

# ECLIPSE



*The Newsletter of the Barnard-Seyfert Astronomical Society*

Celebrating our 75th Year in 2003

November 2003

## Meeting Announcement *Asteroids—Deadly Impact*

Asteroids and comets: Every year, millions of these “stray bullets” streak through the skies, and tons of small meteorites strike our planet. Some 65 million years ago, dinosaurs were wiped off the face of the Earth — in what many believe was the aftermath of a massive cosmic collision. Could something like this happen again? Scientists believe that the impact of an asteroid only a mile wide would be globally catastrophic. Join renowned geologist Eugene Shoemaker and his wife, Carolyn, who together have remapped the heavens with their discoveries of more than 30 comets and hundreds of asteroids. Now that we know what’s out there, how can we defend ourselves?

Come to the BSAS Membership meeting on November 20 at 7:30 pm at Dyer Observatory, 1000 Oman Dr. to see the National Geographic program which has been described above.

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### FROM THE PRESIDENT

Joseph M. Boyd, Jr.

In the October issue of the Eclipse, I set out some of the goals I would like to see our Society work toward and accomplish during the coming year. Several of you have responded to these goals by volunteering to work on, or even to be in charge of, some of them. There is a lot of enthusiasm among our members at this time, and I appreciate your willingness to step forward and offer to help us in specific areas.

One of our primary goals of the BSAS is outreach. Outreach consists of working with people outside of the BSAS to promote a better understanding of astronomy and to enable them to get started in amateur astronomy. It involves working with the staffs at Adventure Science Center, the Warner Parks, and the state parks such as Long Hunter by furnishing the telescopes and other equipment as well as the expertise of our members to inform the public about the various aspects of astronomy. It also involves working with schools and school groups; speaking to and working with young people such as Boy Scouts, Girl Scouts, and Civil Air Patrol cadets; and speaking to service clubs. Other opportunities will be the sidewalk astronomy as soon as we get it organized. We are already well into our outreach program, and I want to give you some examples of what we, as a Society, have been doing lately.

- Long Hunter State Park, 16 August, over 600 people
- Warner Park, 23 August, about 700 people
- Adventure Science Center, Saturday, 6 September, about 750 people
- Australia Festival/Adventure Science Center, 13 September, about 650 people
- Murfreesboro Rotary Club, presentation by Dennis Williams, 30 September, 75 people
- Sumner County After School Program, Hendersonville, 9 October, Lonnie Puterbaugh and Joe and Mary Boyd, 150 students and parents
- Percy Priest Elementary School, 16 October, Joe and Mary Boyd, 66 children and 3 adults

Although the Tennessee Star Party is primarily for those already involved in astronomy and is therefore not an outreach program per se, there were some present who were not already involved, and those would qualify for outreach, an estimated 20 or 25.

Some of our members have assisted Dyer Observatory in some of its activities, including the public nights and Music on the Mountain.

As you can see, we have been busy, but there are still great outreach opportunities available. I hope you will tell your church groups, your civic clubs, clubs your children are in, and your children’s teachers that the BSAS members are available to put on programs which can not only better inform about astronomy but also can promote an interest in science and math. When the children see a practical side to math and science, they are more interested and are more likely to want to pursue a career in science and technology.

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**FROM THE PRESIDENT**, Continued from Page 1

Even during our external activities, our committees have been working to increase our effectiveness as a Society, and to make our BSAS activities more fun for our own people. The following is an indication of the committee work that has gone on.

Long Range Planning Committee, Dennis Williams, chair, 10 September  
 Equipment & Facilities Committee, Lonnie Puterbaugh, chair, 10 September  
 Dark Sky Committee, Powell Hall, chair, 7 October  
 Mentoring Committee, JanaRuth Ford, chair, 14 October  
 Finance & Budget Committee, Bob Rice, chair, 15 October and again on 29 October

I am asking that every BSAS committee hold at least one meeting during the month of November so we can see where we have been and where we are going.

All of this activity has led to a number of new members of the BSAS. I ask each of you to introduce yourself to each of them at the next meeting and make them feel welcome. We often tend to talk only to those we already know, and thus the new people who do not know anyone else at the meeting will feel left out. Please don't let that happen. Think of how you would feel in their place.

