little as one frame for faint stars.

Gene Lucas presented a talk he has previously given to astronomy enthusiasts on “Modern Asteroid Occultation Observing Methods.” Starting with IOTA’s main web page and discussion group, Lucas described many of IOTA’s activities including the Occultation Newsletter (ON) available to its subscribers plus Edwin Goffin’s North American Supplement on asteroid occultation predictions. The traditional professional fixed site observatory is usually not suited for occultation work due to the location sensitivity of occultations thus the need for portable systems. Lucas showed the different types of portable equipment used to chase these events. Typically an asteroid occultation observer will use:

1. 4 to 10 inch telescope
2. Short Wave radio or GPS time signal unit
3. Video camera and VCR or camcorder
4. All equipment battery operated for portability

Lucas showed photos of several of David Dunham’s setups along with those of Alin Tolea, Art Lucas and Richard Nugent.

Lucas also showed several asteroid profiles including the record event of May 29, 1983 occultation of 1 Vulpeculae by 2 Pallas, and the sky plane plot of the occultation by 9 Metis on September 7, 2001. This occultation was published in Sky and Telescope for March 2002 and was the first to have a remote unattended video station.

A long discussion followed concerning the state of the art of time insertion methods onto the videos. Currently there are 2 methods to time insert UT into the videos

1) The Manly time inserter built by Peter Manly which is triggered by the top of the minute tones from WWV,

2) Devices that use the GPS 1 pulse per second (1pps) signal from the GPS satellites and converts it (along with GPS coordinates) into a custom overlay on the video screen.

Other options under discussion was a Crystal Cam method of time insertion currently being investigated by Sandy Bumgarner.

Following this presentation a station list was agreed upon for the occultation later that night by 64 Angelina, being the 3rd event attempted by many of the group in this same week. The meeting was called to a close around 6:30PM. The participants continued their discussions and others went out for dinner at nearby restaurants.

Saturday, July 3

The meeting resumed at 10:15 AM. Results from the 64 Angelina event were discussed. Due to the sky conditions at the time of the event and the altitude of around 30° plus a nearly full Moon in the sky, only a few observers reported successful occultations, and the other observers were not even sure they had or saw the target star. From the preliminary reports, a possible south shift occurred, and the asteroid was almost half the size it was expected to be.

Derald Nye described his homemade time inserter he uses for occultation observations. He built this unit using the Manly time inserter circuitry plus other components. Nye has boards for sale for \$25 and this includes instructions and a parts list. Nye said he cannot give construction advice therefore a knowledge of electronics is essential to build one of the units. He reduces his video tapes after the events due to the increased number of wires needed to use the unit in real time.

On the subject of time insertion, a discussion continued on how to modify the various devices including the GPS time insertion devices now used. Steve Preston suggested recording an occultation video (from a digital camcorder) directly into a computer as a Type1 AVI file, then analyze it later.

Richard Nugent showed his portable asteroid occultation setup that consists of a 4” Meade 2045D Schmidt-Cassegrain non-computer telescope, PC164C camera, Collins I3 image intensifier, Sharp 8mm camcorder and Grundig digital shortwave radio. Nugent’s system is so portable, all components weigh together just 32 pounds and in the large briefcase, fit in the overhead compartment of airplanes. With this system, Nugent can reach stars to  $m = 12.0$  in a dark sky on video.

David Dunham described how he operates his remote video occultation stations. The first ever successful asteroid remote station was for 9 Metis on September 7, 2001 in northern California. Later that year on December 21, 2001 Dunham’s

*Occultation Newsletter*, Volume 11, Number 3, July 2004



remote stations were successful for the t2 Aqr graze at Kitty Hawk, North Carolina. Other remote station observers who have successfully used the technique are Roger Venable and Steve Preston. For remote video stations, Venable programs his VCR to turn on a few minutes before the event conserving precious battery power and allowing him plenty of time to drive to the 2nd site and set up.

