



Asteroidal Occultation Paths That Cross The Southwestern USA From June 30 To July 6

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ON THE COVER:

Asteroidal occultation paths that cross the southwestern USA from June 30 to July 6, 2004

Graphic courtesy of Steve Preston

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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 1 will be published in July. Please send submissions for that issue to Editor_ON@straight2you.net no later than 15 July 2004.

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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Secretary & Treasurer
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Stillwater, OK 74074 USA
Email: business@occultations.org

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

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Send Lunar Grazing Occultation reports to:

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Send interesting stories of lunar grazing occultations to:

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

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

International Lunar Occultation Centre (ILOC)
Geodesy and Geophysics Division
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Tokyo, 104-0045 Japan
Email: iloc@jodc.go.jp

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Send observations of occultations that indicate stellar duplicity to:

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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
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

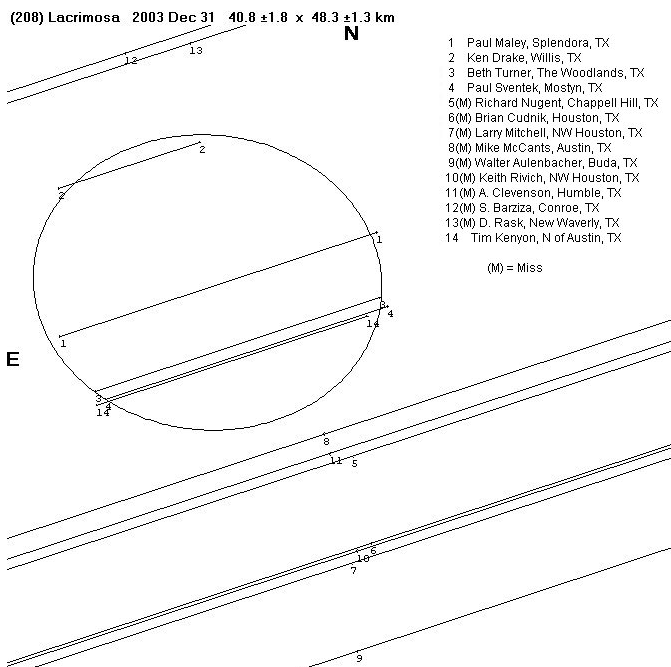
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Youngest Asteroid Occultation Observer

Richard Nugent

Executive Secretary, IOTA

Members of the International Occultation Timing Association (IOTA) know an asteroid occultation is a unique type of eclipse – when an asteroid passes directly in front of a star. Then for several seconds the star dims or completely vanishes – providing a unique opportunity for ground based observers to time this event and produce a direct size/shape profile of the asteroid. These observations are sought by IOTA for several reasons. They can provide direct size/shape profiles of the asteroids plus asteroid occultation observers are the prime contributors to the discovery of asteroid moons – whose observations go back to 1977. Asteroid occultations can be observed and recorded by amateurs using only modest equipment, a small telescope, short wave radio and/or and video system. Asteroid occultations are very elusive events, some observers have been trying for years to bag one with no luck, since many observations have been foiled by path shifts, cloudy weather and or last minute equipment problems.



Profile of 208 Lacrimosa

This past December 31, 2003, the asteroid 208 Lacrimosa was monitored by 14 observers in Texas as it drifted in front of the $m = 9.0$ star SAO 98314. Five observers had an occultation, and nine had misses. One

of the observers was 15-year old Beth Turner of The Woodlands, Texas. (30 miles north of Houston). From her driveway, Beth videorecorded a 5.03 second occultation using an 8" Meade LX-50 telescope and Supercircuits PC-164C low light video camera. Beth's chord is shown as #3 in the profile of Lacrimosa. Thanks to Beth's observation, and those of the other observers Lacrimosa's size is estimated as 40.8 x 48.3 km with an uncertainty of only 3%. This observation makes Beth the youngest ever successful asteroid occultation observer EVER !!