Finally, don't forget that we are cosponsoring the Seyfert Lecture this year. The lecture will be at Vanderbilt University on 4 December. Please make your plans to attend that lecture, both because we are one of the hosts and also because it will be an interesting program. You will hear more about it at the next meeting and in the next Eclipse.

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## LUNAR ECLIPSE PROGRAM

The BSAS voted several weeks ago to cosponsor with Warner Parks a program on Saturday, 8 November, at 1000 hours. The hour long program will be at the Nature Center, on Highway 100. During this program, our members, along with the Warner Park staff, will talk to the young people about the lunar eclipse that night and about the solar system. Those who can participate are urged to call 386-3134 to let us know who and how many will be there. We need at least ten members to assist in the program.

That night we will cosponsor with Adventure Science Center and Warner Parks a public viewing of the total lunar eclipse. This will be held at the Warner Parks model airplane field which is located just off Old Hickory Boulevard between Highway 100 and Hillsboro Pike. A large crowd is expected, so we will need approximately 20 telescopes, plus additional people to help staff the BSAS booth, pass out literature, and to help explain the event to the public. Since the eclipse will already be underway when the moon rises, those who participate should plan to get set up before dark if possible. NOTE: This event was previously scheduled to be held at the Adventure Science Center, but was moved to Warner Park for better viewing early in the evening. Warm clothing, with layers to add or subtract, is recommended. If you can participate, please call 386-3134 to leave your name and the equipment you will bring. This is a fun event, and all of our members are urged to attend.

### MAGAZINE SUBSCRIPTIONS FOR BSAS MEMBERS

We are always able to accept requests for new and renewal yearly subscriptions to SKY AND TELESCOPE and ASTRONOMY from our members in good standing.

The current yearly rates are as follows:  
 SKY AND TELESCOPE: \$29.95  
 ASTRONOMY: \$29.00

Checks or Money Orders should be made out to the Barnard Seyfert Astronomical Society (BSAS) and sent to the following address:

BSAS  
 P. O. Box 150713  
 Nashville, TN 37215-0713

### DUES INFORMATION

On your Eclipse mailing label is the expiration date for your current membership in the BSAS. There will be a two month grace period before any member's name is removed from the current mailing list. You will be receiving a number of warnings informing you that your membership is expiring.

Dues are \$20.00 per year for Regular and Family memberships and \$15.00 per year for Seniors (over 60 years of age), and \$10.00 for students (under 22 years of age). Please call President, Joe Boyd, (615) 386-3134 if you have questions. Dues can be sent to:

BSAS  
 P. O. Box 150713  
 Nashville, TN 37215-0713

### THE ECLIPSE NEWSLETTER

Editor: Bill Griswold  
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Logo Photograph:  
 Francisco Diego

## Happy Birthday Vesto M. Slipher

by Robin Byrne

This month we honor a man whose pioneering work in astrophysics laid the foundation of modern astronomy. Vesto Melvin, "V. M.", Slipher was born in Mulberry, Indiana on November 11, 1875. He attended Indiana University and graduated with a Bachelor of Science degree in 1902. Upon graduation, he was asked by Percival Lowell to come work at Lowell Observatory in Flagstaff, Arizona. While working at the observatory, Slipher finished his Master of Arts degree and Ph.D. in astronomy, both from Indiana University.

Slipher's early work concerned taking spectra of the planets. Spectroscopy involves taking the light from an object and, by means of a prism or diffraction grating, dividing it into its constituent colors, or wavelengths, of light. Analysis of a spectrum can lead to an understanding of an object's composition, as well as, its motion. One of the planets observed in this way was Venus. Due to its thick cloud cover, determining the rotation rate of this planet was very difficult. From 26 spectral observations of Venus, Slipher deduced a rotation rate that was finally confirmed in the 1960's, using radar techniques. He used a similar technique to determine the rotation rates of Mars, Jupiter, Saturn and Uranus. While studying the spectrum of Jupiter, Slipher also discovered that the atmosphere of this planet contained traces of iron and copper. In 1933, Slipher received the Gold Medal from the Royal Astronomical Society for his work on planetary spectroscopy.

