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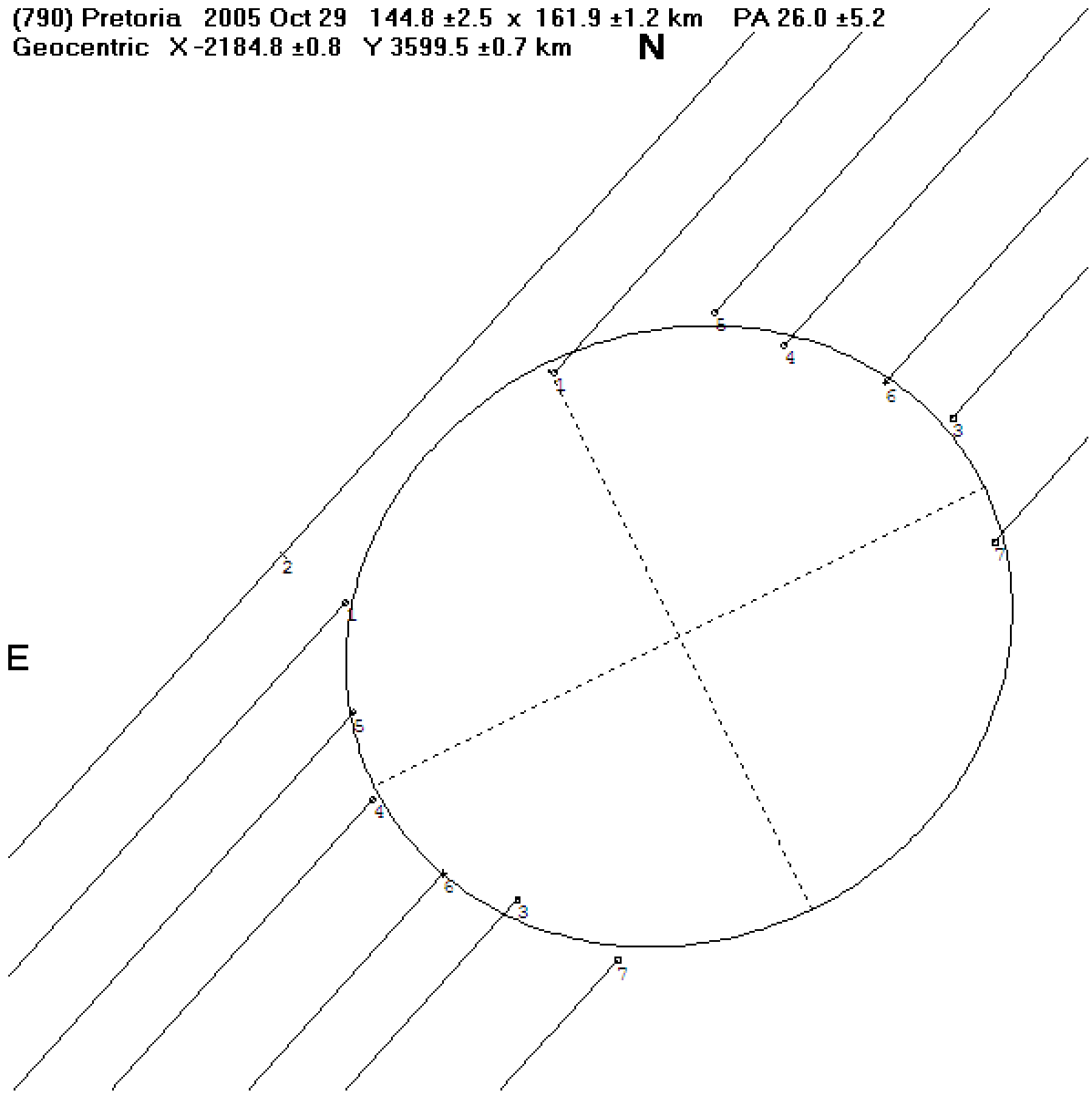

Occultation of 10.6-mag. TYC 0216-01594-1 by the P-class main-belt asteroid (790) Pretoria

In this Issue

ON THE COVER:

During the early morning of 2005 October 29th, a few hours before the start of the 2005 meeting of IOTA, several attendees video recorded the occultation of 10.6-mag. TYC 0216-01594-1 by the P-class main-belt asteroid (790) Pretoria. The observations, made from sites in eastern Oklahoma, are shown projected on the plane of the sky at Pretoria on the cover, with an ellipse of dimensions 144.8 km by 161.9 km fitted to the well-spaced observations. A few other observers, in central Oklahoma closer to Stillwater, where the meeting was held, were clouded out. In addition, IOTA member Benny Roberts observed the occultation visually from Mississippi. The observers and their locations, listed from north to south across the asteroid and keyed to the numbers shown on the plot, are listed below:

2. David Dunham, Fairland, OK (attended, no occultation)
1. David Dunham, Success, OK (remote station)
5. Robert Sandy, Big Cabin, OK
4. Chad Ellngton, Pryor, OK
6. Benny Roberts, Byram, MS
3. Paul Maley, Catoosa, OK
7. Richard Nugent, Leonard, OK

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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:

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

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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

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 inside back cover)
Southern Africa--Brian Fraser - 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)

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Minutes of the 23rd IOTA Annual Meeting, 2005
Oklahoma State University, Stillwater, Oklahoma

Richard Nugent, Executive Secretary, RNugent@wt.net

The 23rd annual meeting of the International Occultation Timing Association was held Saturday and Sunday October 29-30, 2005 at Room 110 of the Physics building at the Oklahoma State University (OSU) in Stillwater, Oklahoma. This location was chosen to coincide with the favorable asteroid occultation of 790 Pretoria in the pre-dawn hours of October 29, The meeting location was arranged and hosted by IOTA's Secretary/Treasurer Art Lucas who lives in Stillwater, Oklahoma.

