ECLIPSE

The Newsletter of the Barnard-Seyfert Astronomical Society

Celebrating our 76th Year in 2004 **March 2004**

March meeting of the BSAS
For the March 18, 2004 we will meet at Dyer Observatory at 7:30 pm.

March Presentation by Dr. David Ernst on "Nervous Neutrinos"

Please see Page 5 for the continuation

FROM THE PRESIDENT

By Joseph M. Boyd, Jr.

In spite of February usually being a short month, this February has been full of activity, and much has been accomplished.

The program on the 19th at our regular monthly meeting was outstanding. Loren Ball not only talked about his experiences in discovering asteroids, but also gave us a lesson in how to protect the night sky. This was a program that would be of interest to every astronomer, whether amateur or professional. Our members, plus their guests, turned out in force, but unfortunately we had only two or three professional astronomers. We are somehow missing the boat on attracting the professional astronomers to participate in the activities of the BSAS. I am informed that in the past, the professional astronomers, from Vanderbilt in particular, took a very active part in the affairs of the Society. One even served as BSAS treasurer within the last ten years. I personally hope that we can attract the professional astronomers in the area who are not presently active participants or even members. The BSAS was never intended to be solely an organization of amateur astronomers. Neither was it intended to be primarily made up of professionals. A healthy mix of the two would be very desirable. I was shocked last month to learn that an out of town visitor recently asked one of the astronomy professors at Vanderbilt how many astronomers there are in Nashville, to which the professor advised him that there were "only two or three". That certainly implies that we who are amateurs and not considered by some of the professionals to be "real astronomers". Somehow we need to change this perception.

We will have an opportunity to help change that viewpoint at our March program. Our speaker is Dr. David Ernst, who is Professor of Physics at Vanderbilt, and who has served as the Chair of the Department of Physics and Astronomy three separate times. He will describe to us his primary field of research, which is neutrinos. While he was the department chair recently, Dr. Ernst went out of his way to make the BSAS a part of the Vanderbilt astronomy community, both by inviting our members to their various programs and by inviting us to be cosponsors of the annual Seyfert Lecture Series. We had our first cosponsorship in December and look forward to working together in future years. We will, of course, invite the astronomy and physics faculty at Vanderbilt to attend our meeting to hear the program by Dr. Ernst.

The Dark Sky Committee has promoted the organization of a Section of the International Dark Sky Association (IDA) for Middle Tennessee, and our own Powell Hall is the Section Chair. With all of the emphasis on "more is better" lighting, the Section has its work cut out for it. Although the BSAS is an organizational member of the IDA, I hope many of you will follow the request of Powell and become an individual member of IDA. We need to support the new section as much as possible, as its members embark on promotion of the adoption of lighting ordinances by the various governing bodies in this area. The IDA has produced and is making available a model ordinance for a city the size of Nashville as well as an ordinance designed for smaller communities. The illuminating engineers are well aware of the lighting problems, and are also vitally interested.

While we are talking about the illuminating engineers, you should know what on 17 February, Powell, Bill Griswold, and I attended the monthly meeting of the Illuminating Engineers Society (IES) and heard a presentation on lighting forensics. The speakers emphasized that engineers, architects, and builders or owners are being sued for designing and installing improper lighting which results in an accident or a crime. They pointed out that the

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Atlanta school system has adopted a policy of turning out ALL school lights after 10:00 P.M. each night, and the school officials are pleased with the results of this six year long program. It has actually resulted in a reduction in crime in the schools at night. Criminals who want to break into a school have to furnish their own flashlights, and the use of a flashlight makes it easy for law enforcement to spot them. This is something to be considered in the Nashville area. I am sure that the program has also resulted in a significant savings in the electric bill for the schools.

I am proud to say that many of our committees have made real strides during this past month. Our Public Relations Committee, after many hours of work, has produced a logo which will be presented to the Board of Directors in March. In addition, the committee is working on a new brochure to represent the Society. The brochures we are presently using are almost gone, but their effects will continue. The new one will update what we are doing and accomplishing, and will incorporate the new logo. The Finance Committee is working on a budget revision and on getting our tax reports in. The Outreach Committee is working with several local agencies to complete our schedule for this year. The Mentoring Committee is making plans that will result in helping our new members and in training our own people in the use of the loaner equipment.

We have a lot going on, and I want to say thank you for the participation by so many of our members who have volunteered to do so many things.

Austin Peay State University adds astronomy minor

by Rebecca Mackey

The Academic Council has approved a new astronomy minor for the department of physics and astronomy

According to Dr. Spencer Buckner, associate professor of physics, the minor is designed for the "avid amateur astronomer" and does not require a science background.