Beth Turner has also made 1st place finishes in the Astronomy division in the 2002 and 2003 Science and Engineering Fair located in Houston, Texas (which brings in students from a 16 County-Wide area) for her projects, "Orbital Trajectory of Saturn's Moon Titan" (2002) and "The Orbital Trajectories of Jupiter's Galilean Satellites" (2003). Beth also took the Grand Award in the 2003 Science Fair ! For 2004 Beth took 2nd Place at the Science Fair with her project, "Asteroid Occultations" and thus she qualified to attend the International Science fair Competition in Portland, Oregon, where she received:

- 1) 1st Place Award from Caltech's Jet Propulsion Laboratory plus a \$1,000 scholarship
- 2) \$20,000 scholarship to Indiana University
- 3) Special Recognition award from NASA
- 4) 4th place overall with a \$500 scholarship

Beth attends the Academy of Science and Technology at Oakridge High School in Conroe, Texas. She has plans to become an astronomer. She also plans to become a mobile occultation observer when she gets her driver's license in June 2004.

It was at the March 2002 Science Fair that her project was judged by Richard Nugent, Executive Secretary for IOTA. Nugent encouraged Turner to consider attempting occultation observations including the upcoming occultation of a 6th magnitude star by the asteroid 828 Lindemania in November of that year. Beth attempted it (she was 14 at the time) but last minute clouds/fog moving in foiled the observation. She also attempted a few other occultations from her home and again cloudy weather prevented any positive results. ■

2004 IOTA Annual Meeting Apple Valley California, July 2/3

Arrangements have now been made to hold the 2004 annual meeting of the International Occultation Timing Association (IOTA) in the Thunderbird Campus Theater of the Lewis Center for Educational Research in Apple Valley, California, on Friday July 2 and Sat. July 3 from 10 am to 5 pm, thanks to efforts by Dave Meyer and Teresa Dowd.

From June 30 to July 3, 3 asteroidal occultation paths will cross the western and central Mojave Desert, near or over Apple Valley, which is in the south-central Mojave Desert, a few miles north of Cajon Pass and about 25 miles north of San Bernardino; the nearest large airport is Ontario, Calif. The occultation on July 1, by (559) Nanon, is the best, involving an 8.6-mag. star.

Those who can stay to July 6 will have a chance also to observe an occultation of a 9.9-mag. star by (491) Carina from the southernmost part of California (San Diego - El Centro area), and if you don't mind some driving, there is also a 10.9-mag. occultation by (524) Fidelio on July 5 in northern California, near Sacramento.

Although the area is quite hot in July during the day, all of the occultations will occur during the relatively cool early morning hours. Details of the occultations can be found at <http://iota.jhuapl.edu/early304.htm>.

Dave Meyer notes that members of the High Desert Astronomical Society (HiDAS) can help us observe the occultations, including at the Luz Observatory at the Lewis Center, and short meetings to coordinate coverage of these occultations will be held the evenings before, to be arranged.

The address of the Lewis Center is 17500 Mana Rd., Apple Valley, CA 92307. ■

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

**and IOTA • ES at:
<http://www.iota-es.de>**

2004 IOTA Election Year

Richard Nugent
Executive Secretary, IOTA

This year marks an election year for IOTA Officers and Directors which is part of the official business requirement of IOTA continued status as a non profit corporation. Elections are held every 3 years.

Below is a list of the candidates who have volunteered to continue in their respective positions. Remember, these are all volunteer positions there is no compensation except for the satisfaction of making valuable scientific contributions to the field of Occultations and related fields.

All IOTA members are encouraged to cast their votes. If you would to propose a "write in" candidate for any position, feel free to do so.