Paul Maley discussed his efforts on random asteroid satellite searches. Tom van Flandern has calculated that an asteroid satellite can have a stable orbit at least up to 10 asteroid diameters from the parent asteroid. Fueled by Maley's own visual observation of a blink during the asteroid occultation event of (6) Hebe in March 1977 while he was far outside the occultation path, and other observations/photographs of asteroid satellites, Maley has attempted to observe all occultations where he was within 1,000 km of the path from 1977 to the present. In all, he has attempted over 500 such occultations, 80 of them alone in the first 6 months of 2003. Maley has a supporting database of observers in Houston which consists of their lat/long position and telescope size. He discussed his concentration on the deployment of large urban groups to intercept asteroid occultation paths, the most successful of which has been the 1983 Pallas expedition.

A brief discussion continued on the possible methods of detecting asteroidal satellites and the theory of their origin, including the impacts and the approximate distance from the parent asteroid. In order to confirm an asteroid moon, IOTA needs observers separated by no more than 2-3 km, since these objects are small.

Walt Morgan described how he uses new technology NiMH rechargeable batteries for use to drive his GOTO telescope and video system. "AA" NiMH cells now cost about \$1-\$2 each plus the cost of a charger. These batteries can run his GOTO telescope adequately for about 10 hours. Compared to conventional AA sized non-rechargeable batteries, these NiMH batteries can be re-charged many times and are much cheaper to run a telescope/video system. When unused, NiMH batteries lose about 1% of their charge per day, so Morgan recommended recharging them the day before the scheduled event to maximize their effectiveness.

Paul Maley discussed some recent occultation news from Japan where his job frequently takes him. He works with Dr. Isao Sato, who led expeditions for 253 Mathilde on 4-9-04, and 704 Intermedia on 3-23-03 (amongst others). The Intermedia event was in cooperation with a group of observers organized by Maley in Hawaii which was one the best observed asteroid occultation events ever. Sato has formed the Nakano Star Gazers Club, which has a good following of occultation observers.

Walt Morgan laid out plans for a grazing occultation of a  $m = 8.9$  star by the totally eclipsed Moon on October 28, 2004. The graze will occur at 6:44 PM Pacific Daylight time with the Moon just  $6^\circ$  altitude,  $79^\circ$  azimuth. The Sun will be  $7^\circ$

below the horizon thus twilight will be a factor for this event. Morgan plans an expedition for this event near Esparto, CA.

----Lunch----

David Dunham opened the continuation of the meeting with a successful report on his (and Wayne Warren's) long term efforts to secure funding for IOTA's long term solar radius experiment and research. A 3-year grant proposal was submitted last April 2003 and accepted in December 2003. The principal investigator is David Dunham, Co-investigators: Wayne Warren, Jr., Alan Fiala, Harry Bates, Sabatino Sofia, David Herald and many IOTA observers. The main focus of the research will be to analyze Baily's Beads timing data from solar eclipses to search for solar radius variations. Previous eclipse data analyzed included the eclipses of 1715, 1925, 1975, 1979, 1981, 1983, 1984 and 1987 giving a  $-0.11 \pm 0.03^2$  decrease in the solar radius relative to the  $959.63^2$  standard value.

The main plan of this research is to:

- 1) Re-reduce earlier eclipse data from the May 30, 1984 eclipse to validate and/or modify the OCCULT program,
- 2) Reduce the solar eclipse video tapes of Baily's Beads from 1991-1994, 1998, 1999, and 2002 one station at a time to measure for consistency in data.
- 3) Collaborate with S. Sofia eclipse radius corrections compared to SOHO observations, and Solar Disk Sextant, and ACRIM data.
- 4) Analyze early eclipses from 1869 and 1878 in the USA, eclipses from 1905 Aug 30, 1922 Sep 21, 1930 April 28 and 1966 May 20

This important funding breakthrough will aid IOTA in one its long-term goals of determining if real measurable solar radius variations occur as part of the Sun's evolution.

David Dunham presented important asteroid occultation milestones in history:

1st asteroid event observed, from India in 1961

2 Pallas on May 29, 1983, best observed with 130 observers yielding its size  $530 \times 513 \pm 2.9$  km This event even had a graze near the limb of Pallas with 2 'D's and 2 'R's.

