



ECLIPSE



The Newsletter of the Barnard-Seyfert Astronomical Society

Celebrating our 76th Year

April 2005

Membership meeting, April , 21, 2005 Adventure Science Center, 7:30 pm

The speaker at the April meeting of BSAS will be Mike Benson, who will discuss the Astronomical League and the benefits which our club and its members derive from belonging to the national organization. Among the topics will be the various observing clubs and insurance.

In addition he will briefly highlight his recent trip to New York City which included a visit to The American Museum of Natural History's, Rose Center for Earth and Space. The new, state-of-the-art Hayden Planetarium is a part of the Rose Center.

FROM THE PRESIDENT

By John Harrington

For this month's column, I thought you might like to hear the experiences of a totally non-tech-savvy amateur astronomer (i.e., me) as he learns the basics of webcam astrophotography. I would point out that I've been a "Dob guy" for years, enjoying the elegant simplicity of the Dobsonian design. But the phenomenal images that so many amateurs are beginning to produce finally tempted me to begin inching my way up the learning curve of astrophotography.

Why webcam-based imaging, you ask? A few simple answers: (i) it's cheap, (ii) webcams are excellent for imaging planets (my favorite objects) and (iii) did I mention it's cheap? I purchased a used Connectix QuickCam 3000 with a 1.25" adapter for a grand total of \$75. Since I already had a Dob, a basic laptop, and an equatorial tracking table (made by Johnsonian, just like the two loaners available to you from the BSAS) I was set to go. Those of you with computerized Cassegrain telescopes (like the ETX® and NexStar® lines) already have clock drives and so can dispense with an equatorial table.

But like anyone new to astrophotography, I made my share of mistakes, so let me just list the few basic rules I've learned before you actually try to image anything:

- First, download the drivers and other software for the camera to your laptop computer (they probably came on a CD with our camera). Then, **READ THE WEBCAM DIRECTIONS!!!** It's important to know exactly how to adjust your camera's settings for things like "gamma" (length of exposure, basically) and contrast, as well as the size in pixels of the images taken by your webcam. What I didn't realize when I started (but do now) is that you'll probably want to substantially shorten the default exposures taken by your webcam, since planets tend to be quite bright. You'll have to experiment with the contrast setting, but the factory default may be OK. And you'll want to increase the size in pixels of the images you take and playback to 480x640. There should be an icon marked "camera controls" or something similar when you open the camera's imaging software. The icon in my Logitech® software was well-hidden behind an unmarked icon—mousing over the icon finally showed that it was the "change camera settings" control.
- The next thing to do before attempting webcam astrophotography is to download a copy of RegiStax 3 shareware. RegiStax 3 is a very powerful program that not only takes your dozens or hundreds of webcam images and digitally aligns and stacks them (greatly improving the image quality), but can also adjust image contrast and brightness. There are even powerful "wavelet filters" that can remove much of the blurriness of most astrophotos. You can download a copy at <http://registax.astronomy.net/>
- Once you've done the above, the next important rule is simply this: set up all your equipment in daylight! This took me about 25 minutes the first time, but should be do-able in more like 10-15 minutes once you've gotten practice at it. By setting up in daylight, you can more easily see to plug in the various small connectors to laptops, telescope drives and webcams. Plus you'll have time for your telescope's optics to adjust to the ambient temperature (and to collimate and polar align your 'scope).

So, did I do all of that prior to trying webcam photography? Of course not—but I wish I had! Following these directions will save you time, I promise.

OK, enough preparation you say: how do I actually take an image of something??? My advice is simply to aim your scope at the moon, if available, or any other bright astronomical object (NOT the sun, unless appropriately filtered). Use a low-power eyepiece and make sure the object is centered in the 'scope's field of view. Then remove the eyepiece and insert a Barlow lens and then your webcam (I'm assuming that you've attached a 1.25" adapter to your webcam so it'll fit in your eyepiece holder). The Barlow will bring the image to focus for the webcam.

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Next, simply open your webcam's imaging software and then click on whatever option that looks like an order to prepare to begin recording video. You should see a nice dark square—this is the image display box. If your webcam's factory settings are still in place, remember that you'll need to adjust them to use a 480x640 display and to reduce the "gamma" setting. And why reduce the gamma setting? Take it from me, it's much better to stack a bunch of underexposed (dim) webcam frame, than to try stacking a bunch of way-overexposed frames! Adjust your 'scope's focus so that the webcam image is as sharp as possible.