Thirty-two members and attendees were present. This included fifteen persons actually at the Physics building and up to seventeen persons watching via a webcast:

President David Dunham from Maryland,
Vice President Paul Maley from Texas
Executive Secretary Richard Nugent from Texas,
Secretary Treasurer Art Lucas from Oklahoma,
Barb Lucas from Oklahoma,
Roger Venable from Georgia,
Rick Frankenberger from Texas,
Derald Nye from Arizona,
Bob Sandy from Missouri,
Derek C. Breit, Daniel Falla, Sandy Bumgarner from California.
Chad Ellington, Rob Walker, Byron Labadie, Peter Shull from Oklahoma,

Webcast members present:
Dave Gault, Australia; Ed Morana and Charles Poplinger, California; Pedro Valdez Sada, Mexico; John Graves (editor *Occultation Newsletter*, ***ON***), Tennessee; Willem Van Leewen, Netherlands; Walt Robinson (IOTA's Webmaster), Kansas; Jim Stamm (Vice President Planetary Occultations), Arizona; Rocky Harper and Dave Clark, Texas; Tony George, Oregon; Suresh Singh, India; Vincenzo Flourincio, Italy; and Warren Grider, Oklahoma.

Art Lucas opened by introducing Dr. McKeever, Vice President of Research at OSU. Dr. McKeever immediately mentioned the long history of contributions to the University by Art and Barbara Lucas, including the starting of the first observatory at OSU. For this and his many other contributions to OSU's Physics Department over the years, Art received the highest honor an individual can receive: an honorary Doctorate in May 2004. A round of applause followed this announcement. Congratulations to Art Lucas for this outstanding achievement!

President David Dunham opened the meeting and asked the attendees to introduce themselves. Following the introductions of the local attendees, the webcast meeting began with an inappropriately timed (for us) maintenance power outage at the host location at the California Institute of Technology. The webcast was delayed by approximately 2 hours, including all of the business session.

Business Meeting, Saturday, October 29

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

Starting Balance: June 28, 2004	$6,302.56
Ending Balance: September 20, 2005	7,318.93
Net Increase in Bank Balance:	$1,016.37
Total Income	**$4,115.00**

Expenses	
Printing Costs	$1,375.44
Web Service	$ 350.97
Mailing costs	$1,275.40
Fees and interest	$ 88.70
Total Costs	**$3,090.51**

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. And since the bulk of IOTA's expenses is the ***ON***, the membership should take advantage of it and submit material to John Graves, whether it be observations, techniques, etc.

There was no opposition to the financial report, and it was accepted by the members. An original copy of the Annual Financial Statement is on file with the Executive Secretary.

Executive Secretary **Richard Nugent** noted that the 2004 meeting minutes were published in ***ON***. In 2004, it was considered that IOTA seek publication of a "Proceedings" similar to other specialized astronomical groups, and Nugent had received some quotes from the Astronomical Society of the Pacific. They were interested in publishing such a volume and were also seeking a minimum of approximately $4,000 in sales. This would have come to about $55/volume. At that time ***ON*** was very short on submission so it was decided to drop the idea of an outside source for a Proceedings publication.

Art Lucas has asked the members to seriously consider taking over his job as Secretary/Treasurer due to his age/health reasons. The main duties of the Treasurer are:

1. Mail the ***ON*** from the printer,
2. Deposit member dues checks into the bank,
3. Make a year end financial statement (2 pages),
4. Make a membership list,
5. Prepare lists for distribution, mainly, annual predictions.

Chad Ellington volunteered to do the secretarial work, but not the treasurer's work. Art said this would be very helpful, and Chad, who also lives in Oklahoma, has started to work with Art to learn the system.

Dunham told the group that the yearly Sky and Telescope (S & T) asteroid occultation articles would probably be much shorter and published several times per year. This being due to the initial large uncertainties in the paths of these events. A world map of the better 2005 events is now on the S & T website.

Richard Nugent presented the status of the IOTA Observer's Manual. He brought a paper copy (256 pages) of the completed chapters and appendices to pass around. Remaining chapters needed to complete the manual are solar eclipses (limited to IOTA solar radius research and lunar polar diameter measurements), grazes and IOTA history. The results of IOTA's long term solar radius experiment just recently became available in September 2005 so Nugent now has the needed results to proceed with the eclipse chapter. Nugent gave a current copy of the manual (electronic form) to Sandy Bumgarner and David Dunham. Due to the large size of the manual, a new website will be used to show the chapters. It is located at http://iota.jhuapl.edu/iotaman.htm

With no further business, at 10:55 it was motioned to close the business portion of the meeting, Bob Sandy seconded the motion and the business meeting was closed.

Technical Sessions

President **David Dunham** began the technical sessions asking for preliminary results of the asteroid event by 790 Pretoria earlier in the morning. Results were:

Bob Sandy: 45 km north of predicted center, 6.6 second occultation,

Derald Nye: Dew and clouds, 30 km north,

Paul Maley, 8 second occultation 11 km north,

Richard Nugent: 7 second occultation, 40 km south of predicted center,

Chad Ellington: 5 second occultation, 25 km north,

Rick Frankenberger: Clouds,

Roger Venable/Derek Breit: Clouds/dew.

11:20 AM 12:00 Noon --- Break

David Dunham mentioned that Steve Preston now has predictions for all asteroid occultations for 2005 and 2006 on his website. Full updates are given for events about a month in advance, with preliminary updates for the rest. He also mentioned that valuable accurate asteroid astrometric observations comes from the Jet Propulsion Laboratory's Table Mountain Observatory since they have a telescope that is not restricted to meridian observations, but the bulk of the observations are still provided by the FASTT Meridian Transit telescope of the U. S. Naval Observatory in Flagstaff, Arizona. Hugh Harris is now providing most of those observations after the unfortunate recent death of Ron Stone, who established the FASTT program with the important linkage to the accurate Hipparcos/Tycho catalogs that became available from ESA in 1997.

A brief discussion began about the possible use of automated telescopes to capture asteroid occultations (and occultations by asteroidal satellites). **IOTA Vice President Paul Maley** and others agreed that it is very difficult to recruit general observers for asteroid events unless the observation is very convenient (i.e., done from their backyard, a bright target star, Saturday night, before 12 midnight, etc.). Such occultation telescopes might be controlled from the internet. Internet telescopes exist to do this, however few, if any, are portable; they must be reserved long in advance; and many have fees associated with their use. More discussions on this continued during the breaks.

Chad Ellington showed the use of Google Maps for plotting and viewing asteroid event paths. The program Google Earth can take Steve Preston's detailed Info files to overlay the asteroid ground track on a map with just a few mouse clicks. "Kiwi" Geoff Hitchcox wrote the software to accomplish this. These maps are clickable to show terrain to extraordinary detail, and can calculate the distance of a line (using mouse dragging) from the center of limit of the path. Charlie Ridgway in New York City has a web page for North American asteroid events showing the capability of these maps at
http://digitalmagic.i8.com/Astronomy/Occultations/

12:30 – 1 PM- Lunch down the hall hosted by Art and Barbara Lucas.

