The ECLIPSE

June 2016

The Newsletter of the Barnard-Seyfert Astronomical Society

Next Membership Meeting:
June 15, 2016, 7:30 pm
Glendale United Methodist Church - Fellowship Hall
900 Glendale Lane

Topic: Mike Benson - Double Stars

Details on page 6

In this Issue:

Barnard-Seyfert Astronomical Society
bsasnashville.com

From the President:

Summer reading: now that my youngest is out of school, we don't have required reading. So I thought I'd encourage some online summer reading!

First, spacecraft Juno arrives at Jupiter on July 4. As the giant planet pulls the spacecraft in, it will accelerate to over 150,000mph… making it the fastest spacecraft to date. Mission: to see what is actually inside Jupiter! The classic textbook illustration shows a solid core… but we don't actually know that it has one. Juno should measure whether there is a core and how big. The camera onboard is there for public outreach… vote for what images it should send back. Keep up with the mission at the website missionjuno.swri.edu.

Second, this summer we mark the start of the one year countdown to the biggest astronomical event in US history… next year's Great American Eclipse. The path of totality will sweep across the entire US… and only touch the US. So this one is all ours, and many will take advantage of the opportunity to see a once in a lifetime event that is within a one day's drive for much of the country. Check out eclipse.gsfc.nasa.gov/SEmono/TSE2017/TSE2017.html, eclipse2017.org, and greatamericaneclipse.com for maps, information, and more. The internet has lots of good information… it also has a lot of nonsense. You'll get questions, be involved in helping Nashville and Tennessee enjoy the eclipse safely!

Last, I hope you are exploring the Night Sky Network. If you travel, you can check for events held by other Clubs around the country! We've had folks come out to our events that found BSAS on NSN. If you can, take a few minutes after volunteering at a star party to log your volunteer hours on the site. It's amazing how those hours and people seen at

continued on page 9

BSAS
Barnard-Seyfert Astronomical Society

Officers

Theo Wellington
President
tmwellington@comcast.net

Gary Eaton
Vice-President
gceaton@comcast.net

Tom Guss
Treasurer
t_guss@bellsouth.net

Bud Hamblen
Secretary
wrhamblen@comcast.net

(no one)
Ex-officio

Directors at Large

Mike Benson
ocentaurus@aol.com

Spencer Buckner
BucknerS@apsu.edu

Jeffrey Horne
Jeffrey.Horne@gmail.com

Rob Mahurin
robert.s.mahurin@gmail.com

Kris McCall
planetmccall@gmail.com

Kathy Underwood
katy2222@comcast.net

Newsletter Editor
Drew Gilmore
eclipse@bsasnashville.com

Observing Highlights June and July

Open Clusters
M48, M44 *(Beehive)*, M67, Mel111 *(Coma Star Cluster)*, M6 *(Butterfly)*, M7, M23

Galaxies
M81, M82, NGC3115 *(Spindle Galaxy)*, M95, M96, M105, M108, M65/M66/NGC3628 *(Leo Triplet)*, M109, M98, M99, M106, M61, M100, M84, M85, M86, M49, M87, M88, M91, M89, M90, M58, M104 *(Sombrero Galaxy)*, M59, M60, M94, M64 *(Black-Eye Galaxy)*, M63 *(Sunflower Galaxy)*, M51 *(Whirlpool Galaxy)*, M83, M101/M102

Variable Stars
R Leonis

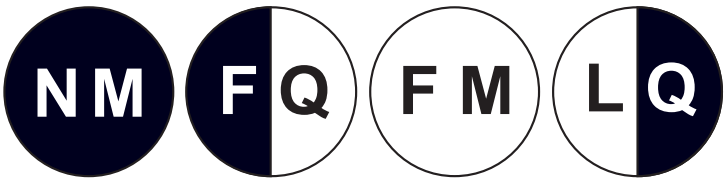
Nebulae
NGC3242 *(Ghost of Jupiter)*, M97 *(Owl)*, NGC6302 *(Bug)*, NGC6309 *(Box)*, NGC6543 *(Cat's Eye)*

Globular Clusters
M68, M53, M3, M5, M80, M4, M107, M13, M12, M10, M62, M19, M92, M9, M14