Please email your ballots to the Executive Secretary, Richard Nugent at RNugent@wt.net or print this ballot and mail to:

Richard Nugent
P.O. Box 131034
Houston, Texas 77219
USA

Please get your ballots to me ASAP in time for the 2004 IOTA meeting scheduled for July 2, 2004 in California. ■

2004 IOTA Election Ballot

President: David D. Dunham

Vice President: Paul D. Maley

Executive Secretary: Richard Nugent

Secretary & Treasurer: Art Lucas

V.P. for Grazing Occultation Services: Mitsuru Soma

V.P. for Planetary Occultation Services: Jan Manek

V.P. for Lunar Occultation Services: Walt "Rob" Robinson

Editor of Occultation Newsletter: John Graves

Minutes of the 21st IOTA Annual Meeting, July 2003

Richard Nugent, Executive Secretary, IOTA

The 21st annual meeting of the International Occultation Timing Association was held Friday and Saturday July 18-19, 2003 at the Sierra College in the Science Museum Planetarium, in Rocklin, California. This location was chosen to coincide with the spectacular asteroid occultation of a $m = 6.5$ star by 1263 Varsavia the night before over the same area. The meeting location was arranged and hosted by Dave Kenyon, of the Astronomy Department at Sierra College.

Seventeen members and attendees were present at the meeting:

President David W. Dunham from Maryland, Executive Secretary Richard L. Nugent from Texas, Secretary Treasurer Art Lucas from Oklahoma, Derald and Denise Nye from Arizona, John Westfall, John Sanford, Derek C. Breit, Dave Kenyon, Ed Morana, Bob Garfinkle, Peter Dunckel, Nick Dunckel, Frank Anet, Daniel Falla and Sandy Bumgarner from California, and Stephen McCann from England

At 1:00 PM, President David Dunham opened the meeting and asked the attendees to introduce themselves. Following the introductions, Executive Secretary Richard Nugent asked the attendees to sign in to the Executive Secretary's record book which has photos and Minutes of the past meetings going back to 1998. This history file will be maintained by Nugent for IOTA history purposes.

President David Dunham briefly remarked about IOTA's history and how he has been involved in occultations for over 40 years. He purposely delayed forming any type of formal organization to avoid the paperwork and other requirements. At the University of Texas, in 1974, Dunham had assisted in occultation mailings and other occultation research and in 1975 IOTA was formed. In 1983, due to the efforts of Vice President Paul Maley, IOTA became a non-profit 501c corporation in Texas. Annual meetings were held in Texas until 1998 when newly elected Executive Secretary Richard Nugent showed that annual meetings could be held anywhere. This opened the door to have meetings near major occultation events, including the highly successful asteroid occultation of 1263 Varsavia the night before this meeting. In previous years, a triple graze was observed in the Nashville, TN area during the 1998 meeting, in 1999 the last graze of Aldebaran in the current series was observed near Denver Colorado, and in 2002 the asteroid occultation by 161 Athor was observed near Houston, Texas (however, that was fortuitous, not planned; that event occurred 3 days before the IOTA meeting and was almost 200 miles north of Houston. The 2003 meeting was the first IOTA meeting planned around an asteroid occultation). Furthermore, IOTA's non profit status allows its members in certain situations to

deduct their IOTA travel related expenses since occultation work involves extensive travel.

Secretary/Treasurer Art Lucas gave a report of IOTA's financial status.

Summary of balances are:

Starting Balance: June 18, 2002	\$6,973.05
Ending Balance: June 17, 2002	\$6,274.88
Net Reduction in Bank Balance:	\$ 698.17

Total Income	\$3,240.00
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Expenses

Printing Costs	\$1,728.90
Web Service	\$ 462.44
Mailing costs	\$1,708.98
Fees and interest	\$ 37.85

Total Costs	\$3,938.17
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The bank balances have grown over the last few years due to the slow Occultation Newsletter (ON) publication schedule. ON has been back printing again, hence the reason for the net reduction in the bank balance.

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. One member is 4 years ahead on 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. It was also stated that IOTA has many more observers than members, and Dunham commented this is fine, since IOTA's goal is to maximize observations, not membership.