Dr. Peter Shull showed slides of the OSU's HS Mendenhall Observatory located 6 miles southwest of Stillwater. Dedicated in 2003, it currently has a Celestron-14 under a 16 foot Home dome. A new 24-inch telescope to be built by Optical Guidance Systems, out of Pennsylvania has been recently funded by an Air Force Grant.

Video Time Insertion

Several GPS time/WWV video time inserters are in use for occultation work. The current status of some of the available units was discussed by the attendees:

Manly WWV Time inserter: This is the oldest time inserter, developed by Peter Manly in Arizona about 20 years ago. Derald Nye built his unit using the Manly time inserter circuitry plus other components. Derald has boards for sale for $25 including instructions and a parts list. Nye said he cannot give construction advice therefore a good 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. The main advantage of this time inserter is that time insertion can be done after the observation is made, so that anyone who has recorded WWV, WWVH, or CHU time signals on a video tape can later obtain a time-inserted copy from an IOTA member who has one of these units. Rick Frankenberger in San Antonio provides this service for most IOTA observers.

KIWI OSD: "Kiwi" Geoff Hitchcox designed a GPS time inserter that displays LAT/LONG, Altitude and GPS time. It has a backup time to keep the time display going in case the GPS signal is lost (built in quartz clock), allows NTSC/PAL formats, displays satellite info, and is accurate to 1 ms of UTC. These units are now manufactured and sold by PFD Systems, LLC in Bethesda, Maryland, Web site for details:

http://www.pfdsystems.com/kiwiosd.html . The price of this unit ready to go and assembled is $150. It requires a Garmin 18 LVC GPS receiver for an additional $85 plus shipping/handling.

McAfee VTI: Don McAfee (e-mail dmcafee@mcafeescientific.com) designed a box unit fully assembled which displays GPS time to 0.001 second, plus LAT/LONG, ALT and date info all for about $285 ready to go. Like the Kiwi OSD, it uses the Garmin 18 LVC GPS receiver which has a built in magnet to attach to a convenient location. This VTI also has a toggle switch to go back and forth from position info to time. The time displays a single time to 0.001 sec unlike the Kiwi OSD which has half frame times displayed. The McAfee unit also uses a built in quartz clock to keep the time displayed in case of loss of signal. McAfee has made only a few of these units, not having the larger manufacturing capacity of PFD Systems for the Kiwi unit.

ViTi and GHS Clock: This unit is designed and sold in Japan. More info is available from http://www2.synapse.ne.jp/haya/ghstivi/ghstivi.html. This device can display a variety of GPS/time/satellite information and has been used by Japanese observers for a few years now, it being the first GPS video time inserter designed for occultation work.

Hans-Hellmuth Cuno gave a talk at the European Symposium on Occultation Projects (ESOP) about a GPS time inserter he built. Details can be found at http://www.astronik.de .

Derek Breit suggested setting up a GPS unit early for an occultation to allow almanac data to download to your particular receiver. This helps prevent time errors which have been known to deviate from WWV by as much as 10 seconds, either when satellite geometry is poor due to local obstructions or during the early acquisition before the GPS solution has had time to stabilize; this usually takes 5 minutes or more.

David Dunham showed some slides for the pre-pointing method. The basic concept of this method is to have telescope stations already set up and pointed in the direction that the target star will be at the predicted time, allowing a non-specialist to record the occultation since the pointing can be done hours in advance. The pre-pointing is made to a star field at the same declination as the target star, with a right ascension difference equal to the time difference to the event, taking into account the 10-seconds/hour difference between sidereal and mean solar rates. The non-specialist will have to do only a few simple tasks to get the system operational for the occultation, such as: a) setting an alarm to wake up, b) taking the cover off the end of the telescope tube, c) reconnect any batteries, d) turn on the timing device (WWV shortwave), e) press the "record" button on the VCR/camcorder. f) stop the recording after the event. With the non-specialist working the pre-pointed telescope system, the specialist drives to another location to set up another station. If time permits, two or more telescopes at different locations can be pre-pointed. The basic idea was developed for remote (unattended) stations, but it has other applications, helping those who can't find target stars to obtain observations. The pre-pointing should be timed to an accuracy of about 10 seconds, which can easily be obtained with inexpensive self-setting "atomic" clocks that use WWVB or DCF long-wave time signals. The technique can be used for visual as well as video observations. Dunham first used the technique in 1965 for a visual observation of a daytime partial occultation of Jupiter by the Moon when both objects were too close to the Sun to see without telescopic aid.

Vice President Paul Maley talked about his rating method for advertising asteroid occultations in the Houston, Texas area. Steve Preston's "rank" for asteroid events is a bit confusing for the general observer so Maley came up with his own ranking method to make it easier to recruit these observers. It is based on a variety of factors including the star magnitude, magnitude drop, day of week, time of day, elevation, azimuth, Moon phase, Moon distance, Sun distance, and prediction accuracy, He assigns a numerical weighting scheme for these factors to come up with a rating as to whether or not the general observer should try the occultation.

Maley's ratings are:

X = eXtra special/don't miss it =5
PG = Pretty Good =4
G = Give it a shot =3
M = Maybe worth trying =2
R = Ridiculous but not impossible =1

An "X" rated example event for this system for the Texas is the December 3, 2005 occultation by 52 Europa. This is an 8.9 mag. star with a maximum predicted occultation of 7.8 seconds, with a very large asteroid with wide path with high certainty.

LiMovie

Kazuhisa Miyashita in Japan developed a new software program to produce light curve plots of occultation events; its basic operations are in English. LiMovie converts a video to a light curve for a qualitative analysis of occultations events including those difficult ones with very small magnitude drops. The high detail of the light curve plots can allow the user to detect possible

asteroidal satellite events by analyzing the magnitude drops. LiMovie is useful for occultations involving close double stars, allowing measuring the component magnitudes. LiMovie is a free program obtainable at:
http://www05.upp.so-net.ne.jp/k_miyash/occ02/limovie_en.html

David Dunham gave a few tips on finding the target star for asteroid events using a GO TO telescope based originally on Walt Morgan's on-line article. The preferred finderscope is a straight thru type, except for stars near the zenith when a right angle finder is easier to use. When the GOTO scope is moving toward the target star check carefully that you have the correct field. This might involve moving/inverting/flipping your star chart to identify the field. Some GOTO scopes allow the user to jump to bright stars when moving toward a target area. A synchronization key can be used to minimize errors in pointing as the telescope moves closer to the target star. This reduces the propagation of errors as the telescope slews across the sky. Morgan prefers the Starry Night Pro to create finder charts, Dunham prefers the Millennium and/or Herald-Bobroff Atlases. The various planetarium programs such The Sky, MegaStar, SkyMap, etc. have a rectangle that can be overlaid onto the FOV simplifying the identification of video fields.