Alright, the moment of truth: if you can see your selected celestial object on your laptop and if the image isn't too bright, try waiting until the image settles down for a moment and then click on the "record video" icon. You don't want to record more than a few seconds' worth of video—you're collecting up to 30 video frames per second, and the video file size grows very quickly. If your camera software gives you the option, tell it to save the video as an .AVI file and not as a JPEG or other compressed file (compression reduces quality).

OK, so now you've got some video images of your object. Click on the webcam software's "playback video" or similar icon—you should now be treated to a replay of the video you've just taken. This is very cool if, like me, you're used to waiting days for so-so (at best) 35mm astrophotos to come back from the store. But wait, there's more—

Open your "RegiStax" software and click on the "Select" button at the top of the frame. Select the video file you've just taken and press the "Open" button. Next, take your cursor over the video image, and a box will appear (you can adjust the size of the box by choosing 32, 64 or 128—size it to fit snugly around your object). Place that box over the image of your celestial object and click on the object. Then, hit the "Align" command at the top right of your screen. Here's the truly amazing part—RegiStax 3 automatically begins aligning all the images of your object and then optimizes and stacks all of the images in your video file, eventually producing a relatively sharp composite image with much of the distortion produced by poor seeing subtracted!

In other words, folks, you get much of the benefit produced by fancy, professional observatory adaptive optics, without spending a few million bucks in the process! This means that you can take planetary images that are superior to anything the professional observatories produced (using photographic plates) through the mid-1970s.

But wait, there's still more: once you've got your nice aligned, optimized and stacked image, try clicking on the "Wavelet" icon. You'll see a bunch of wavelet filter sliders on the left side of your screen. The frequency portion of the image being adjusted increases with as you go up through the layers (1 through 6). Layer #1 produces the most dramatic results, but try not to overadjust that filter; instead, try moving the sliders for layers #2 and #3. You'll see much of the same sharpening effect, but it will be more gradual and easier to control. Keep experimenting.

OK, one last set of options. Look to the right side of your screen and you'll see buttons for "wavelet," "RGB Shift" and "Histogram." All of these can produce subtle or profound changes to your image, but you'll have to experiment with these on your own to see what settings work best for you. Below those buttons, you'll see two others labeled "contrast" and "gamma." Try experimenting with the contrast commands—they are very powerful. By clicking and dragging the contrast and brightness sliders, you can bring out faint detail like gaps in Saturn's rings. Next, click on the "gamma" button. You'll see a nifty-looking chart with a line going diagonally through it. Try clicking and dragging on the small red circle in the middle of that line, and watch the brightness levels of your image change! When you've got the image you want, remember to hit the "Save" command.

That's about as far as I've gotten with imaging and processing to date. And besides, I'm out of room in this column. But take a look at the Saturn image below, produced after only two nights of trying! The bi-colored aspect of the rings (bluish on one side, slightly reddish on the other) is real but not well understood by astronomers. If I can do this, so can each of you. Clear skies, everyone.



Happy Birthday Hubble Space Telescope

by Robin Byrne

This month we celebrate the life of one of the most significant pieces of equipment ever to, literally, grace the skies. The idea of an orbiting telescope is not a new one. In 1923, Herman Oberth, the German rocket engineer, proposed putting a telescope in orbit to avoid the distorting effects of Earth's atmosphere. Lyman Spitzer was also a strong proponent of a space telescope, and spent nearly 30 years trying to make it a reality. By the 1970's NASA and the European Space Agency began to seriously consider such an undertaking. Funding was established in 1977 for a 2.4 meter telescope. By 1981, the grinding of the primary mirror was complete. A launch aboard the space shuttle was scheduled for 1986, but was delayed due to the grounding of the shuttle fleet after the Challenger explosion. The Hubble Space Telescope was finally carried to orbit April 25, 1990 aboard the shuttle Discovery.

Named for Edwin Hubble, the astronomer responsible for discovering that galaxies exist beyond the Milky Way and the expansion of the universe, the Hubble Space Telescope is roughly the size of a school bus and weighs over 20,000 pounds. Orbiting at an altitude of over 300 miles, Hubble circles the Earth once every 97 minutes. Hubble is equipped with CCD detectors able to observe from the near ultraviolet part of the spectrum, through all optical wavelengths, and partly into the infrared. Using gyroscopes to point and steady the entire system, Hubble has a pointing accuracy of 7/1000 th of an arcsecond.