"The most math that any of the new courses require is college algebra," says Buckner. "The minor is 19 credit hours and includes the two introductory astronomy courses–'Planetary Astronomy' and 'Stellar Astronomy'–along with 'Observational Astronomy,' 'History of Astronomy,' 'Cosmology' and 'Astrophotography and Image Processing.'"

"Several students previously had expressed interest in an astronomy minor, and this new program is a direct response to those request. Among those who had expressed an interest are a political science major, a journalism major and a music major, so it definitely does not require a science or technical major."

One of the upper-level astronomy courses, Cosmology, first was offered last spring. A second, History of Astronomy, is being offered this semester. The other new courses will debut in Fall 2004.

A description of the new minor can be found on the physics home page, http://www.apsu.edu/physics, by clicking on the "Astronomy" link. It also will be in the 2004-05 Undergraduate Bulletin.

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, 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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Minutes of a Regular Meeting of the Board of Directors of the Barnard-Seyfert Astronomical Society Held On February 5, 2004

The Board of Directors of the Barnard-Seyfert Astronomical Society met in regular session at the Jefferson Square Club House in Nashville, Tennessee on February 5, 2004. A sign-in sheet was passed around in lieu of a roll call. President Joe Boyd declared a quorum to be present and called the meeting to order at 7:35 P.M. Board members Mike Benson, Joe Boyd, Janaruth Ford, Bill Griswold, John Harrington, Kris McCall, and Jill Thompson were present. Board members Tony Campbell, Powell Hall, Lonnie Puterbaugh, and Pam Thomas were absent. In addition to members of the Board, Assistant Secretary Bob Rice was also present. The minutes of the previous regular board meeting were approved as published in the February 2004 issue of the Eclipse newsletter.

Joe Boyd announced that Scott Hubbard, Director of NASA's Ames Research Center, would give a public lecture on the recent Mars landings at 7:30 PM on Wednesday, February 11th, in the Stevens Center at Vanderbilt University. Mr. Boyd commented on the significance and timeliness of this lecture and encouraged everyone to attend.

Secretary Jill Thompson reported that the Dark Sky Committee, chaired by Powel Hall, wished to announce that the Society of Illuminating Engineers, with whom they have been working, would meet on Tuesday, February 17th at 11:15 AM at the Vanderbilt University Club with a presentation on "Lighting Forensics." The attendance fee will be $15.00.

Membership Chair Bill Griswold reported that the BSAS had 140 active members and 30 inactive members who had not paid their dues. Mike Benson, our Astronomical League Correspondent, commented that an updated membership list had been sent to the League's national headquarters noting that this was the first update supplied to them since 2002. Mr. Griswold announced that BSAS member Donna Schot had agreed to handle nametags at our membership meetings and exhibited the seven alphabetized clear plastic boxes that will be used to store them. Mr. Griswold also displayed examples of the new nametags that are now computerized with distinctive large dark print.

Janaruth Ford reported that the Mentoring Committee was working on a new member packet, an interest survey, and possibly a brief test to assess the most needed areas of instruction. Ms Ford stated that her committee was also considering a certification program with levels of understanding being designated by awarded patches. She indicated that classes could possibly be held before or after our monthly membership meetings. Ms Ford noted that books would be needed for these classes and cited Terence Dickinson's popular Nightwatch as a possibility.

Kris McCall reported that the Public Relations Committee was working on a BSAS logo and on new text for our informational brochure. Ms McCall said that she would contact an acquaintance with 30 years of graphic design experience for some ideas on the logo. She also reported sales of 15 copies of the RASC Observer's Handbook with only 5 copies remaining.

Joe Boyd reported that he and Outreach Chair Heinrich Tischler met with Warner Park Ranger Heather Gallagher last week to discuss joint outreach projects for the year and develop a schedule of events. Mr. Boyd also stated that he was still working on a loaner scope policy. In addition, Mr. Boyd reported that officials from Shelby Park had asked the BSAS to put on a program on its choice of either March 15th or 17th. He pointed out that these dates were during Metro Schools' spring vacation and that the program would be conducted during the day. Kris McCall will contact Heather Gallagher for more details regarding the specific location at Shelby Park.

Joe Boyd suggested that the board consider changing the dark sky site for the upcoming Messier Marathon to a more convenient location such as the Warner Park model airplane field. John Harrington also suggested setting several alternate dates since this event has been cancelled due to bad weather for the last several years. Mr. Harrington pointed out that, if necessary, the Marathon could be combined with a previously scheduled star party on March 20th. Following a discussion of possible sites and their merits, Mr. Harrington said that he would contact the Metro Police Department about our using the Police Academy on Lebanon Road. Mr. Boyd will look into our using the Girl Scouts' Camp Sycamore.

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Presentations Committee Chair John Harrington reported that amateur astronomer Loren Ball, who has discovered 138 asteroids, will present the February 19th program on his observing techniques. Mr. Harrington commented that he had suggested a presentation of up to 70 minutes followed by a question and answer session.