Problems can occur with a GOTO telescope system. Don't assume that just because you push a few buttons that you are dead on the target star. Alignment star errors, the amount of slewing distance, and other factors can affect your GOTO accuracy. Bob Sandy commented that a dry run is useful 2 or 3 days before the event. A practice session can help identify unforeseen problems. The lesson here is to learn your own system.

David Dunham discussed how to use predictions and profiles to find observing sites for grazing occultations. The Tan Z correction and limit correction were plotted on the 1:125,000 scale Delorme's Street Atlas USA Version 8. Dunham mentioned some important considerations about using graze predictions: The Tan Z correction can usually be ignored for elevations less than 750 feet above mean sea level since it is so small, and graze profiles change when stations are more than 100-200km along the limit line. Unlike asteroid events, in which the asteroids are relatively small and far away, the Moon's profile changes slightly due to its proximity to Earth.

Dunham spoke about the southern-limit graze he attempted last December 17, 2004 of m = 7.5 ZC 3434 at Valley Lee, Maryland from 3 stations. He set up 2 remote stations and one attended station. With these optimally placed stations, he recorded 3 lines of the lunar profile. The attended station recorded a 1.5 minute occultation, the middle station had 8 events, and the southern most station 6 brief events at mountain tops. Dunham made a 92-mile trip to the sites from his office through rush hour traffic. He would have been able to set up a 4th station, however a property owner had called his cell phone and asked him to remove his equipment. One station Dunham had set up in the most shaded part of the local Post Office's parking lot, but he didn't realize until after setting it up that it was only about 30 feet from the entrance. Despite several persons walking in and out to get mail from their P.O. boxes, no one bothered the equipment.

Wayne Warren had attempted to observe this graze with Dunham, however he didn't make it through the rush hour traffic in time and wasn't able to start observing until just after the graze ended! David Dunham has made the record book again: this event marked the first graze made by a single observer operating 3 stations.

On the topic of grazing occultations for 2005, several videos of the more favorable ones were shown: Kerry Coughlin's video of Antares from Baja California on March 3, and Ed Morana's and Derek Breit's videos of Upsilon Gem on April 18 (m = 4.1 star). This event had 9 stations and 15 observers. Dunham recorded a graze of Tau Ari (m = 5.0) on March 15 with a 30% Moon from 3 stations in clear cold skies in Pennsylvania. Ken Smith, a local homeowner, made the mistake of offering to help Dunham. Ken quickly obtained permission from his neighbors to set up the scopes at nearby locations, helping with the setups, and then running one of them at his home!

The best graze of the year was of the 1st magnitude star Antares on July 18. Dunham showed graze profiles obtained from expeditions from Washington State/Utah, Texas and Georgia, and Bob Sandy showed a video Dave Clark took of the Antares graze in Texas..

Bob Sandy then showed the reduction profile of the Aldebaran graze from September 12, 1998 from Tennessee. This unique graze occurred at extreme Cassini region libration angles and was the the 3rd graze observed that night making it an IOTA "second": The second triple graze observed in one night. Exactly 19 years before, on September 12, 1979, a Meton cycle earlier, Richard Nolthenius first accomplished this feat with the SAME three stars with similar geometry in California. The 1998 Aldebaran graze had 10 stations and 18 observers, coinciding with the 16th annual IOTA meeting at Dyer Observatory in Nashville.

Following a short break Bob Sandy showed some color film slides of a crescent Moon of a Venus Occultation, and a Jupiter occultation sequence. The Moon/Venus occultation slide is the one used on the IOTA baseball cap.

David Dunham continued the meeting with a status report on his (and Wayne Warren's) long-term effort in IOTA's solar radius experiment and research. Dunham had presented the results of his research at the 2005 SORCE (SOlar Radiation and Climate Experiment, a NASA satellite launched in 2003) Science Meeting September 14-15, in Durango, Colorado. A 3-year grant proposal was submitted in April 2003 and accepted in December 2003, and finally funded by NASA in June 2004. The principal investigator is David Dunham, with co-investigators: Wayne Warren, Jr., Alan Fiala, Harry Bates, Sabatino Sofia, David Herald, and help from many IOTA observers. The main focus of the research was to analyze Baily's Beads timing data from solar eclipses to search for solar radius variations. Previous eclipse data analyzed and published in 1994 included eclipses from 1715 to 1987 giving small changes of the solar radius relative to the 959.63″ standard value for each of the eight eclipses.

Videos of Baily's Beads obtained during the eclipses of 1991, 1994, 1995, 1998, 1999 and 2002 were analyzed in part with David Herald's Baily's Bead module of the program OCCULT. James Thompson, a NASA summer mentor student, performed most of the work under Dunham's supervision. The results indicate solar radius changes varying from 0.06″± 0.06″ (Aug 11, 1999 eclipse) to -0.27″± 0.02″ (May 1994 eclipse). A plot of the solar radius changes didn't show any obvious trend, however this doesn't prove that there isn't a cycle of small scale solar radius changes occurring with the Sun.

One of the nagging issues in this research is the criticism of the lack of standardization of equipment used for the Baily's Bead's videos. Different telescope systems and different solar filters were used at each of the eclipses studied and this may be partly responsible for the inconsistent results. Different filters allow different maximum wavelength transmissions of the Sun's light to be analyzed possibly affecting the Bead timings. Dunham suggested that Richard Nugent's compact 4-inch telescope system with Thousand Oaks solar filter would be useful to use as a standard system.