Dunham reminded everyone that next year (2004) is an election year and a quick survey showed that Dunham plans to continue as President, Art Lucas said he's good for a few more years as treasurer, Richard Nugent will continue as Executive Secretary and Nugent remarked that Paul Maley would continue as Vice-President. The other vice presidents for IOTA's services will be poled to see if they are willing to serve for three more years, or would prefer someone else to perform their duties. Dunham mentioned that IOTA/ES has approximately 80-90 members.

Richard Nugent proposed that IOTA aggressively work on completing the IOTA Observer's Manual. The current IOTA

Observer's Manual was last updated in 1994 and is only available on-line in text format. Many advances in equipment and techniques have resulted in a flurry of observations not possible 10 years ago. Nugent proposed that a list of chapters be made and assigned to various IOTA members with a goal of completing the manual in a publishable format in 1 year. Wayne Warren has been working on this huge project, but his time for it has been limited and some of technical problems have not been resolved. Art Lucas mentioned that IOTA has the talent to complete this task with a variety of expertise in computing, publishing, illustrating, etc. Dunham would put this out on the IOTA e-group list and ask for volunteers.

New Business- A suggestion was made to hold next year's IOTA meeting in Oakland, California in conjunction with the meetings of the Association of Lunar and Planetary Observers (ALPO) and the Astronomical Society of the Pacific (ASP). Dunham said that he is already invited to participate in the Riverside Telescope Makers Convention next Memorial Day weekend with a theme on Occultations and Transits. This fits very well with the rare transit of Venus across the Sun one week later on June 8, the first since 1882, but the transit will not be visible from California. All of this will be considered by the officers, but since this year's meeting was held in California, it's more likely that next year's official meeting will be held elsewhere. But as long as some members are willing to do the work, we can have additional meetings in conjunction with other meetings.

With no further business, Dunham motioned that the business part of the meeting be closed, and Art Lucas made a 2nd on this motion.

Following a short break, the meeting continued with some slides of the Mars graze/partial occultation over Florida earlier in the week. Several high quality images of Mars next to the Moon were shown taken by amateurs using only modest equipment. (Curiously, this Martian partial occultation was visible over Venus and Jupiter, Florida.)

David Dunham then described his first graze predictions and attempted observations, appropriate for this first full IOTA meeting in California where grazing occultation expeditions largely began. On October 30, 1957, Dunham described the β Cap ($m = 3.0$ double star) event over the Los Angeles area, showing a map of the southern limit computed with the Occult program. On that night, from his home in La Cañada, the 15-year-old Dunham saw the star get closer and closer to the moon, and skim over the mountains above the South Pole, when he saw the $m = 6.0$ component disappear, but not the $m = 3.0$ primary. An occultation had been predicted for the "standard station" in central California, but no prediction for the Arizona station. During this occultation, he realized that he was a short distance on the wrong (south) side of the southern limit of the occultation, and that if he had been a little farther north, at the limit, the star would disappear and reappear among those southern lunar mountains. Dunham thought that it would be neat if someone would calculate

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those lines, so that one could travel to them to observe grazes, but at the time he didn't think he would ever be able to do that.

But the situation changed after Dunham took a course in solid geometry at the University of California at Berkeley. For the March 12, 1962 Aldebaran graze, Dunham was armed with sine/cosine, log tables along with a "BIG CLUNKY" Frieden calculator. He found that the path was to go just south of the San Jose area. He had a 2.4 inch telescope but not a car. He finally located a ride that Sunday evening. While being driven, he was watching the star get closer to the moon. He saw and timed the reappearance at Palo Alto, but missed timing the disappearance - he saw it from the car while crossing the Dumbarton Bridge. Time had run out on the last Aldebaran graze in the U.S.A. during that Saros (actually, Meton) 19-year cycle. But Dunham was close enough to the southern limit to see the star reappear "like a drop coming slowly out of a faucet" and realized that, with the near-grazing geometry, he had seen a gradual reappearance caused by the large angular diameter of the orange giant star.