The Hubble Space Telescope has a primary mirror 2.4 meters wide, and a secondary that is 12 inches wide. The grinding of the mirrors was intended to be so accurate that if the mirror were scaled up to the size of Earth, the largest bump would only be 6 inches tall. However, within 2 months of launch, it was realized that there was a flaw in the primary mirror: by less than the width of a human hair, the edges were too flat. Initial images were computer manipulated to allow astronomers to still achieve superb results. In December of 1993, during the first repair mission carried out by astronauts, corrective optics were installed to allow Hubble to perform at its maximum capabilities. With servicing missions always intended for Hubble, a total of 4 missions have been performed, allowing periodic replacements of the vital pointing gyroscopes and installation of improved detectors.

Hubble's primary mission was to carry on in the footsteps of its namesake by measuring the age and size of our universe, observe the evolution of galaxies, and to study all objects in our solar system and beyond with an unprecedented degree of detail. Among the major achievements of Hubble are: two Hubble Deep Field images, proof that quasars are inside of galaxies, measurement of the expansion of the universe, and proof that gamma ray bursts originate in galaxies.

Another repair mission of Hubble was planned for 2006, which would have prolonged the telescope's life to at least 2011. However, an announcement made in February of this year stated that there will be no more repair missions. In the wake of the Columbia accident, things have changed. The new safety protocols require some way of saving astronauts, should the shuttle be damaged. A mission to Hubble would be unable to reach the International Space Station (which would be able to safely return crew members to Earth with their emergency Soyuz capsule). The only other option would be to have a second shuttle prepared to launch a rescue mission, and to develop a wide new range of emergency procedures. The decision was made that this would cost too much, especially since the plan is to eventually retire the shuttle fleet, once the International Space Station construction is complete, and to focus more attention on future missions to the Moon or Mars.

No one knows how much longer we will have this workhorse of the astronomical community available. Once the gyroscopes begin to fail, Hubble will be de-orbited in such a way that it will mostly burn up in our atmosphere and, whatever pieces survive reentry, will land in one of the oceans. For 15 years Hubble has provided some of the most beautiful and scientifically rich images ever seen. When that ends, the world will be a poorer place indeed. Let's hope that with the limited time left, we will make the most of this invaluable telescope.

References: HubbleSite <http://hubblesite.org>

ESA Science & Technology <http://sci.esa.int>

NASA Cancels Shuttle Mission to Service Hubble by Robert Roy Britt and Brian Berger for Space.com http://www.space.com/scienceastronomy/hubble_service_040116.html

**Barnard-Seyfert Astronomical Society
Minutes of a Regular Meeting of the Board of Directors
Held On Thursday, March 3, 2005**

The board of Directors of the Barnard-Seyfert Astronomical Society met in regular session at the Jefferson Square Club House in Nashville, Tennessee on March 3, 2005. A sign-in sheet was circulated in lieu of a roll call. President John Harrington declared a quorum to be present and called the meeting to order at 7:41 P.M. Board members Mike Benson, Joe Boyd, Tony Campbell, Bill Griswold, John Harrington, Kris McCall, Bob Rice, and Pam Thomas were present. Board members JanaRuth Ford, Randy Smith, and Gary Wilkerson were absent. In addition to members of the board, BSAS Equipment Committee member Keith Burneson and Equipment Committee Chair Lonnie Puterbaugh were also present. The minutes of the previous regular board meeting held on February 3, 2005 were approved as published in the March 2005 issue of the *Eclipse* newsletter.

John Harrington, reporting for Dark Sky Committee Chair Powell Hall, announced that this committee met on Tuesday, March 1. Mr. Harrington also announced that Glen Johnson from the International Dark-Sky Association would make a presentation at the Adventure Science Center (ASC) for Astronomy Day on April 16, 2005.

Equipment Committee Chair Lonnie Puterbaugh announced that the BSAS' traveling display has been completely updated. In addition to current information about the BSAS' website, advantages of membership, and the loaner scope program, new photos can be easily attached with Velcro. Mr. Puterbaugh commented that displayed details were saved in PowerPoint to facilitate media reproduction and future updates. Mr. Puterbaugh stated that the display would be ready for presentation at the ASC for Astronomy Day. He also announced that the Equipment Committee would buy a fluid-head video mount for the Society's newly acquired PST loaner scope and that the new six inch Dobsonian would be assembled soon.