Roger Venable suggested testing all equipment and combinations side by side at the next solar eclipse. The videos/bead timings can be analyzed for any type of variation or systematic errors. Along these lines, Sandy Bumgarner suggested using remote stations for testing/comparing the equipment. Maley cautioned that although in principle this sounds simple enough, there are unstable conditions beyond the observer's control such as dust storms, wind, tampering/theft of equipment, etc. More study is needed and the funding of this research has an additional year to go; a final paper is planned for publication.

Paul Maley discussed his proposed Project Blind Squirrel, a concept for intercepting asteroid occultations and asteroid companions. The concept is to provide a deployable portable system of 8-inch telescopes for asteroid occultation intercepts. Several telescope systems were discussed, that have been nicknamed TOTO=totable occultation tracking optics. Maley commended Dunham and Venable who have used multiple stations to achieve success but believes that to get better results the adage "more is better" should be applied.

The portable systems (approximately 10-15) would be deployed at intervals along a road for an asteroid event, the actual locations to be defined by the occultation. The systems would be required to have a simple quick setup (15 minutes) and be automated to record the occultation event. Control of the telescope systems could be automated/robotic, done via the internet or some other wireless method. One possible lower cost (~$500) system would consist of an Orion portable table top mount, 50 mm telephoto lens suitable only for 7th mag or brighter stars, and a Supercircuits PC164 camera.

The advantages of this method are to increase the probability to intercept occultations and increase the chances to detect and confirm an asteroid satellite. Funding is needed to implement such a system; so far, IOTA has received no support for this work.

David Dunham briefed the attendees about an ESOP 2005 (European Symposium on Occultation Projects) presentation by Wofgang Beisker on The Dual Wavelength Occultation Camera. This camera shoots the occultation simultaneously at two wavelengths using dichroic mirrors, making it is possible to record images in two or even more different wavelengths from a single telescope without wasting light. This method was developed mainly for occultations involving planets with atmospheres, but it could also be used to measure the colors of components of binary stars occulted by the Moon or by asteroids.

Prior to the close of the meeting, Danny Falla mentioned a Science News article for August 13, 2005 that the asteroid 87 Sylvia now has confirmed 2 satellites. See the Science News web announcement: http://www.sciencenews.org/articles/20050813/fob5.asp

The meeting was adjourned for the day at 6:15PM. The attendees proceeded to Art and Barbara Lucas's house for a BBQ dinner.

Sunday October 30, 9:20 AM

David Dunham began the meeting with a plan to update all observed asteroid occultation events into the OCCULT program historical observations database. There are over 700 observed asteroid occultation observations with just 413 listed in version 3.0 of

OCCULT. New observed events are being made at the rate of about 2-3 per week. Sandy Bumgarner asked if the reporting of asteroid events could be standardized into a unique format so that the information could be loaded directly into the OCCULT program database (by creating the .obs file). There is a web page maintained by Jan Manek that allows observers to report asteroid events online.

2005 did not any have any spectacular asteroid events observed with dozens of observers, but a few are worth mentioning:

71 Niobe may have a large satellite when it occulted an 8th magnitude star on February 10, 2005. The occultation was observed photoelectrically by Bob Cadmus at Grinnell College Observatory, Grinnell, Iowa. Doug Kniffen, south of Warrenton, MO, timed a 1.0-second occultation using a 16-inch telescope. Both observations were definite and accurately timed, but an analysis of them shows a 35-second mismatch that is most easily explained as occultations by two separate objects. A short Niobe occultation timed in Japan in November 2004 might also have been caused by the satellite. The next occultation by Niobe will occur on 2006 Feb. 16.

54 Alexandra was timed by 15 stations on May 17, 2005 in Mexico, Texas, and Oklahoma. Dunham traveled to Baja California to view the event. He brought 4 camcorders, which the Mexican customs officer saw and pointed out that tourists are only allowed one. After an explanation of the purpose, and that this was a private effort, the officer let him pass. The officer said that next time he should write a letter to the Mexican Consulate to get permission. The size of Alexandra from the observations is an ellipse 160.1 ± 1.3 km x 135.1 ± 1.2 km. This high precision fit is due largely to the long duration of the occultation chords - several over 60 seconds, and good distribution of observers across the actual path, in spite of a substantial south shift. Dunham also noted that a rotation period could be computed with 3 good occultation profiles combined with a light curve data.

89 Julia was observed by 7 stations on August 13, 2005. The resulting size came to 174.4 ± 5.8km x 135.6 ± 2.6km.

166 Rhodope by the 1st magnitude star Regulus on October 19, 2005 (10 days before the IOTA meeting) over Europe/Asia. This was a daylight event except for southern Europe; Iberia had the darkest skies. Dunham traveled to Spain and was assisted by Arturo Montesinos from Madrid. The preliminary reduction profile by the European Asteroid Occultation Network (EAON) showed that Dunham's remote station had an occultation near the southern limit. His manned station further south had a miss. Regulus is a fast 15 hour rotating elongated (2:3 size) star as measured by interferometry. Another chance to see Regulus occulted is in 2014 March 20 by 163 Erigone over the northeast US. Mark your calendars !

Dunham mentioned a good tip for airline travelers. He places a note in his suitcase with his equipment so that when the TSA security officials randomly inspect his checked baggage, they can contact him about the strange equipment on his cell phone. The note in the suitcase idea is an excellent method to avoid a delay which could possibly cause his baggage to be removed from the flight.

Paul Maley discussed his efforts on random asteroid satellite searches. Tom Van Flandern has calculated that an asteroidal 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 miles of the path from 1977 to the present. In all he has attempted over 800 such appulses, 80 of them alone in the first 6 months of 2003, with 43 successes overall. 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 typically expected to be relatively small compared to the primary.

Possible solutions to help IOTA confirm an asteroidal satellite are:

1) Need more remote stations
2) Two (or more) nearly co-located sites less than 5 km apart to confirm the short occultations caused by satellites

Maley believes that for a single person attempting to provide confirmatory evidence of an asteroid satellite one approach is to place one video/and one visual < 5km to 5 meters apart. In this way it is easier for one person to control and support two stations and maintain their integrity.

Along this discussion, Sandy Bumgarner said that the popular Collins I3 image intensifier may not be available for sale to individuals due to large government orders of the basic tube for the Iraq war and homeland security.

Following a short break Dunham recapped the observations made earlier on Saturday morning by 790 Pretoria. At the time of the meeting, there were 7 positive chords which included Dunham's remote station which recorded a 3 second occultation.