Another area of spectroscopic work that Slipher worked on concerned the nebulous material observed around the stars in the Pleiades star cluster. Slipher found that the spectrum of the nebulosity and of the stars were identical. This led him to conclude that the nebula was shining not by its own light, but by reflected light from the stars in the cluster. He also was the first to discover that there existed gas and dust throughout the galaxy, between the stars. The discovery of the interstellar medium would allow astronomers to compensate for its dimming effect when observing distant objects.

In 1912, Slipher turned his spectroscopic observations to another celestial object - the Andromeda Nebula, as it was known at that time. From this work, Slipher found that this nebula was moving toward the solar system with a speed of 300 km/s (over 670,000 mph). By 1925, he had measured and catalogued the velocity of most of the known 44 spiral nebulae. Since many of these objects were very faint, this process required very long exposures of the photographic film, up to 80 hours in some cases. All showed speeds as amazingly fast as Andromeda. Slipher decided that nothing could remain a part of the Milky Way galaxy if it was moving with such high speeds, so these objects must be outside of our galaxy. His findings convinced many astronomers, including Heber Curtis and Edwin Hubble, that there were "island universes" beyond the Milky Way. This early work of Slipher's ultimately led to Hubble discovering the expansion of the universe.

After the death of Percival Lowell in 1916, Slipher was made acting director of the observatory. He held this post until 1926, when he became the official director of Lowell Observatory. He held this post until he retired in 1952. One of the major events that occurred under his directorship was the search for Planet X begun by Lowell himself. To help with this project, Slipher hired a young Kansas farm boy named Clyde Tombaugh in 1929. Tombaugh would successfully discover the planet Pluto the following year.

V. M. Slipher died November 8, 1969 in Flagstaff, Arizona. From planets, to interstellar gas and dust, all the way out to galaxies beyond the Milky Way, Vesto Slipher observed and studied it all. I cannot think of any other single astronomer whose career spanned such a wide range of objects, and who made such significant discoveries in each area. The world of astronomy owes much to this month's honoree: Vesto Melvin Slipher.

### References:

The Bruce Medalists: V. M. Slipher Web Page <http://www.phys-astro.sonoma.edu/BruceMedalists/Slipher/>  
The Lake County Astronomical Society Astronomy Bio by Jay Bitterman <http://www.bpccs.com/lcas/Articles/slipher.htm>

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## SYMPATHY

The sympathy of our members is extended to Lloyd and Kathy Watkins on the death of Lloyd's father, Ernie Watkins of Rockwood, Tennessee, who died on 17 October. In addition to Lloyd, he is survived by his widow, Bobbie Watkins of Rockwood, and several other children. Lloyd and Kathy have been faithful members of the BSAS for many years.

**Diamond in the Rings****By Lonnie Puterbaugh**

During the night of November 14-15 (that's a Friday night/Saturday morning folks!), a somewhat unusual astronomical event will occur. Saturn will overtake an 8<sup>th</sup> magnitude star and will occult it with both its rings and the main body of the planet. The occultation will begin at approximately 11:20pm local time. There is an article about this event in the November issue of Astronomy magazine on pages 76-77. A second opportunity will occur later in the month, but it won't be as good as the first and it will occur on a less opportune Monday night/Tuesday morning. Here's some questions and answers I thought many of you might have:

**Q:** With all the stars out there, doesn't this happen every night?

**A:** While the gas giants do occult stars on a regular basis, the stars aren't usually this bright. The next occurrence of a 6<sup>th</sup> magnitude star being occulted by Saturn's rings is on April 7, 2032.

**Q:** What's so special about a star getting hidden by a bright planet?

**A:** This is different than a simple occultation by a main planet body. The best part of this event will be the possibility for wild fluctuations in the brightness of the star when it gets behind the sparse C-ring. This ring is not easily visible in amateur telescopes. Other possibilities for some excitement will be when the star passes through the Encke Gap and the Cassini Division, which are not really empty space.

**Q:** Do I need a telescope for this event and which ones are best to use?

**A:** Yes a telescope will be necessary to see most of this event. Binoculars are capable of both observing the star and watching it disappear, but they will not show any detail. Larger scopes that track the sky will be best for this event (over 8"), but smaller scopes will still enjoy the visual effects of the star's variability. High magnifications of 40X-50X/inch of aperture (up to 200X for a 4" telescope) will show the most detail if the atmosphere cooperates.