On April 10, 1962 the 2nd graze he attempted, 64 Ori, $m = 5.2$, was predicted for nearby Concord. Dunham and members of the Walnut Creek Moonwatch Team tried to observe the graze from 4 stations but they only saw a total occultation. He showed the results to his professor, who told him that he forgot to account for the rotation of the Earth, which changes the angle of the graze on the Moon.

On September 18, 1962 Dunham made predictions of the graze of 5 Tau, $m = 4.3$. His predictions showed the graze path about 40 miles north of Los Angeles. Dunham, then in Berkeley, could not travel to see this one but he did notify several observers. One of them, Leonard Kalish, traveled from his home in L.A. to the path just north of Castaic Junction and saw several disappearances and reappearances of the star. This was Dunham's first successful graze prediction, and as far as we know, the first time ever that someone had traveled to an occultation limit and seen a graze. He had calculated that path a few weeks before with a Marchant calculator in an office in Long Beach where he had a summer job. The calculations, taking some 5-6 hours by hand, were too time-consuming. In late 1962, Dunham decided to learn FORTRAN and wrote the first graze prediction computer program.

Even in California, the weather can be cruel, and Dunham was clouded out for 5 attempted grazes in a row in 1962 and early 1963. The first graze that he observed was on March 31, 1963 of Z.C. 0881, B9, $m = 5.9$ near Roseville north of Sacramento, less than 20 miles north of our meeting location in Rocklin, but timings were not possible since the event was on the sunlit limb. It wasn't until September 9th of that year that he made his first good timings of a dark-limb graze near Davis, California. During this graze, he had recruited several observers from the Sacramento Valley Astronomical Society. Four (4) stations were set up and Dunham called out 3

disappearances and 3 reappearances with WWV also tape recorded. Art Leonard had only a one-second occultation at his location and was quite impressed with that, realizing that, if the Moon were a perfect sphere, that implied that he was only 6 inches from the northern limit!

For the graze on October 8, 1963 of η Tauri, Dunham had published the prediction in the October, 1963 Sky and Telescope issue. It is interesting to note that in 1963, Sky and Telescope had been publishing the yearly occultation supplement for standard stations for 5 years, but this was the first map published of a grazing occultation and suggesting that these events be observed. It was observed near Ft. Worth, Texas; Cincinnati, Ohio and Columbus, Ohio and this became the first published account of a grazing occultation in Sky and Telescope, December 1963, page 369. Tom Van Flandern at the US Naval Observatory saw and analyzed these results, and was amazed to find more than half a mile error in the current combination of star position, lunar ephemeris, and lunar limb data. That sparked USNO's interest in occultations, especially grazes, and Van Flandern began working with Dunham to facilitate the prediction process and obtain more graze observations.

Asteroid Occultation News - Dunham reported that a new release of OCCULT is expected next month (August 2003) and will include a new version of the XZ catalog including data from the US Naval Observatory's recently released UCAC-2 catalog.

704 Intermania – At the time, this occultation was the most widely observed event thus far this year (March 23, 2003), timed from 24 stations in Japan and Hawaii. The Varsavia event was timed from more stations, but Interamnia will result in additional chords from more careful analysis of the video records since the star was double.

Asteroid occultations are now a widely popular area for IOTA observers and Dunham demonstrated how the prediction process works:

1. Emails are sent to Ron Stone of the USNO Flagstaff Station of potentially good asteroid events that are originally predicted by Edwin Goffin of Belgium, Scott Donnell of Elbert, Colorado, and others.
2. Ron Stone uses the FASTT meridian transit instrument to update asteroid positions. He emails these position updates to Steve Preston and others around the world.
3. Preston and others use the updated positions to refine the asteroid's orbit and thus its position to predict occultations. Preston updates occultation predictions using David Herald's OCCULT program to his website, www.asteroidoccultation.com, which is also linked from the main IOTA website. Jan Manek performs similar calculations for Europe, posting them at <http://sorry.vse.cz/~ludek/mp>. John Sanford described the Starhome Observatory that he built in the dark skies of Springville, California, a small town