John Harrington thanked Vice-President Pam Thomas for ably conducting the February 17 membership meeting during his absence. Mr. Harrington, reporting for Treasurer Randy Smith, announced that the BSAS' checking account balance was still approximately \$6,000.00. Joe Boyd reported that the Long Range Planning Committee would next meet on April 12, 2005.

John Harrington, reporting for Presentations Committee Chair JanaRuth Ford, announced that Mike Benson would make a presentation at the March 17 membership meeting on the Astronomical League and about his recent trip to the Rose Center for Earth and Space at the Museum of Natural History in New York City. Later in the meeting Mr. Benson recalled that that he had a conflict due to an earlier obligation to judge astronomy related entries at the Middle Tennessee Science & Engineering Fair on the same evening. Tony Campbell agreed to present a program on useful astronomy related websites for the March 17 meeting with Mr. Benson's presentation to be rescheduled for the April meeting.

Lonnie Puterbaugh stated that, if the Messier Marathon scheduled for March 5 had to be cancelled because of bad weather, early announcements would be made on both the BSAS and tnastronomy websites with a fallback to the planned rain date on March 12. John Harrington announced that, based upon communication with Dr. David Fields, March 19 was the best date for a BSAS field trip to Tamke-Allan Observatory. Notices will be placed on the BSAS and tnastronomy websites in addition to a verbal announcement at the March 17 membership meeting. Mr. Harrison suggested that a second field trip might be scheduled later in the summer. He also stated that arrangements were underway for a BSAS field trip to the Mid-South Stargaze on April 6-10.

Tony Campbell announced that he had sent notices about TNSP 2005 to *Astronomy* and *Sky and Telescope* magazines. Mike Benson said that he would contact the Astronomical League to get announcements on their website and in the *Reflector* newsletter. Joe Boyd announced that he had contacted Burgess Optical about being a vendor at TNSP 2005; Lonnie Puterbaugh said that he would also contact REI. After a brief discussion, the board recalled that no signs were left over from the previous TNSP.

John Harrington presented the board with a draft letter to the National Park Service (NPS) seeking permission to use the Water Valley Overlook site on the Natchez Trace Parkway for future star party dates. Kris McCall suggested that the public star party dates described in the letter should be de-emphasized but, after additional consideration, the board decided that this would not be a problem. Lonnie Puterbaugh suggested that getting copies of additional NPS forms might be necessary. Mr. Harrington will continue working on this communication to the NPS.

John Harrington presented the board with a suggested schedule for BSAS star parties during 2005 noting that events at Middle Tennessee State University in which BSAS members might participate were not included. Mr. Harrington noted that this schedule called for one public and one private star party per month and moved for its adoption. Pam Thomas seconded this motion and it passed by a unanimous voice vote. This schedule of star party dates will be posted on the BSAS website and published in the *Eclipse* newsletter.

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Mike Benson, the BSAS' Astronomical League Correspondent, announced that he would email the board regarding the results of the League Executive Council's upcoming vote on a proposed bylaws change to establish a multiple tier system for constituent clubs to enroll their members. Mr. Benson pointed out that this proposed change simply provided an option for having different fees for each tier. Lonnie Puterbaugh announced that the BSAS' liability insurance policy was obtained through the auspices of the Astronomical League.

Lonnie Puterbaugh recommended that the BSAS provide public outreach star parties following the first Brentwood Concert Series on or about May 22 and also following the very last concert in the season. Mr. Puterbaugh noted that the first concert would feature the Nashville Symphony, which typically draws a large audience. He also commented that concerts held during the remainder of the summer let out while it was still daylight which discouraged people from lingering to look through telescopes. Kris McCall moved for adoption of Mr. Puterbaugh's recommendation and John Harrington seconded the motion which passed by a unanimous voice vote.

Lonnie Puterbaugh announced that he had made preliminary arrangements with the Kitt Peak National Observatory staff to provide online remote viewing for BSAS members through their telescopes in Arizona on a date to be determined. Mr. Puterbaugh suggested that this event could be set up as a members only all-night Kitt Peak Star Party at the ASC with the BSAS providing refreshments. He will coordinate potential dates and other arrangements with Kris McCall at the ASC.