**Q:** How long will this occultation take place?

**A:** I would plan on spending at least 2.5 hours (from 2300 to 0130) on this event. The star will pass behind Saturn about two hours after entering the A-ring. It will reappear on the other side of Saturn around 0430 (for the more hardcore amateurs). The star will still be in the rings when the sun starts to rise in the east, but Saturn will be high enough to track for quite awhile after sunrise. If we're still awake, this will give us a chance to see if the video cameras can get to 8+ magnitude in daylight. I haven't tried anything beyond about 6<sup>th</sup> magnitude so far.

**Q:** Can I take pictures of the occultation?

**A:** While still images capable of at least 9<sup>th</sup> magnitude will certainly show the "diamond in the rings", video will best display the variability of the star throughout the occultation. I hope to run at least two video cameras and recorders for this "live" event myself and Dennis Williams will put his fine video setup to work also.

**Q:** Will the BSAS meet as a club for this event?

**A:** Weather permitting, Dennis Williams and I were already planning on meeting in my driveway to record this event with a 10" SCT, 11" SCT, and possibly even a 16" Newt. We will be operating at magnifications in excess of 500X with the cameras. We are planning an all-night session if the weather cooperates. I simply have too much equipment to try and take anywhere else and keeping it heated would be near impossible. I will open up the event to the first 25 BSAS members who respond that they would like to attend. I have to limit the number of attendees for logistical reasons. There is plenty of parking in my large cul-de-sac. Extra telescopes are always welcome, but please realize that this is not a dark-sky site and you don't have to bring a telescope to participate. This occultation will be very visible with eyepieces from my location, but I've never seen the Milky Way from my home, so don't plan on doing too much deep-sky work visually. Dress appropriately, but the temperature in my "Garage Observatory—version 4.2" should be over 60°F even if it's very cold outside. Hot chocolate and hot-spiced cider will be provided. Bring your own lawn chair and some munchies to share. Tables will be setup inside the heated garage.

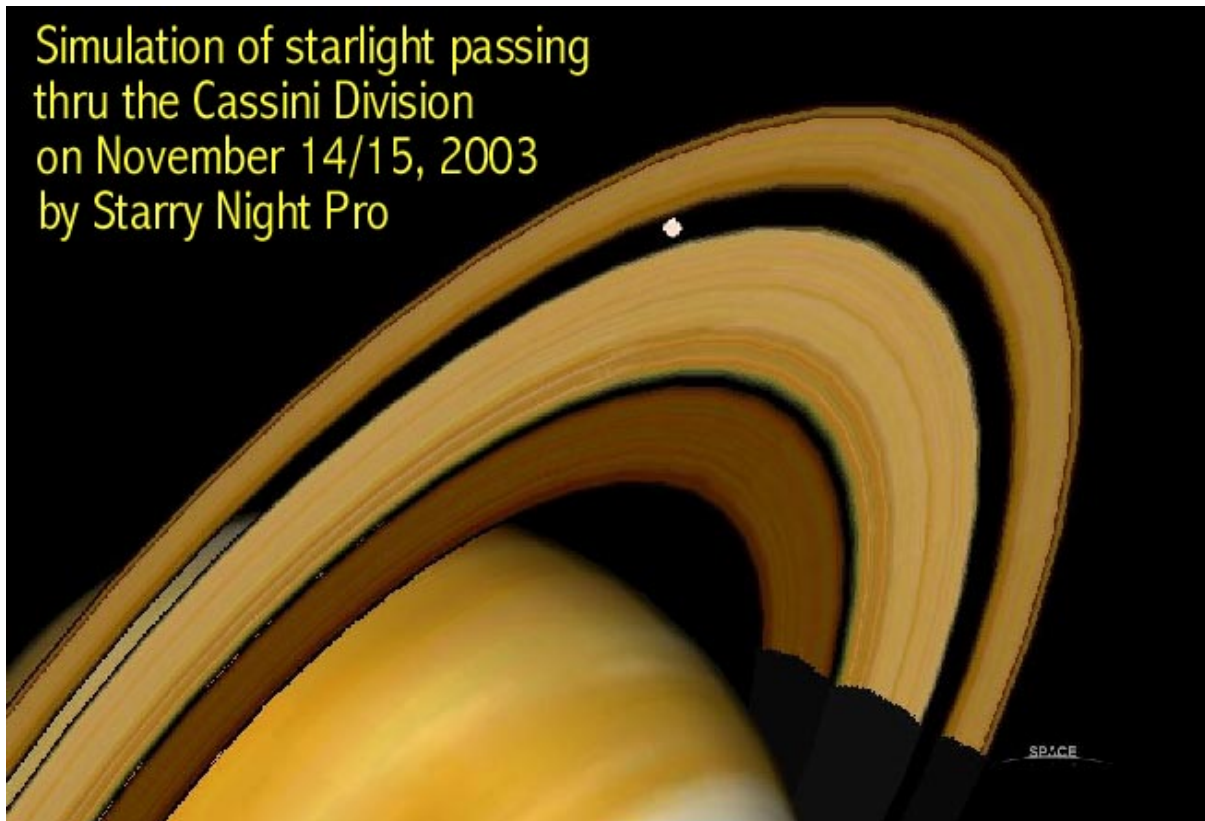
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**Diamond in the Rings**, Continued from Page 4