Multiple Star Systems
Gamma Leonis *(Algieba)*, M40, Gamma Virginis *(Porrima)*, Alpha Canum Venaticorum *(CorCaroli)*, Zeta Ursae Majoris *(Mizar)*, Epsilon Bootis *(Izar or Pulcherrima)* Mu Bootis *(Alkalurops)*, Beta Scorpii *(Acrab)*, Alpha Herculis *(Rasalgethi)*

Upcoming Star Parties

Friday 6/3 8:30 pm - 10:30 pm	Public Star Party Bowie Nature Park (Fairview)
Saturday 6/4	Private Star Party Natchez Trace Parkway mile marker 435.3
Saturday 6/11 9:00 pm to 11:00 pm	BSAS Public Star Party Long Hunter State Park
Wednesday 6/15 10:00 am to noon	BSAS Public Solar Viewing Warner Park Nature Center
Saturday 7/2	BSAS Private Star Party Natchez Trace Parkway mile marker 412 (Water Valley Overlook)



June 4 July 4 | June 12 July 11 | June 20 July 19 | June 27 July 26

Happy Birthday Allan Sandage
by Robin Byrne

This month we celebrate the life of a man whose contributions to cosmology are innumerable. Allan Sandage was born in Iowa City, Iowa on June 18, 1926. An only child, his father, Charles, was a professor of advertising at Miami University, in Ohio, while his mother, Dorothy, stayed at home. Early on, Allan fell in love with astronomy after looking through a friend's telescope. Soon after, his father bought him a telescope for his own. Allan even started to grind his own mirror, but never finished that project. After high school, Allan attended Miami University for 2 years before being drafted into the Navy during World War II. Upon his return, he went to the University of Illinois to major in physics and mathematics.

He graduated from U of I in 1948 and headed to the California Institute of Technology (CalTech) for his graduate work in astronomy. By 1949, he was working as an observing assistant to none other than Edwin Hubble at Mount Wilson Observatory, while Walter Baade served as his thesis advisor. Here, Sandage became proficient at working with large telescopes. Building on the relatively new understanding of stars, Sandage's thesis involved determining the age of a globular cluster, M3, based on the color and brightness of the stars in the cluster. He found it to be 3.2 billion years old, which had the added bonus of providing a minimum age of the universe. That would become a theme of much of his subsequent work.

In 1953, Sandage received his PhD, and went to work for the Carnegie Observatories at Mount Wilson and Mount Palomar. He would stay here for his entire career. The same year that Sandage graduated, Edwin Hubble passed away. Sandage began his career by continuing Hubble's work. Sandage described his position as a new PhD following in Hubble's footsteps as: "It would be as if you were appointed to be copy editor to Dante. If you were the assistant to Dante, and then Dante died, and then you had in your possession the whole of 'The Divine Comedy,' what would you do?" Sandage lived up to the task.

When Hubble was measuring distances to galaxies, he was using Cepheid variable stars as the source of known brightness. The distances, combined with the velocity of the galaxies, allowed him to determine the age of the universe to be 1.8 billion years old. The key was the value of the ratio of velocity to distance, which is now called Hubble's Constant. The value at the time was close to 500 km/s/Mpc. However, there turned out to be two problems with his approach. First, Baade discovered that there are two types of Cepheid variable stars, with different luminosities. The second problem was that Hubble used bright areas in galaxies, assuming they were all stars, but some turned out to be HII regions where stars were being born. Sandage corrected all of this. Correcting for the Cepheids brought the age to 3.6 billion years. Correcting for the HII regions raised it again, to 5.5 billion years, but Sandage wasn't through. In 1958, after five years of work,

continued on next page

Allan Sandage, continued

Sandage finally had a solid value for Hubble's constant of 75 km/s/Mpc, which corresponded to an age of about 12 billion years. In the subsequent years, other estimates for Hubble's constant ranged from 50 - 100 km/s/Mpc. Here we are, 60 years later, and the best value for Hubble's constant is between 71 - 74 km/s/Mpc, with a universe age of 13.7 billion years. Sandage did quite well.

In 1958, Allan Sandage married Mary Connelley, who was also an astronomer. She had studied at Indiana University and Radcliffe before taking a teaching position at Mount Holyoke in Massachusetts. After marriage, she discontinued her work to raise their two sons, David and John.