There being no further business to discuss, President Harrington declared the meeting adjourned at 8:50 P.M.

Respectfully submitted,
Bob Rice, Secretary

BSAS Star Parties for 2005

April 9	Private star party (Natchez Trace Mile 433.5 parking lot)
May 7	Private star party (Natchez Trace Mile 433.5 parking lot)
June 4	Private star party (Natchez Trace Mile 433.5 parking lot)
June 29	Solar viewing party for children (Edwin Warner Park)
July 9	Private star party (Natchez Trace Mile 433.5 parking lot)
August 6	Private star party (Natchez Trace Mile 433.5 parking lot)
August 12	Public star party (Edwin Warner Park)
September 3	Private star party (Natchez Trace Mile 433.5 parking lot)
October 1	Private star party (Natchez Trace Mile 433.5 parking lot)
October 7-9	Tennessee Star Party (Camp Nakanawa)
November 4	Public star party (Adventure Science Center)

Telescope for Sale

Telescope - Hardin Optical Star Hoc 8 inch Equatorial Mount Still in Box \$350 Call 333-1661. Ken Mayor

**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: \$32.95
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 per year are \$20.00 Regular (1 vote); \$30 Family (2 votes); \$15.00 Student (under 22 years of age)(1 vote); \$15 Seniors (65 years or older)(1 vote); \$25 Senior Family (65 years or older)(2 votes). Please call President, John Harrington, (615) 269-5078 if you have questions. Dues can be sent to:

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THE ECLIPSE NEWSLETTER

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BSAS Logo by Tony Campbell

Image of M51, the Whirlpool Galaxy

By Mark Manner

"I took the image March 3, 2005, Thursday night. Seeing was not particularly good. Image consists of 5x 8 minute luminance, 5x 2 minute R,G,B. Acquired by RCOS16/ME/SBIG ST10XE, Astrodon filters. Processed with CCDSoft, MaximDL, CCDSharp and Photoshop CS. I am new to this type of imaging, and the learning curve is steep!"



Running Man Nebula (NGC 1977 in Orion)

by Steve Wheeler

Steve Wheeler said, "I took it on 03/02/05 from my backyard in Franklin, TN with a Meade LXD-75 SN8 and a SAC-Mintron video camera. I recorded the camera output to a Sony Digital-8 camcorder and ported it over to the pc where 150 frames were stacked and processed via RegiStax. The image is somewhat small, so be careful if you try to enlarge it.

I shot it over my neighbor's house with their outdoor floodlights on, which should be a testament to the benefits of video astronomy!"

**Barnard-Seyfert Astronomical Society
Minutes of the Monthly Membership Meeting
Held on Thursday, March 17, 2005**

President John Harrington called the meeting to order at 7:41 P.M. at the Adventure Science Center (ASC) and welcomed new members, returning members, and visitors. The minutes of the previous membership meeting held on February 17, 2005 were approved as published in the March 2005 issue of the *Eclipse* newsletter.

John Harrington announced the upcoming public star party at Warner Park on April 2 and Astronomy Day activities at the ASC on April 16. Lonnie Puterbaugh announced that the BSAS' updated traveling display would be ready for Astronomy Day. Mr. Harrington stated that the field trip to Tamke-Allan Observatory at Roane State Community College would probably be held during a weekend in April. He also reported that approximately a half dozen BSAS members were planning to attend the Mid-South Stargaze as a group on April 6-9. Mr. Harrington noted that this event cost \$20.00 to attend and was located approximately 240-260 miles from Nashville on the Natchez Trace Parkway.

John Harrington commented that the National Park Service required the Society to provide a 45-day notice to gain formal permission to use our current dark sky site off the Natchez Trace Parkway. Mr. Harrington reported that he sent a letter to the Chief Ranger ten days ago seeking approval for all of our 2005 star parties, but that he hadn't yet received a response. He stated that, as a result, the April 9 star party would not be held. However, he hoped that the Society would have permission in time to hold the star party planned for May 7.

John Harrington reported that the Tennessee Star Party (TNSP) Planning Committee met following the last Board meeting on March 3 and had already lined up five speakers for this event. Mr. Harrington then called for volunteers for TNSP 2005. BSAS Treasurer Randy Smith reported that the Society's bank balance was \$6,407.70. Mr. Smith noted that little expenditure had yet been made, but that payments would soon be required for our newly acquired equipment.