Everyone will be able to watch via several monitors ranging from 15" to 32". Weather cancellations will be made via the Yahoo tnastronomy website. I can be contacted via phone at 615-661-9540.

If you've ever thought of creating your own home observatory and have an extra single-car garage bay, you may want to attend to get some ideas. My garage observatory is the single most used piece of astronomy gear I have and it didn't cost a lot to convert.



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**MEETING LOCATIONS**

All BSAS members are reminded that the November membership meeting will be held at the Dyer Observatory, but the December, January, and February meetings will be held at the Adventure Science Center. The meetings start at 7:30 P.M.

**Regular Meeting of the Barnard-Seyfert Astronomical Society  
Board of Directors on October 2, 2003**

The regular monthly meeting of the Barnard-Seyfert Astronomical Society's Board of Directors was called to order by President Joe Boyd at 7:30 PM on Thursday October 2, 2003 at the Jefferson Square Clubhouse. A quorum was present consisting of board members Joe Boyd, Jill Thompson, Jana Ruth Ford, Kris McCall, Bill Griswold, Mike Benson, and Lonnie Puterbaugh. Board member John Harrington arrived later. The guests present were Bob Rice, Rocky Alvey, Mike Green, Lloyd Watkins, and Kathy Watkins. All are BSAS members. The minutes of the September board meeting were approved as presented. There was no treasurer's from Lonnie Puterbaugh as he had not received the paperwork from the previous treasurer at meeting time. Arrangements were being made for A.G. Kasselberg and Lonnie to meet to exchange materials.

Lonnie announced that Bill Collins donated a 4 Ω" telescope to the club but that it needs a tripod. He recommends converting it to a dob if the go-to mount doesn't work.

Bob Rice announced that there would be a Finance & Budget Committee meeting on the following Thursday. However, this was later rescheduled to accommodate the public outreach in Hendersonville for about 100 students and parents as part of the "Lights On After School" Program that evening. This activity was approved later in the meeting. It was noted that the fiscal year begins 1 November.

Janaruth Ford announced that the Mentoring Committee would meet the following week, with the time to be announced later. She also announced that she has been invited to teach an adult continuing education class on astronomy. The class will have 3 to 6 sessions and will be in Green Hills.

John Green asked if there was a list of club resources available, such as who was willing to do what. Joe Boyd recommended that the best way to get that information was to address his Outreach Committee members. Janaruth will keep in close contact with John so that the activities of their two committees don't overlap. Kris McCall and Lonnie Puterbaugh both expressed an interest in being on the Outreach Committee.

Lloyd Watkins reported on the Tennessee Star Party (TNSP) 2003. He thanked Kathy Watkins for all of her hard work, and especially for spending so much time at the registration desk. He also mentioned that Kris McCall's Skylab presentations were excellent and that Greg Selah's Fall Messier Marathon was very enjoyable as well. Lloyd estimated that the profit was approximately \$2100, which is about 3 times what was earned last year. He also stated that he and Rocky were willing to continue handling the Star Party if the club agreed.