Now that Sandage had the age of the universe pegged, his next big project was determining the fate of the universe. In 1961, he published an article titled "The Ability of the 200-inch Telescope to Discriminate Between Selected World Models." In the paper, he proposed that by determining two properties of the universe, we would know its fate. Those two properties were: the value of Hubble's constant and a term he called the deceleration parameter, which was a measure of how quickly gravity was slowing the expansion. The paper included a variety of ways to measure both of these terms. One of those techniques led to the discovery, in 1998, that the universe's expansion is actually getting faster.

In 1962, Sandage continued looking at big questions, now tackling how the Milky Way Galaxy formed. Working with Olin Eggen and Donald Lynden-Bell, they used the motions of the oldest stars in the galaxy to developed a model to describe how the Milky Way formed out of a giant proto-galactic cloud of gas. To this day, the ELS paper (short for Eggen, Lynden-Bell, and Sandage) is the standard when discussing how our galaxy formed.

Also in 1962, Sandage became involved in a, seemingly, different area of study. Radio astronomy was still relatively new, and much of the work involved finding optical counterparts to strong radio sources. One such object was 3C48, which was found, by Thomas Matthews, to look like a faint star. Based on the strength of the radio signal, that was surprising. Sandage discovered faint nebulosity surrounding the object. He was able to detect a few emission lines, as well. However, the lines did not seem to correspond to any known elements. Sandage then teamed up with Matthews to continue studying this object for another 2 years. They found that it had a 30% variation in brightness over the course of a year. Because it looked like a star, the assumption was that it was located in our own galaxy. It wasn't until Maarten Schmidt discovered that the emission lines were, in fact, very redshifted hydrogen lines, that they realized it was not only beyond our galaxy, but at a distance of 4 billion lightyears. At that distance, you are looking at something brighter than hundreds of galaxies, yet, based on the rate it varies in brightness, no larger than our solar system! Ultimately, it was determined that the answer to this enigma would be material falling into a supermassive black hole, and these objects that sort-of looked like stars (quasi-stellar objects) would become known as quasars, the most distant objects we can see.

continued on next page

Allan Sandage, continued

In 1997, Sandage retired, but that doesn't mean he stopped working. His last two publications, of the over 500 articles he wrote, were written the last year of his life. One was about the motions of galaxies in the local supercluster, and the other was about RR Lyrae stars. Allan Sandage died of pancreatic cancer on November 13, 2010 at the age of 84.

Sandage had a reputation as someone who could be difficult to work with. The consensus was, if Sandage got angry enough to stop speaking to you, then you had made it in the world of astronomy. After a public feud over some of his work concerning the value of Hubble's Constant, Sandage became more of a recluse, but never stopped working and publishing. When it was discovered that the expansion of the universe appears to be accelerating, Sandage said, "So the universe will continue to expand forever, and the galaxies will get farther and farther apart, and things will just die. That's the way it is. It doesn't matter whether I feel lonely about it or not." I think that sums up the personality of a man whose life's work dealt with the entire universe, and who truly understood how small a part of it revolves around our lives. On the next clear night, gaze up at the unfathomable expanse of the universe, and pay tribute to the man who helped us better understand our place in the vast cosmos, Allan Sandage.

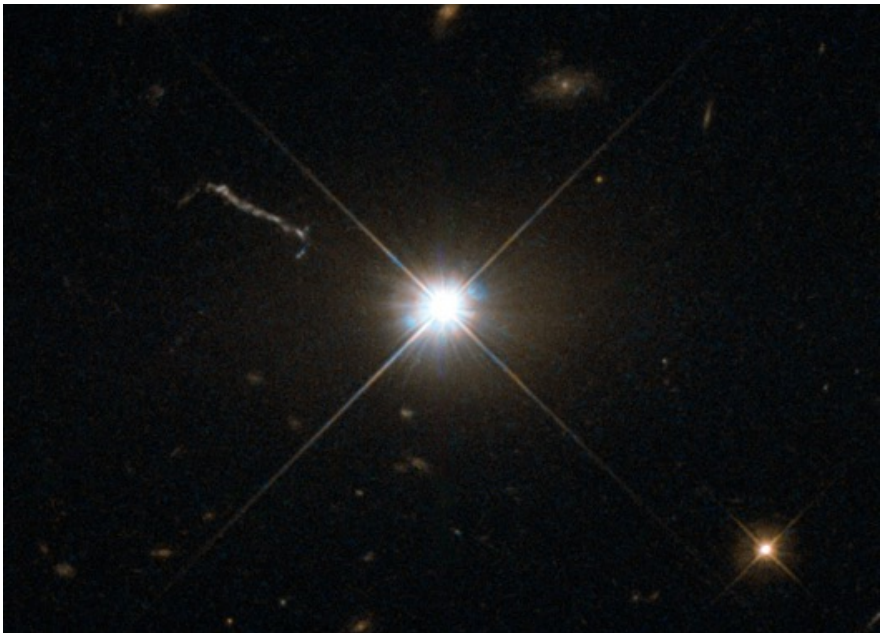
References:

Allan Sandage - Wikipedia

Tribute to a Pioneering Cosmologist - Sky & Telescope

Allan Sandage, Astronomer, Dies at 84 - New York Times

The Discovery of Quasars by Maarten Schmidt



This image from Hubble's Wide Field and Planetary Camera 2 (WFPC2) is likely the best of ancient and brilliant quasar 3C 273, which resides in a giant elliptical galaxy in the constellation of Virgo (The Virgin). Its light has taken some 2.5 billion years to reach us. Despite this great distance, it is still one of the closest quasars to our home. It was the first quasar ever to be identified, and was discovered in the early 1960s by astronomer Allan Sandage.

Credit: ESA/Hubble & NASA

Barnard-Seyfert Astronomical Society
Minutes of a Regular Meeting of the Board of Directors
Held On Wednesday, May 4, 2016.

The regular meeting of the Board of Directors of the Barnard-Seyfert Astronomical Society was held May 4, 2016, at the Girl Scouts of Middle Tennessee office, 4522 Granny White Pike, Nashville, TN 37204. Present were Spencer Buckner, Gary Eaton, Tom Guss, Bud Hamblen, Rob Mahurin and Theo Wellington. A quorum being present, Theo called the meeting to order at 7:35 PM. Theo asked for a motion to adopt the minutes of the March board meeting as printed in the May, 2016, edition of the Eclipse. Spencer made the motion, Gary seconded, and the minutes were approved by a unanimous voice vote. Tom reported that there was $1,919.62 in the regular account and $1,619.84 in the regular account, and that that the society is receiving membership applications and fees through First Financial Credit Union.

Planned star parties are scheduled for May 7 at the Natchez Trace Water Valley Overlook (Private), May 13 at Bells Bend Outdoor Center (public), June 3 at Bowie Nature Park (public) and June 11 at Long Hunter State Park (public).

Arrangements have been made to use the parking lot near the ball fields to view the transit of Mercury on May 9.

Heather Gallagher at Warner Parks said that the telescope workshop on April 16 was well received and that we were welcome to do it again.

Mark Manner asked whether we would like to have the club picnic at MBA's observatory near McMinnville on June 4.

continued on next page

Next BSAS meeting
June 15, 2016, 7:30 pm
Glendale United Methodist Church - Fellowship Hall
900 Glendale Lane

Topic: Longtime member and Astronomical League representative Mike Benson will talk about double stars.

Minutes of a Regular Meeting of the Board of Directors, continued

The society has been invited to participate in solar viewing at Warner Park on June 15. The program includes sun prints in connection with The Frist Center. Solar viewing is from 10-2pm, but we can stay as long as we like.

Janet Ivey (Planet Janet) has asked for help with a fundraiser. No resolution was adopted, but the general consensus of opinion was to announce the event and contact information at the membership meeting so that anyone who wanted to help could.

Rob will be presenting his program on symmetry at the May 18 meeting, Mike Benson will be presenting a program on double stars at the June 15 meeting, and Spencer will be presenting a program on gravitational waves at the August 17 meeting. Katelyn Grace Henke has been invited to present her exhibit on light pollution at the July 20 meeting.

Katherine Shaw, Bellevue Public Library, is looking for someone to make a public presentation at the library.

There being no further business, Rob moved for adjournment, Tom seconded, and the meeting was adjourned at 8:30 PM.