9-11-83, 51 Nemausa with over 30 chords, size:  $166.0 \times 122.6 \pm 2.3$  km; it was the second-best observed event at the time.

7-18-03, 126 Varsavia over California, Oregon and Washington with 38 chords, size  $54.5 \pm 1.6$  km  $\times$   $36.2 \pm 1.0$  km. The short 2-second duration of the Varsavia event made personal reaction times difficult to estimate. Several visual

observer's chords had to be shifted to coincide with nearby video chords to make the least squares fit work.

345 Tercidina 9-17-02 over France, Germany, and Slovakia. Size  $107.5 \pm 0.8$  km x  $91.1 \pm 0.8$  km. Over 70 chords made this the 2nd best observed event ever until:

420 Bertholda on 8-26-03. With over 75 chords its size was computed to be  $168.8 \times 122.8$  km.

For the 322 Clarissa event, Dunham recounted his 618 mile roundtrip to Walden, NY. A welcome surprise was Phil Dombrowski's observation of an occultation by a possible satellite of Clarissa. Being north of the path, he recorded a 0.25 second event long after the main occultation. Dunham estimated this moon to be  $\approx 5$ -6 km in size. But the star was near the limit of visibility with the small telescope that had to be used; Frank Anet's careful analysis shows there is some doubt about Dombrowski's observation.

Observations of other recent events showing perhaps better evidence for asteroidal satellites include 772 Tanete in April and 98 Ianthe in May.

Paul Maley went over his plans to lead his 30th solar eclipse expedition to Panama for the April 8, 2005 annular eclipse. Maley's concerns with this eclipse is that of many previous and future eclipses in asking people to observe the Bailey's Beads from the umbral edge to aid in determine possible solar radius variations when there are many unreduced tapes from prior eclipses. With the lack of publications/results on this solar radius experiment, plus some professional skepticism, Maley was hesitant if the project should continue. Dunham said we should, since now he has finally acquired the funding to reduce the prior years eclipse tapes. Even though there are satellites that can produce a more accurate solar radius, Dunham says the NASA grant will aid in older eclipses and compliment the newer observations.

Other eclipse expeditions in Maley's plans are:

October 3, 2005 – Annular eclipse over Tunisia. Two days later a 5th magnitude star will be occulted by an asteroid near the eclipse site at the Algeria/Tunisia border. If political conditions warrant, a backup plan will be to observe from Spain where Maley met in May with Carles Schnabel, a Barcelona IOTA/ES member who provided presentation material shown by Maley on proposed north and south limit sites in Spain.

March 29, 2006 – Total eclipse over Africa. The US State department has discontinued the travel ban to Libya, a prime site for observing the eclipse. Maley plans to set up a camp near the north edge with prime observing scheduled for the centerline.

September 22, 2006 – Annular eclipse over Surinam/ French Guiana in South America.

Detailed plans for these expeditions can be found at [www.EclipseTours.com](http://www.EclipseTours.com)

David Dunham then summarized some major occultations for the rest of the year 2004, Total occultation y1 Aqr ( $m=4.2$ ) on August 3, 2004 by the Moon visible from Florida to North Carolina,

y2 Aqr ( $m=4.4$ ) Total occultation by the Moon from Central California to Montana.

Two good asteroid occultations (from Sky and Telescope):

914 Palisana, September 12, 2004, Texas to Maryland,  $m=7.2$  star (but Preston's update has moved that path north to New Mexico, New York, and Nova Scotia).

433 Eros, October 11, 2004 Northern California to Nebraska,  $m=7.7$ . Dunham remarked that because of the recent NEAR Mission to Eros, its orbit is known very accurately.

2005 Predictions: Grazes of Antares:

March 3, 2005, with a 54% illuminated Moon,  
July 18, 2005, gibbous Moon  
September 10, 2005, Maryland to Texas  
December 25, 2005 – Spica graze, Washington to New Mexico

An occultation of Saturn's Moon Titan will occur on August 24, 2004 in NE Brazil, with a  $m=8.0$  star. This is the last occultation before the Huygens Probe descends on Titan in January 2005. But a late update for this event moved the interesting central flash region north into the Amazon River area at low altitude where the chances for a successful observation were very small, so expedition plans were cancelled.