Joe requested that Janaruth, Lonnie, John Green, and Kris McCall meet and draw up a schedule of events to present to the membership. They will coordinate people and determine who will participate in each event. In regard to the "Lights On After School" Program at Hendersonville, there was a consensus that the BSAS should include this as a club project. With objection, this was approved.

Because of an unpleasant e-mail message received by Nancy Dwyer at Dyer Observatory from a BSAS member, Rocky Alvey wished to address some of the ill will that seems to have arisen between Dyer Observatory and the BSAS. There was a lengthy discussion on what had happened and what could be done. John Harrington suggested that a list be drawn up detailing what the BSAS could do to help Rocky before, during, and after meetings. John will be in charge of drafting protocols and will forward it to Rocky and other Board members for revisions.

Lonnie Puterbaugh announced that there would be a Saturn Occultation on 14 November and suggested an all night event for club members. Kris McCall offered to host the event at the Adventure Science Center. Mike Benson moved to approve this as a private club activity. Janaruth seconded the motion. The motion passes unanimously.

Joe Boyd recommended reviewing the TNSP 2004 contract with Camp Nakanawa in order to make various changes. Bill Griswold moved that September 17, 18, and 19 be selected as the 2004 dates for the Tennessee Star Party. Mike Benson seconded the motion. The motion passed unanimously. Kris McCall moved to approve the TNSP contract with Camp Nakanawa after any necessary changes had been made and approved by John Harrington. Mike Benson seconded the motion. The motion passed unanimously. Joe asked Lloyd to be chair of the TNSP for the next year and requested that he select a co-chair. He also requested that Lloyd select certain people to train in order to have a number of people who are able to plan the event. It was also discussed that there should be subcommittee chairs set up in the next few months. John Green agreed to act as treasurer for the TNSP. Lloyd expressed the desire to have some independence in the way the TNSP will be planned.

Upon Kris McCall's inquiry, it was stated that there are no plans at this time to hold a telescope clinic. Various people present indicated that it was a good idea, but no definite plans were made.

With no objection, Joe Boyd declared the meeting adjourned at 10:00 PM.

Respectfully submitted,  
Jill Thompson, Secretary

## Minutes for Barnard-Seyfert Astronomical Society Monthly Membership Meeting on Thursday, October 16, 2003

The monthly membership meeting was called to order by Joe Boyd at 7:35 P.M. in the library of Dyer Observatory, with an introduction of visitors. Treasurer Lonnie Puterbaugh introduced the speaker for the evening. Dr. David Fields, from Tamke-Allan Observatory at Roane State Community College, spoke about activities and plans at the observatory. He invites BSAS members to visit the dome some time in the future. His presentation ended at 8:30 P.M. Joe Boyd recognized Mary Watson, who accompanied Dr. Fields on the visit and is one of the astronomers working at Tamke-Allan.

Shortly after, the minutes of the previous meeting were approved as presented. Joe Boyd briefly discussed Rocky Alvey's comments from the last Board of Director's meeting and asked all present to put up chairs and straighten the room at the end of the meeting. He announced that the public outreach programs on August 16 at Long Hunter State Park, on August 23 and September 11 at Warner Park, on September 6 at the Adventure Science Center, and on October 6 in Sumner County had been very successful and greeted enthusiastically by the public. He strongly supported the idea of doing more outreach. Joe also announced the committee meetings that had taken place recently. The Long-Range Planning Committee and the Equipment Committee met jointly on September 10. The Dark-sky Committee met on October 7. The Mentoring Committee met on October 14, and the Finance & Budget Committee met on October 16. Joe re-emphasized the necessity of having regular committee meetings and keeping accurate records.

Joe also explained that there had been a problem getting the paper form of the Eclipse printed, so they were mailed late this month. He and Mary Boyd just finished mailing them on Wednesday, 15 October.

In addition, he announced that the BSAS financial records had been given to, Lonnie Puterbaugh, the new treasurer. Lonnie had not had enough time to prepare a report, so there was not a treasurer's report this evening.