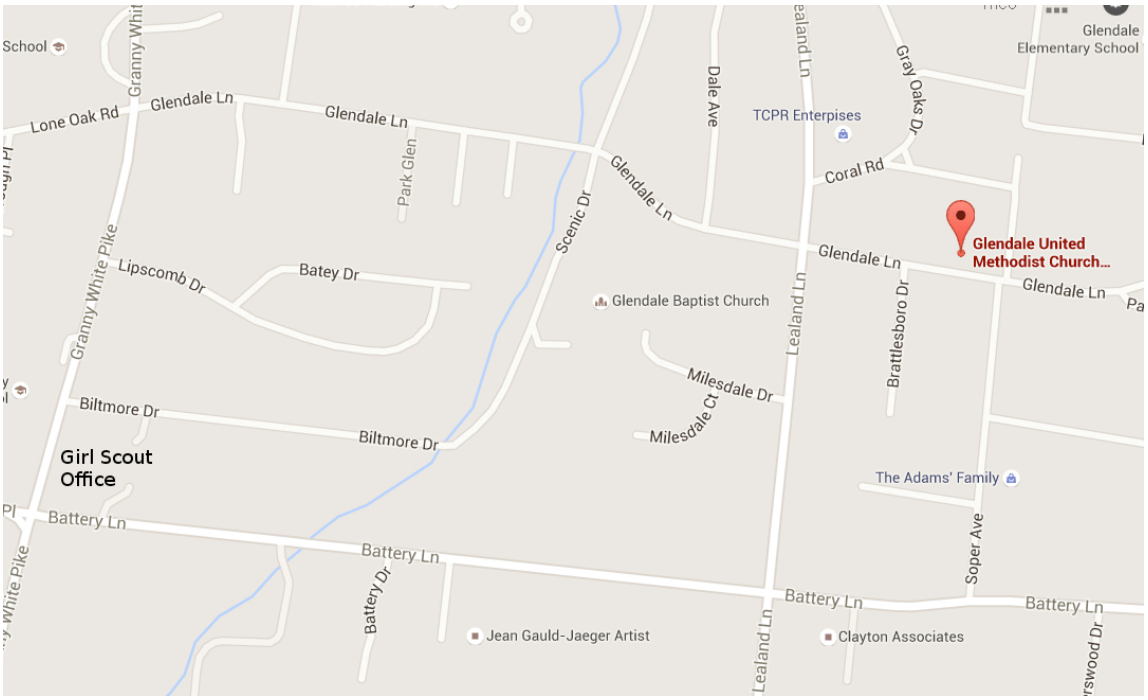
Respectfully submitted,

Bud Hamblen
Secretary

NOTICE: the location for our board and member meetings has changed for June, July and August!

The Girl Scouts are renovating, so we will be at the [Glendale United Methodist Church, 900 Glendale Lane, Nashville 37204](#).

It's just around the block from the Girl Scout office.



Barnard-Seyfert Astronomical Society
Minutes of the Monthly Membership Meeting
Held On Wednesday, May 18, 2016.

The Barnard-Seyfert Astronomical Society held its monthly membership meeting at the Girl Scouts of Middle Tennessee, 4522 Granny White Pike, Nashville, Tennessee, on Wednesday, May 18, 2016. Twenty-one members and guests signed in. Theo Wellington called the meeting to order at 7:45pm. Theo asked for a motion to approve the minutes of the April 20, 2016, meeting as printed in the May 2016 edition of the Eclipse. Melissa Lanz made the motion, Bill Griswold seconded, and the minutes were approved by unanimous voice vote.

Theo described the following requests for members to provide assistance for outreach:

June 15 from 10 am to noon – Solar viewing at Warner Parks Nature Center.

June 19 in the evening – Nashville Paddle Company full moon paddle at Hamilton Creek Recreation Area. Date of your choice – Kathryn Shaw, Bellevue Branch of the Nashville Public Library, is looking for someone to make a daytime presentation on any astronomical subject.

October 15 – Cheekwood Botanical Garden is looking for telescopes at a Japanese Full Moon celebration.

Contact Theo if you can help.

Theo announced upcoming star parties:

June 3 from 8:30 to 10:30pm – Public star party at Bowie Nature Park, Bowie Lake Rd, Fairview, TN.

June 4 – Club picnic at MBA's Long Mountain Observatory, McMinnville, TN.

June 11 from 9 to 11pm – Public star party at Long Hunter State Park.

Other business: John Laylon has seven telescopes for sale.

Owing to renovations at the Girl Scout Office, the club will meet in the fellowship hall of Glendale United Methodist Church, 900 Glendale Lane, Nashville, during June, July and August. See the BSAS web site for directions.

Dr Rob Mahurin, MTSU, presented a talk on "Symmetry, the Big Bang and You", after some travails. There being no further business, Theo asked for a motion to adjourn at 9:15pm. Rob Mahurin so moved, Bill Griswold seconded, and the meeting was adjourned.
Respectfully submitted,

Bud Hamblen
Secretary

Outreach Opportunities

Please respond to tmwellington@comcast.net so we have a list of volunteers.