Dunham mentioned there are a few good grazes left in 2005:

25 November 2005: σ Leo from North Carolina to Tennessee.
23 December 2005: β Vir (*m* = 5.0) from Florida to San Francisco
25 December 2005: 1st magnitude Spica from El Paso to Seattle
26 December 2005: Eta Vir, San Antonio to Oregon

In 2006 no observable 1st magnitude star grazes occur over the USA, however several Pleaides grazes will occur.

With some occultations at or near daylight conditions, Roger Venable suggested using an infrared filter to increase the contrast to aid in observing the event.

Remaining good asteroid events for 2005:

15 November: 345 Tercidina, m = 8.9 star California to Kansas. The station details for this one are on Derek Breit's web site.
2 December: 52 Europa, California to El Paso

2006 Events:
3 January 2006: 598 Octavia, *m* = 10.0 star in Gemini
28 January 2006: 490 Veritas, *m* = 10.0 star in Orion
16 February 2006: 71 Niobe, South Florida to Spain. Niobe has a possible satellite
from occultation observations as mentioned earlier. This is a good one to watch.
21 February 2006: The Mars moon Deimos will occult a m = 9.0 star
24 February 2006: 530 Turandot, *m* = 7.9 star, northeast USA.
12 April 2006: 305 Gordonia (50km size) occults λ Vir, a *m* = 4.6 star over southern Africa
and Madagascar.
5 May 2006: 7 Iris, occults HIP 116495, *m* = 5.8 over the northeast USA. This is a low altitude event near morning twilight.
6 May 2006: 762 Pulcova, *m* = 11.9 star in a north south path from Houston to Canada. Pulcova is a known binary asteroid with a separation of about 500km.

David Dunham said Adirondak Video now markets an occultation video package which consists of a Supercircuits PC-164 camera and adapters for about $170.

From the web, ON editor John Graves wrote in that possibly several times per year, we could have a webcast to pursue online discussions. This would be a useful way to prepare for important occultation events and other IOTA matters. Needless to say, verbal communications are often more effective at getting things done than the usual emails.

Following this a few videos were shown of the Pretoria event and other recent occultations.

The meeting adjourned at 12:53 PM and the attendees continued their informal discussions.

Most of the presentation files for this meeting are at http://iota.jhuapl.edu/2005iota.htm , and a summary of the minutes of this meeting and meeting photos is located here: http://www.weblore.com/richard/IOTAMeeting2005.htm ■

Editor's note: I've been remiss in the last few years regarding publication of the IOTA meeting minutes. Over the next few issues, I will be publishing the unpublished minutes from recent IOTA meetings, as well as the customary content.

The IOTA Asteroid Satellite Controversy: Not Resolved

Paul D. Maley

The first confirmed asteroid satellite (Dactyl) was found by the Galileo spacecraft in 1993 but not noticed until some six months after the images were downlinked and hence discovered officially in 1994. However, the real hunt for asteroid satellites was initiated in 1977 after the occultation of (6) Hebe produced a secondary occultation that I reported and was documented in the July 1977 issue of ON. The term 'secondary occultation' is used here to describe an occultation that was not due to the asteroid itself ('primary occultation').

I just now read the article that Hal Povenmire wrote [see ON, Vol. 13, No. 1, January 2006] where he stated that his observation of an occultation by (129) Antigone in 1974 of a similar event is now resolved by a more recent analysis of astrometry. This is in fact not the case. Neither the Antigone nor Hebe observations have been resolved at all. But the main comment that should be made is that **no observations made by IOTA observers have ever resulted in a confirmed discovery of an asteroid satellite**---not back then, and not now. The hunt is still on! One of the main programs and goals of IOTA continue to be the laborious, yet challenging and fun-filled, search for and confirmation of such a satellite. Only last year was a Japanese team successful in capturing chords across a previously known satellite which came in addition to a number of chords across the primary asteroid. Even the largest group occultation intercepts with the greatest number of chords (and/or misses) have not resulted in the reporting of more than one outlying suspect secondary observation whose location in the sky plane would match with other secondary observations. And, it does not take a large group of observers to spot a secondary event.

Two excellent modern day examples of this can be found from Roger Venable's documented observations of a possible satellite of (98) Ianthe and (1024) Hale [see ON, Vol. 11, No. 2, April 2004]. Both events were video recorded and are clearly not due to the primary. But the question remains whether they are due to an asteroid satellite or 'something else'. The most common offense is to assume that because secondary events are typically of short duration that they are caused by scintillation. In the case of Ianthe the duration was 0.117 seconds, for Hale, 0.133 seconds. Both of these events are quite brief. In the case of the 1977 Hebe secondary, I was only able to estimate that it took a fraction of a second for the 3.6 magnitude star to blink off. This estimate was 0.5 second or less but there was no way to actually get a more precise handle on it at the time. In the above referenced ON, Roger concludes that both secondary events are due to moons. Again, I wish to point out that no such conclusion can be made unless confirmed. The term 'suspected moon' should more appropriately be used in any future publications.

As I have attempted to stress in the past, we have to be our worst critics and question our methods and resulting data. Confirmation of an asteroid satellite is a very difficult issue and best executed through the use of large ground base instruments with adaptive optics (or with a working space-based telescope). Confirmation essentially means that an asteroid satellite's orbit can be defined from observations obtained. From my point of view, there are at least two potential ways for Earth-based conventional observers to detect potentially clear evidence of a natural satellite associated with a minor planet. Considering our current technology and equipment available to most of us, the 'best' way is to co-locate two independent video systems within a very short distance of each other (1km or possibly as close as even a few meters separation). If both systems capture an occultation that is clearly determined not to be due to the primary asteroid itself, this is likely to be a satellite. However, it is NOT a confirmation. Remember, an orbit must be able to be defined in order for a suspect observation to turn into reality.

Another way is to assemble a massive team of closely spaced observers where the definition of "closely spaced" might be 5km. Most asteroid occultations involve target stars of magnitude 11. Getting a very large team organized for something like this is for the most part unrealistic and if executed, might tend to be a waste of resources (as is certainly the first method). If two or more adjacent observers simultaneously detect a secondary event, it again, is likely to present very good evidence that a satellite has been detected. The largest effort I was ever able to produce involved a grazing occultation of a reasonably bright star in Houston in the 1980's in which I was able to coerce 200 separate observers with telescopes to commit for this; the effort was set up with 300 total participants in the local area spread over a vertical region of about 5km due to the graze profile. Due to bad weather this effort ended in a huge failure as

clouds blocked the view and I never wrote up anything on it. It took months of telephone calls and constant attention to training and the individual needs of each observer to set up the plan; it is totally atypical of a normal asteroid occultation organization.