Lloyd Watkins reported in the TNSP 2003. He stated that there had been a few things that were done differently this year, such as having a round table of astronomers for a question and answer session. Overall it had been very successful and he thanked the volunteers. The dates for the next TNSP are 17, 18, and 19 September, 2004 at Camp Nakanawa.

Janaruth Ford indicated that she would submit a written report on the activities of the Mentoring Committee.

Joe Boyd asked for volunteers for two upcoming events. The BSAS will have representatives at Warner Park on Saturday, 8 November (10:00 A.M. – 11:00 A.M and 5:00 P.M. – 8:00 P.M.) for the total lunar eclipse and Saturday, 13 December (7:30 P.M. – 9:30 P.M.) for Saturn and the Geminid meteor shower. A sign-up sheet was passed around among those present.

Lonnie Puterbaugh announced that there would be a private star party for BSAS members at his house on Friday, 14 November. There will be an occultation of a star by Saturn. The occultation (Diamond in the Rings) will begin about 11:30 P.M. and continue through the night. However, members are invited as early as 8:30 to star gazing and deep sky work. Lonnie may try to image Einstein's Cross and Anky's Comet (???)?. Because space is limited, only 25 people will be able to participate. Interested individuals must contact Lonnie as soon as possible.

Joe Boyd announced that the nametags for the club are still missing and he requested that members try to locate them. If they are not located by the end of the week, the club will have to replace them.

Joe announced that there would be a brief special meeting of the Board of Directors immediately following the membership meeting. With no objections, the meeting was adjourned at 9:02 P.M.

Respectfully submitted,  
Jill Thompson, Secretary

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## MEETING NOTICES

The Dark Sky Committee, Powell Hall, chair, will meet on Tuesday, 4 November, at McKendree Tower on Lebanon Pike, at 7:30 P.M. Please note that this is a change of meeting time.

The Equipment and Facilities Committee, Lonnie Puterbaugh, chair, will meet on 12 November, at 7:30 P.M., at Jefferson Square Club House, 5039 Hillsboro Pike.

The BSAS Board of Directors will meet on Thursday, 6 November, at Jefferson Square Club House, 5039 Hillsboro Pike, at 7:30 P.M.

**Activities and Events**

November 1 - November 30, 2003

11/1 Conj., Moon & Neptune  
 11/2 Conj., Moon & Uranus  
 11/3 Conj., Moon & Mars; Taurid meteors  
 11/4 & 5 Taurid meteors  
 11/8 FULL MOON, penumbral lunar eclipse, star party at Warner Park, Airplane field.  
 11/10 Conj., Venus & Antares  
 11/13 Conj., Moon & Saturn  
 11/16 LAST QUARTER  
 11/18 Conj., Moon & Jupiter; Leonid meteors  
 11/20 BSAS meeting, 7:30 pm at Dyer Observatory  
 11/22 Private Star Party, Natchez Trace site  
 11/23 NEW MOON; total solar eclipse, not visible in U. S. or Canada  
 11/24 Conj., Moon & Mercury  
 11/25 Conj., Moon & Venus  
 11/27 THANKSGIVING DAY  
 11/29 Conj., Moon & Neptune  
 11/30 FIRST QUARTER

**December 1 - December 31, 2003**

12/1 Conj., Moon & Mars  
 12/4 Board meeting, 7:30 p. m.  
 12/8 FULL MOON  
 12/9 Mercury, gr. elong. e. (evening star)  
 12/10 Conj., Moon & Saturn  
 12/12 Conj., Pluto & Sun  
 12/13 Public Star Party, Edwin Warner Park's model airplane field; Geminid meteors  
 12/15 Conj., Moon & Jupiter  
 12/16 LAST QUARTER  
 12/18 BSAS COVERED-DISH DINNER, 6:30 p. m. at Adventure Science Center  
 12/22 Winter solstice  
 12/23 NEW MOON  
 12/25 CHRISTMAS DAY; Conj., Moon & Neptune; Moon & Venus  
 12/26 Mercury in inferior conjunction  
 12/27 Conj., Moon & Uranus  
 12/30 FIRST QUARTER; conj., Moon & Mars; Moon & Neptune  
 12/31 Saturn at opposition.

**BSAS****P. O. Box 150713****Nashville, TN 37215-0713**