David Dunham discussed station plans for the 491 Carina occultation for the following Tuesday morning. The meeting continued with the showing of videos of recent occultation events, including 522 Helga and 559 Nanon from earlier in the week, and some grazes and totals. One interesting video was shown from Roger Venable of the 98 Ianthe asteroid event. Some 50 seconds after the main occultation, a short blink was seen on his video possible indicating a asteroidal moon. One of IOTA's major goals is the confirmation of an asteroidal satellite.

The meeting adjourned at 6:51 PM and the attendees continued their informal discussions and met at local restaurants for dinner. ■

## In Memoriam - Prof. Dr. Hans Ehrenberg

### Alfons Gabel

Hans Ehrenberg, the former director of the Institute for Nuclear Physics of the Johannes Gutenberg University of Mainz/Germany, passed away on November 19th, 2004 at the age of 82. He was a profound researcher during all of his life. After his retirement as a meritorious scientist in 1989, he concentrated on occultation projects and became a distinguished observer and an esteemed discussion partner.



As a long term honorary member and nestor of the astronomy club of Mainz he also became a member of IOTA/ES. Joining many ESOP-meetings his last one was 2003 in Trebur/Germany, no longer being able to participate in ESOP 2004 in Paris. Until recently, as long as the state of his health permitted, he planned, organized, and accomplished team expeditions to occultation events and was a successful tutor and motivator for many observers. The experienced physicist was not only a theorist, but of many practical and technical skills and also very helpful through his profound knowledge in optics. The Mainz astronomy club, as well as IOTA/ES, are in mourning for a respected member and a friend. Hans Ehrenberg stays with us in grateful and honouring remembrance. ■

## The February 10, 1977 Near Lunar Grazing Occultation Of Uranus

### Hal Povenmire

Occultations of Uranus by the Moon have been observed a number of times. It has only been since the 1960's that accurate predictions of grazing occultations have been possible. This may have been the first grazing occultation of Uranus to be predicted and observed. This grazing occultation of Uranus was not highly favorable. It had some scientific importance in that it allowed some determination of what instrumentation would be needed to get highly scientifically valuable results.

At this time I was an Astronomy teacher in Florida. I gathered up two of my astronomy students, David Johnson and Robert Berry, and we headed north to Gillisonville, South Carolina. The weather was cold, clear and the seeing was fair. The Moon was 58.5 % sunlit and in the waning phase. The grazing occultation occurred slightly on the dark side of the southern limb. Uranus disappeared on the bright side and reappeared on the dark side. The dark limb was faintly visible so the transparency and clarity was good. Uranus was magnitude 6.0.

We had several larger telescopes, but the 6-inch f/8 had exceptionally clean optics and since Uranus was a low contrast object, it was chosen for the observation. The power chosen was 96X. The Disappearance was slightly visible but not timeable. The Reappearance or Third Contact was discovered at 9:34:34.5 U.T. when Uranus was at magnitude approximately +7.5.

The coordinates in Gillisonville, South Carolina were taken from the USGS 7.5' Coosawhatchie, S.C. topographic quads. This area of South Carolina was not mapped until many years after this observation so the reduction could not be completed until recently.

Longitude 80° 59' 35".0 W. Latitude 32° 35' 55".4 N.  
Elevation 92 feet

The disk of Uranus was pale green with indistinct edges or limb. The 4th contact approximate times (U.T.) were:  
9:34:41.0 almost complete  
9:34:48.0 probably complete  
9:34:56.0 definitely complete

What was learned is that for scientifically better results:  
1. A larger, longer focal length telescope was needed.  
2. A clock drive was needed.  
3. Higher power was needed.  
4. A crescent Moon would have allowed greater accuracy.  
5. A better cusp angle would have allowed greater accuracy.

This observation has to be considered a success in that it provided the foundation for future observations. ■

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## 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.

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## IOTA European Section (IOTA•ES)

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:

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## 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.