If a single observer has two video systems and is reluctant to position them significant distances apart for security or other reasons, then such a tactic might be a very practical strategy. In humid regions such as where I live in Houston, Texas, keeping dew from forming on an unattended SCT is always a challenge. Putting two systems close by would allow both to be tended to the extent necessary and achieve the objective of lying in wait for the highly remote possibility of satellite detection.

The next best plan is to anticipate a relatively bright star to be occulted near a major metropolitan area in the future and to have enough warning time to develop a large, competent observing team with as many video systems as possible. Such bright star occultations are rather rare and the best example of a successful mobilization is that of 1 Vulpeculae and (2) Pallas, observed from the southern USA in 1983. This was well before portable video systems became available and so the bulk of observations were made visually. Although 130 chords were captured during that one event, it occurred before the advent of email and the Internet. Many observers were unnecessarily clouded out. Had we had the Internet back then, many of those clouded observers could have been effectively redeployed. Since we are now able to get noticed of the following year's events about six months early, I see this as a future opportunity.

As of this writing there are about 107 known binary asteroids which have been classified by their taxonomic types. Studies have shown that there appear to be a potentially higher percentage of Near Earth Asteroids that are binary compared to other asteroid types. So, attempting to intercept a NEA would perhaps be a more productive program if it were practical from our ground perspective. The obvious problem is that predictions of occultations for such tiny bodies are notoriously uncertain. Even if they were predictable to some reasonable degree of uncertainty, their durations would be extremely short and possibly below detection of conventional video systems without LIMOVIE analysis. Visual observers would have a very minimal chance to detect such an occultation. The majority of observed and predicted asteroid occultations are those induced by the larger and better defined main belt asteroids.

Over the past 30 years, I have made more than 1,800 attempts (as of July 2007) at corralling asteroid occultations with the singular goal of satellite detection. These efforts have been made usually with a 1974 model Celestron 8 and less so with a Meade 2045D. On the order of forty percent have been clouded out. I stopped keeping track long ago but that is a good guess. My philosophy on this is that if you wait for an occultation to come near you, you will likely have cobwebs on your equipment before it happens.

The only logical approach is to go after them by land, sea or air. Some expeditions have been conducted outside the US (actually to six continents) and most of these failed--e.g. Abu Dhabi, Tanzania, Libya, Taiwan, Japan, Australia, France, Canada, Panama, Brazil (plus several cruise ships in the Caribbean)---either because of poor predictions, weather conditions or both. A few expeditions to Venezuela, Guyana, Mexico, and Canada were successful. After 2001 I added a Watech 902H (later, a PC164) and Collins I3 image intensifier, and conducted the bulk of video recordings *in situ* from Houston, looking for satellites of asteroids whose occultation paths I knew were 1000km or away more from my location. Under the best conditions I could detect a 12.5 magnitude stellar occultation. Many of my searches were, and continue to be, in connection with knowingly 'impossible' events. These I define as those main belt object occultation paths uniquely distant from Houston and small asteroid paths whose occultation probabilities were estimated as less than 10%. Those predictions were created by Andrei Plekhanov and issued through LinOccult [see ON, Vol. 12, No. 4, October 2005]. As might be expected, I have had about as much success as a taco vendor on Mercury. I have yet to detect any evidence of a secondary occultation whose causality would be other than seeing-related, system noise induced, created by cloud or other unnatural reasons. Only a few of my events have ever been analyzed with LIMOVIE. Perhaps this is a project for the future if I can ever get around to it. In the meantime I will continue the search and encourage others to do the same.

While the results described above may be discouraging to date, the presence of scores of known asteroids with satellites / binary asteroids is clear proof that 'they are out there'. The next discovery might just be made by you! ■

The Lunar Incognita

Hal Povenmire

The Moon's orbit is inclined approximately 5.5° to that of the Earth. This means that the Moon appears to rock back and forth so that we see a little around the limbs. These are called librations and they occur in both latitude and longitude. In total, about 59% of the near face of the Moon is visible at some time from some portion of the Earth.

Near the north and south poles of the Moon are areas where the features of the Moon are poorly illuminated as seen from the Earth. These are called the Cassini Third Law Areas. Near the south pole of the Moon is an area where the features are especially low and are only slightly visible during extreme librations. This area is called "The Lunar Incognita." It has been a project of the Association of Lunar and Planetary Observers and the British Astronomical Association to map this area. This area is about 270,000 square kilometers or about the size of the state of Colorado. This area comprises about 2.9% of the surface area of the Moon. This area is of special interest since limb corrections are not possible for the observation of grazing occultations. This same area contains some of the highest mountains and some of the deepest craters and valleys and is where the ice would be hidden deep in lunar valleys. The sun would likely never shine into these areas.

A lunar degree equals about 18 miles on the Earth. The Lunar Incognita covers the south pole of the Moon and extends westward and northward for approximately 900 miles. This is approximately one eighth of the way around the Moon. About every six years there is an opportunity to observe these areas. These areas are best seen when there are strong southernly and westernly librations combined.

The Galileo flyby provided some images. Some data was obtained from the Zond 8 probe. Several other spacecraft also helped.

Is there another method? Yes, the areas are not directly visible from the Earth under good lighting conditions. However, they are visible by silhouette during grazing occultations. Every grazing occultation where data can be obtained should be a high priority target. Most of the marginal areas of the Moon were mapped out by Chester Watts during the 1950's. These gave limb corrections for the grazing occultations. Some grazes occur in areas where part of the limb is mapped and the rest is not. This allows an extension of the known limb corrections into the area where no corrections are available. Transitional Cassini area grazes are especially important since grazes can easily define the elevation of the highest feature within the Cassini region.

References: (1) Watts, C.B. (1963) The Marginal Zone of the Moon (2) Povenmire, H. (1980) The Graze Observer's Handbook JSB Enterprises Indian Harbour Beach, FL (3) Westfall, John (1984) Lunar Incognita: Completing the Map of the Moon Sky and Telescope March pp.284-6. (4) Westfall, John (1991) The Lunar Incognita Project Sky and Telescope November pp. 556-9, ■

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ESOP 2007

Martina Haupt, Germany

ESOP 2007 took place on 24. and 25. August in High Tatras in Slovakia. The conference was held Stara Lesna, which is close to the city of Poprad.