of about 1,500 population at an altitude of 2,200 ft. The building size is 20' x 30' and was built over a period of about 2 years. John decided on a roll-off roof due to the large size of the building. During construction, one problem he encountered was that the Contractor who laid the carpet shoved it all around the telescope pier which caused some vibrations as observers walked around the floor. He fixed the problem by using tire tread to isolate the telescope pier from the rest of the structure. John uses the observatory for Variable star observations, Public Education, "pretty pictures" and soon... occultation work.

Art Lucas presented an invited paper at the Minor Planet Workshop held in Phoenix, Arizona. His topic was the spectroscopy of Lunar Meteors. The eventual goal was to be able to acquire $m = 8$ magnitude spectra of meteors that strike the Moon and spectra of $m = 16$ asteroids. Lucas showed how he uses a diffraction grating made by Rainbow Optics to obtain spectra using an SBIG ST-8 CCD camera system on his 14" telescope. In his magnitude tests he obtained spectra on the following asteroids:

2 Vesta $m = 6.0$, @ $f/3.3$
37 Fides, $m = 10.73$, @ $f/3.3$
90 Antiope, $m = 14.27$, @ $f/3.3$, here the background star contaminated the spectrum

921 Jovita, $m = 14.4$, @ $f/10$
938 Chloisinde, $m = 15.9$, this spectrum was barely detectable.

Derald Nye briefly described his Kirmser-Wakabayashi Observatory located in Corona de Tucson, Arizona. The Observatory consists of an 18 foot 6 inch diameter dome. Derald had acquired the dome as a surplus item for a cost of only \$800 ! The building which is attached to his house cost about \$3,000 and another \$6,000 for improvements. It houses a 16" Cassegrain telescope, which also has a $f/3.8$ Newtonian focus. And to top it all off, the telescope uses a 6" $f/8$ refractor as a finderscope!

Dave Kenyon then presented an overview of Sierra College's Kenyon Astrophysical Observatory, (KAO), located at Blue Canyon at 5,400 ft. elevation in the Sierra Nevada Mountains. Constructed in 1994, it uses the commercially available Tuff Shed building to house the equipment. Current research at KAO involves the use of SBIG ST-7 CCD camera on an 8" scope to reach $m = 21$ in a 45 minute exposure. This system can obtain high-resolution spectra for use in variable star research. KAO is also involved in the NGC/IC project, which involves making corrections to position angles of galaxies.

David Dunham continued by showing the current version of his personal IOTA website and its resources. One of the many technical advances available for IOTA recently is the Global Positioning Satellite system, GPS. Despite the widespread availability of GPS, it is often still advantageous to use maps to plot graze paths. A useful tool for this work is

the Gazetteer maps which are available for most States. These accurate maps show nearly all County roads on large maps in a 15" x 11" book form at a scale of 6.3 miles per inch. This is a significantly higher resolution than the older 1° by 2° USGS (1:250,000 scale) and TPC (1:500,000 scale) charts used in the past for plotting these paths. The Gazetteers can also be used to estimate an observer's position when a GPS unit is not available for say, asteroid occultations and they include topographic information. The Gazetteers are published by Delorme, www.delorme.com.

A brief discussion followed on methods to estimate personal reaction times, a recent popular topic on the IOTA occultation e-group list. Various clever techniques have been devised by IOTA members over the years to simulate an occultation to test the personal equation and skill of potential observers. Techniques included devices such as a slide projector with a rotating wheel to allow a beam of light to pass through to using a computer program to randomly cause a dot to flash on the computer screen. These are useful for the large numbers of especially past visual observations, but now reaction time problems can be eliminated by using video recordings of occultation events with WWV or other time signals overlaid onto the video recording (with very sensitive cameras and associated equipment now a relatively small fraction of the cost of many amateur telescopes), or to use photometric methods. An example of a photometric/photoelectric recording is a light curve of the star brightness intensity plot vs. time. Accurate times can be extracted of "D" and "R" (including gradual events) by direct examination of the light curve plot (with some work, a photometric record can be made from a video recording).