John Harrington commented that the BSAS' recent equipment acquisitions included a Personal Solar Telescope (PST), a six-inch and an 8-inch Dobsonian, and two equatorial tracking tables. Mr. Harrington pointed out that the new PST was currently on display in the meeting room for attendees to examine.

Programs Committee Chair JanaRuth Ford reported that Mike Benson, the BSAS' Astronomical League Correspondent, would present the April 21 program on the Astronomical League and highlights from his recent trip to the American Museum of Natural History's Rose Planetarium in New York City. Ms Ford announced that Elizabeth Warner would present the May 19 program on NASA's Deep Impact Project. Lastly, she informed the audience that Dr. Tim Farris from Volunteer State Community College would present the June 16 program on a topic to be announced regarding the history of astronomy.

John Harrington introduced BSAS Webmaster Tony Campbell who, with his characteristic good humor and witty observations, presented the evening's first program on "A Brief History of Astronomical Computing." Mr. Campbell's PowerPoint program touched upon the beginnings of abstract astronomical representations via notches on bone, the development of more advanced geared mechanical devices, creation of the analog based slide rule, and culminated with today's array of digital astronomical software. Mr. Campbell pointed out that the Colossus vacuum tube mainframe, developed in 1943 for wartime code breaking, was actually the world's first computer. Following his presentation, Mr. Campbell answered questions from the audience and provided guidance for signing up for the BSAS' website forums.

Tony Campbell introduced Equipment Committee Chair Lonnie Puterbaugh who presented the evening's second program on the web based freeware "The Virtual Moon Atlas." Mr. Puterbaugh used a PC projection to demonstrate the program's many features. He noted that this free software would run on almost anything, was easy to install, and provided a downloadable users guide. Mr. Puterbaugh additionally demonstrated Virtual Moon's zoom-in and zoom-out capabilities, its menu driven search features, and its animation of the moon's libration movements. Following his presentation, Mr. Puterbaugh announced that Cosmos 1, the Planetary Society's sponsored solar sail spacecraft, was now set for launch on April 30.

President Harrington reminded the audience about the BSAS' upcoming events and, since there was no further business to consider, declared the meeting adjourned at 9:45 P.M.

Respectfully submitted,

Bob Rice, Secretary

Activities and Events

April 1 — 30, 2005

- 4/1 LAST QUARTER
 4/2 Star Party, Model Airplane Field, Edwin Warner Park,
 8:00 – 10:00
 4/3 Conj., Mars & Moon; Jupiter at opp.
 4/3 Daylight Saving Time begins.
 4/4 Conj., Moon & Saturn
 4/5 Conj., Moon & Uranus; THE DARK-SKY
 COMMITTEE WILL NOT MEET!
 4/7 BSAS Board of Directors mtg., 7:30 p. m
 4/8 NEW MOON
 4/12 Conj., Mars & Neptune
 4/15 Conj., Moon & Saturn
 4/16 FIRST QUARTER
 4/16 Star Party, Adventure Science Center, 8:00 – 10:00
 4/21 BSAS monthly mtg., 7:30 p. m., At Adventure Science
 Center
 4/22 Conj., Jupiter & Moon
 4/24 FULL MOON; Passover
 4/26 Greatest elongation of Mercury W; Mercury is a Morning
 Star.

May 1 — 31, 2005

- 5/1 LAST QUARTER
 5/4 η -Aquarid meteors peak
 5/5 BSAS Board of Directors mtg., 7:30 p. m
 5/7 Private star party (Natchez Trace Mile 433.5 parking lot
 5/8 NEW MOON; Ceres at opposition
 5/11 Vesta in conjunction with the Sun
 5/14 Mars 1.2° S of Uranus (75° W)
 5/15 FIRST QUARTER
 5/16 Double shadow transit on Jupiter
 5/19 BSAS monthly mtg., 7:30 p. m., At Adventure Science
 Center
 5/19 Jupiter 0.4° N of Moon, occultation; Double shadow
 transit on Jupiter
 5/23 Double shadow transit on Jupiter
 5/24 Antares 0.8° S of Moon, occultation
 5/26 Double shadow transit on Jupiter
 5/30 LAST QUARTER; Double shadow transit on Jupiter
 5/31 Mars 0.5° N of Moon, occultation

Note: all dates & hours according to Central Time

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