Most participants arrived on Friday and met at the welcome cocktail. For those who take part for quite some time it was a chance to meet old friends.

The symposium itself took place on Saturday and Sunday morning. It was stuffed with a variety of interesting lectures. It would go beyond the scope of this report to give details of all of them. But, however, I want to mention at least some of them.

Thomas Flatres – Technical audit on a video camera (WAT LCL 902K)
Since the beginning of the nineties video cameras are used to observe occultations. Thomas Flatres tested the true exposure time, the efficiency of the camera, the effect of the gamma and effects of the CCD-matrix.
For me the last item was the most interesting. For example how big the difference is if the image of one particular star illuminates one of the light-sensitive pixels on the chip or if the small line between the pixels is illuminated, because in the case of a fainter star the image of the star is only a tiny spot, if the optics are well focused.

Also interesting was the result of the tests on the true exposure time, because after the exposure the chip has to be read out and the information has to deleted. Thomas Flatres found out, that the true exposure time is a little bit shorter than the exposure time displayed in the settings, because a part of the displayed exposure time is used to delete the information of the previous exposure.

Wolfgang Beisker – The dual wavelength IOTA occultation camera
In 2007 the he camera has been tested twice. In June at the SOAR telescope and in June at a 60cm telescope in New Zealand.
The camera has two channels, one is recording light of the wavelength from 400nm to 700nm and the second channel is recording light from 720nm to 1000nm, which is in the near infrared.

Sven Andersson/Martina Haupt - A low cost GPS-Videotimeinserter
The GPS-Videotimeinserter (VTI) is a free project. It works with a Garmin 18 LVC GPS-receiver and can therefore be used world-wide. As the VTI has been developed in Germany it works with the PAL-video-standard. If the recording device is capable of recording stereo audio signals the PPS-signal (pulse per second) and an audio comment can be recorded together with the vide signal. The current time, longitude and latitude and a command line can be displayed in the video signal and, of course, be recorded.

Sven Andersson/Konrad Guhl – Workshop (Determination of the solar diameter using data from observations of Bailey's Beads
For two thousand years it is a challenge for astronomers to measure the diameter of the sun. One of the most accurate techniques is to observe Bailey's Beads during a solar eclipse. After some basic information the method of observing Bailey's Bead during the annular solar eclipse on 3. October 2007 was shown. After that the method of data reduction and evaluation was presented. The lecture was followed by a discussion on how to observe Bailey's Beads during future solar eclipses and on the improvement of the evaluation.

Pawel Maksym – Google Maps as a tool for the organisation of excursions
If an observation is planned, for example observing a grazing occultation, up to date and detailed maps are needed to find suitable places for all stations, but sometimes such maps are not available as printed maps. If the internet is used for the coordination and communication, and it is much more convenient to use a map that is available on the

internet. In this case Google Maps is very useful, because it gives the organiser the opportunity to mark the places for the observers and to distribute the link to the overlay by email.

Mike Kretlow – A database for archiving, processing and publishing observations of occultations by asteroids.
Occultations of stars by minor planets are observed all over the world. But there is no satisfactory solution for collecting, archiving, processing and publishing the results. MPC has just started to collect this kind of data but there are only few people who have permission for data input. Observation results made available via the planoccult mailing list are collected by Eric Frappa, who publishes them on his homepage.

Mike Krelow works on a database to fix these problems. Every observer should be able to send his results to the database where they are collected, processed and archived. However, the database should not only collect the data, it also processes the information received, and last but not least there should be the possibility to search the database for information.

But ESOP is more than the Symposium. After one and a half day of interesting lectures there is an additional program with interesting excursions. I want to give at least a short summary of this years excursions.

On Sunday afternoon there was the possibility to visit the astronomical institute in Stara Lesna. There are two domes with instruments used for night-observations. Both are reflecting telescopes, one with 50cm aperture and the other one with 60cm aperture. They are used for photometrical observations of variable stars. The solar horizontal telescope, which is in another building, is now only used for testing optical equipment and for practical training of students.

On Monday morning, we had the opportunity of visiting the high altitude observatories Skalnaté Pleso and Lomnický štít. Unfortunately it was rather cloudy that morning, and it was not possible to enjoy the view, which must be picturesque if the sky is clear.

Skalnaté Pleso Observatory is situated at 1,786 m above sea level. The observatory has, in one of its two domes, a 61 cm reflecting telescope, which is equipped with a CCD camera. It is used for photometry of asteroids The second instrument, in the other dome, is a 60 cm reflecting telescope, which is equipped with a photoelectric photometer. It is used for photometry of various types of the variable stars

Lomnický štít Observatory is situated at the mountain peak, 2632 m above sea level. It is equipped with a double coronograph. One of the two identical instruments is used for observing the coronal emission lines, originating in the solar corona. The second one is used for the observation of prominences.

On Monday afternoon there was the possibility to take part in a raft down the Dunajec River. We went down a stretch of the Dunajec River, where it indicates the Polish-Slovakian border. The scenery was picturesque and everybody enjoyed the trip.

On Tuesday sightseeing was scheduled. I personally didn't take part in this tour, but I spoke to some people who did. They told me that is was interesting and that they enjoyed it.

On Wednesday there was the possibility to make a hiking tour. The mountains were within sight from our hotel, and already the view was an invitation to go there. Even though it was strenuous it was worthwhile to go for a day outdoors and to enjoy the wonderful nature of High Tatras mountains. Another good reason to go on a hiking tour was to burn at least some of the calories of all the tasty meal served during this ESOP.

Information regarding ESOP 2008 can be found online at **http://esop2008.fg-vds.de** ■

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

IOTA European Section (IOTA·ES)

Observers from Europe and the British Isles should join IOTA/ES, sending a Eurocheck for EURO 25,00 (bank-transfer-costs included) to the account IOTA/ES; Bartold-Knaust-Strasse 8; D-30459 Hannover, Germany; Postgiro Hannover 555 829-303; bank code number (Bankleitzahl) 250 100 30. Sending EURO 20 EU-members must use the IBAN- and BIC-code as additional bank-address (IBAN: DE97 2501 0030 0555 8293 03, BIC: PBNKDEFF). 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.