Before closing the meeting for the day, Dunham reported on preliminary results of the occultation by the asteroid 1263 Varsavia from the previous night. From emails received, he reported over 30 observations had already been reported in mostly preliminary form, including those of the attendees. Attendees recording the occultation included Derald Nye (who at the time had the most westerly station), Frank Anet, Richard Nugent, Dave Kenyon, Sandy Bumgarner, and David Dunham himself including his remote station, which had no occultation, as did some of the other attendees.

Following this Varsavia report, the meeting adjourned for the day at 7:10 PM. Following this some of the attendees met in town for dinner.

Saturday, July 17, 2003

The 21st annual IOTA meeting continued at 9 AM again at the Sierra College in the Science Museum Planetarium. The discussion began with David Dunham speaking on observing occultations with video, including increasing coverage of occultation events using remote video stations.

On December 21, 2001, for the graze of t Aqr, $m = 4.0$ in Kitty Hawk, North Carolina, 4 observers produced a total of 8 stations, which included 4 remote video stations. Since it *Occultation Newsletter*, Volume 10, Number 4, October 2003

was in December, during the off season, the town was empty, so the remote unattended video stations were quite safe. During this graze, Dunham, with help from Wayne Warren, Jr., had set up his 3 remote video stations and dashed off to his last site for a visual observation, where he had already set up a telescope. But arriving there, he realized he had left the last eyepiece holder at the previous remote station and ended up observing the graze through the finderscope! Fortunately it was a $m = 4.0$ star easily seen in the finder thus usable times were obtained. The lesson learned here is that observers should carry with them as much backup equipment as possible in case of some unexpected failure. In addition to these stations, several stations, all attended, in Georgia observed the event. Some figures and an account of this graze were published in the January 2003 issue of *Sky and Telescope*.

On July 15, 2002, n Virginis, $m = 4.0$, was observed with 5 unattended video stations near Champaign, Illinois by the 26% Moon. The video stations showed several dimming/partial events on this Spectral type M0III red giant star.

The first ever remote video station for an asteroid occultation was run by David Dunham for 9 Metis on September 7, 2001 near Orland, California. The star was SAO 78349, $m = 6.0$ spectral type A2V. Dunham set up a camcorder with 50mm lens and image intensifier on a tripod and pointed it to the area of sky the target star would drift into during the occultation. He then drove some 23 miles south on Interstate 5 and video taped the event with a 5-inch telescope there, near Willows. After returning to the remote station, he saw the battery had died, but fortunately just after the occultation!! Steve Preston video taped this event from Redding, CA and had step events caused by the star's duplicity. Thus, each video station produced 2 chords, and the analysis showed Metis to be elongated in shape 240 x 122 km. Analysis of the tapes by Frank Anet and Dunham found the star components to be separated by 0.040^2 in position angle 343° . Details appear in *Sky and Telescope*, March 2002 page 97.

An important procedure when setting up remote video stations is to point the telescope at the altitude and azimuth that the target star will have at the time of the occultation an hour or two before the occultation. This can be done by finding a star field at the same declination with an R.A. 1 to 2 hours less than that of the target star, set on that field at the right time, and then let the star drift into the field during the occultation rather than use a motor driven mount. Quick polar alignments for one-time occultation events usually result in tracking errors, and these accumulate over time causing the star to drift out of the field; this technique gets around that problem. Another consideration is the difference in solar time vs., sidereal time, 10 seconds per hour, with sidereal time faster than solar time (by 4 minutes/day).

Sandy Bumgarner, gave a presentation on a technique for enhancing the sensitivity of the Supercircuits PC-164C video

camera, which is widely used in occultation work. Many attendees recalled this discussion last year in the IOTA E-Group listserve. Sandy mentioned the original idea for this modification came from Bob Frenzel of Houston (rfenzel@tycovalves.com) who explained the procedure in a PDF file.