The **Nashville Paddleboard Group** would like someone to come out to one of their summer Full Moon paddles to point out what they are seeing in the night sky. They start paddling at sunset and return to shore about 90 minutes later. Dates are June 19, July 19, August 18, and September 16.

The Bellevue Library's Kathryn Shaw asks:
My name is Kathryn Shaw, and I am a librarian at the Bellevue Branch of the Nashville Public Library. We are in the process of organizing our programs for late spring, summer and fall. I am hoping a representative from the Barnard-Seyfert Astronomical Society would be interested in coming to the library sometime to talk about your organization and give an basic introduction to astronomy (i.e. the planets, stars, meteors, comets, famous astronomers, how to use a telescope, etc.).(topic of choice) If someone from the Society would be interested in speaking here, the discussion could take place on a weekday, weeknight, or on a weekend. If you could give me some general idea of your availability, I could then look at our events calendar in order to recommend some possible dates.

Cheekwood:
Public Program Manager Meagan Rust has asked if BSAS can provide telescopes to view the Moon during its annual Japanese Moon Viewing celebration, October 16, 4pm-9pm. The Moon (just past full) rises that night at 6:55pm. We know, it's the Full Moon… but they had 600 guests last year, many of whom expressed a desire to look at the Moon through a telescope. It's a way off, but they were nice enough to give us a long lead time.

From the President, continued

star parties add up. Listen to a Night Sky Network webinar. NASA is trying to have significant public outreach as part of every mission, there is a lot of information that we have access to. Then, put the computer down and enjoy the warm clear nights… Mars is bright, Saturn is coming to opposition in June as well. See you under the stars!

Clear skies,

Theo Wellington

Send your cool astrophotos to
eclipse@bsasnashville.com!

The Bubble Nebula, also known as NGC 7635, is an emission nebula located 8 000 light-years away. This stunning new image was observed by the NASA/ESA Hubble Space Telescope to celebrate its 26th year in space.

Credit: NASA, ESA, Hubble Heritage Team

Barnard-Seyfert Astronomical Society

Become a Member of BSAS! Visit bsasnashville.com to join online.

All memberships have a vote in BSAS elections and other membership votes. Also included are subscriptions to the BSAS and Astronomical League newsletters.

Annual dues:

Regular: $25
Family: $35
Senior/Senior family: $20
Student:* $15

* To qualify as a student, you must be enrolled full time in an accredited institution or home schooled.

About BSAS

Organized in 1928, the Barnard-Seyfert Astronomical Society is an association of amateur and professional astronomers who have joined to share our knowledge and our love of the sky.

The BSAS meets on the third Wednesday of each month at the Cumberland Valley Girl Scout Building at the intersection of Granny White Pike and Harding Place in Nashville. Experienced members or guest speakers talk about some aspect of astronomy or observing. Subjects range from how the universe first formed to how to build your own telescope. The meetings are informal and time is allotted for fellowship. You do not have to be a member to attend the meetings.

Membership entitles you to subscriptions to Astronomy and Sky & Telescope at reduced rates; the club's newsletter, the *Eclipse*, is sent to members monthly. BSAS members also receive membership in the Astronomical League, receiving their quarterly newsletter, the *Reflector*, discounts on all astronomical books, and many other benefits.

In addition to the meetings, BSAS also sponsors many public events, such as star parties and Astronomy Day; we go into the schools on occasion to hold star parties for the children and their parents. Often the public star parties are centered on a special astronomical event, such as a lunar eclipse or a planetary opposition.

Most information about BSAS and our activities may be found at bsasnashville.com. If you need more information, write to us at info@bsasnashville.com or call Theo Wellington at (615) 300-3044.

Free Telescope Offer!

Did someone say free telescope? Yes, you did read that correctly. The BSAS Equipment & Facilities Committee has free telescopes ranging in size from 2.6” to 8” that current members can actually have to use for up to 60 days at a time. We also have some other items in the loaner program such as a photometer, H-alpha solar telescope, educational CDs, tapes, DVDs, and books. Some restrictions apply. A waiting list is applicable in some cases. The BSAS Equipment Committee will not be held responsible for lost sleep or other problems arising from use of this excellent astronomy gear. For information on what equipment is currently available, contact info@bsasnashville.com.