The PC-164C camera comes from the factory with a gain 7 dB lower than the maximum available. Following the modification, the camera's sensitivity is nearly identical with that of the widely used off the shelf Watec 902H camera. Another potentially useful modification to the PC-164C camera Sandy is studying would be a shutter speed adjustment. Right now the PC-164C shutter speed is 1/60 sec ~ 1/100,000 sec automatic with no manual control. Sandy also described a new Supercircuits camera, the PC-182XS, has 600 lines of resolution vs. 420 lines for the PC-164C with the same lux rating of 0.0003. The PC-182XS currently comes in two versions – one with a micro lens attached and one with a pinhole camera lens. The latest Supercircuits catalog (#48) shows the PC-182XS weighing in at only 1 gram, compared to the 68 gram PC-164C camera. Except for afocal video, (camera held directly over the telescope eyepiece), one must remove the lens and make some sort of prime focus adapter.

Another good camera is the Mintron 12V1-EX which has sensitivity similar to that of the PC-164C, but retails for around \$350. His tests on this camera showed it to be a very well made, high quality camera. Sandy will modify your PC-164C and add a sensitivity control. He can be contacted at sandy@vbbn.com.

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.

Frank then showed example light curves of recent occultations he has analyzed with this technique:

701 Oriola – this light curve showed the Fresnel diffraction pattern effect,

3171 Wangshougan, ? Arietis, video from Steve Preston. The light curve showed “D” and “R” to be relatively instantaneous.

30 Piscium graze 11-15-02, video from Roger Venable. A small blip during one of the grazing events was seen and reported by Venable, and did show up on the Anet's light

curve profile, however Dunham thinks it is probably due to the lunar profile background and Fresnel diffraction, and not a double star event.

392 Wilhelmina, 12-27-02. This event Anet video recorded over his house in Valencia, CA.

179 Klytaemnestra, 6-8-03, Robert Jones had a 1 second event, and the resulting light curve plot showed a non-zero (negative) slope prior to and immediately after the occultation. Danny Falla asked what caused this. Anet had explained that this slope was due to statistical reasons. The short duration of frames analyzed before and after the occultation did not allow a real statistical average of the actual brightness of the target star.

David Dunham reported on some upcoming events including the favorable occultation by Titania (brightest moon of Uranus) of a $m = 10.3$ star on August 1, 2003 across North America.

Events for 2004 include:

Venus occultations of 2 stars:

February 18, mag. 8.0, Alaska and Hawaii

April 4, mag. 6.2, Mexico

Asteroid 20755 (10 km size) occults ? Auriga, $m = 4.6$, Africa/Nova Scotia to Arizona

3232 Brest April 8, 2004, $m = 6.0$ star, New York to western Ontario

1698 Christophe, November 29, $m = 6.2$ star, Baja to Carolinas,

983 Gunila, $m = 9.0$ star, January 25, 2004, Georgia to central California

559 Nanon, $m = 8.6$ star, July 1, 2004, Great Plains to southern California

914 Palisana, $m = 7.1$ star, September 12, 2004, New Jersey to Baja California

Prior to the official close of the meeting, videos were shown of the Varsavia event by David Dunham, Dave Kenyon and Richard Nugent. Nugent used the Collins I3 image intensifier and he remarked that although the intensifier wasn't needed to see the $m = 6.5$ star, he used it anyway as a crowd of several people watched. This made the disappearance and reappearance more spectacular to the onlookers. Nugent also showed a video of an occultation by 469 Argentina obtained July 7, 2003 from Central Florida. His 4" f 3.3 telescope system with video was able to resolve the target star and its companion, just 20" away.

The meeting adjourned at around 1 PM while some attendees continued discussions and later went to lunch.

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.



IOTA's Telephone Network

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