Joe Boyd reported that the Dyer Observatory Director's staff had asked for assistance regarding a check for $1504.11 issued by the BSAS to Dyer Observatory at least a year and a half ago for reimbursement of expenses. Apparently the Observatory forwarded the check to the Vanderbilt Physics Department who are now unable to produce any record of the transfer. Since no board member could recall sufficient details about the transaction, Mr. Boyd announced that he would ask the Treasurer to research this matter.

Joe Boyd reported that the Hospitality Committee, chaired by Pam Thomas, was working on social events to celebrate the 75th anniversary of the BSAS.

Mike Benson announced that the Middle Tennessee Science and Engineering Fair, which provides a venue for area students' science projects, would be held at Austin Peay State University this spring with an awards ceremony on April 12th. Mr. Benson mentioned that the BSAS has actively supported this Fair over the years by providing members to serve as judges along with $100, $50, and $25 prizes. Mr. Benson also pointed out that our judges always had the option of not awarding a prize if they felt that there were no appropriate or deserving projects. Noting that the BSAS must notify the Fair by March 1st to participate, Mr. Benson moved that the society again supply judges and prizes just as before. Jill Thompson seconded the motion and, following a very brief discussion, it was approved by unanimous vote.

Joe Boyd observed that having classes following our monthly membership meetings would put an increased burden on the Dyer Observatory staff that would have to stay later. A discussion followed and several suggestions were made that the BSAS hold a varying number of meetings at the Adventure Science Center. John Harrington commented that he would still like to have some meetings at Dyer Observatory. Mr. Boyd announced that he and BSAS member Dennis Williams would discuss this matter later with Dyer Observatory Superintendent Rocky Alvey. Mr. Boyd also announced that he might call a special board meeting before the start of our next membership meeting to further review this issue.

John Harrington reported that he had had earlier emailed those concerned about a conflict between a joint committee meeting scheduled for Wednesday evening, February 11th, and the NASA-Ames "Mars Landings" lecture being held at Vanderbilt University at the same time. Jill Thompson and Bob Rice, responding for the Grants Committee, announced that they preferred to reschedule the meeting. Joe Boyd telephoned the other party, Equipment Committee Chair Lonnie Puterbaugh who was out of town, and left a voice mail message asking for his decision. Mr. Boyd said that he would email the results as soon as possible.

Kris McCall announced that a reenactment of Otto von Guericke's 1657 vacuum-joined hemispheres demonstration would be held at the Adventure Science Center as an Astronomy Day presentation on April 24th. Ms. McCall invited the BSAS to also participate in the Astronomy Day program.

There being no further business, the President declared the meeting adjourned at 9:40 P.M.

Respectfully submitted,
Bob Rice
Assistant Secretary

Program Announcement continued from Page 1

Science today stands at a crossroads—astronomers, observations into deep space with the Hubble Space Telescope continue to suggest that the vast majority of the universe must be comprised of massive yet invisible "dark matter," while physicists, studies of subatomic particles suggest that such infinitesimal particles must comprise much of this dark matter.

We are fortunate to have Vanderbilt University,s Dr. David Ernst to give us a glimpse of developments in the emerging field of "neutrino astronomy," which seeks to better understand the subatomic world and even to use its principles to create "neutrino telescopes." Dr. Ernst has recently published a paper attempting to correlate data collected from the world,s few operational neutrino observatories with physicists, standard model of a universe with only three types of neutrinos. For the significance of this field and Dr. Ernst,s work, please read on:

Neutrinos are a type of subatomic particles that travel at the speed of light, yet are incredibly elusive because they have virtually no mass and no electrical charge, and thus can pass through solid matter while only very rarely interacting with it. The actual detection of neutrinos therefore took years and was a major triumph of modern physics, requiring use of exotic particle detection "observatories" located far beneath bedrock in Canada and Japan that observe the passing of a neutrino by the tiny, brief flash of visible light generated when it strikes an ordinary atom. Physicists believe that three types of neutrinos exist, yet even that tentative conclusion is open to challenge.

We do now know that the sun and other stars—especially supernovas—naturally emit neutrinos, as does the Earth,s atmosphere when struck by cosmic rays. Neutrinos have even been created artificially in particle colliders and certain types of reactors. As we all sit here tonight, in fact, billions of neutrinos from the sun are passing through this observatory, through our bodies, and even all the way through the Earth. Yet we suffer no ill effect.

The beauty of neutrinos for astronomy lies in their exceptional neutrality—neutrinos, lack of electrical charge means that the magnetic fields around stars and some planets doesn,t warp the neutrinos, course, while the neutrinos, lack of mass means that intervening nebulas and even stars and planets don,t deflect their trajectory. Since the path of a neutrino thus points directly back to its origin point, if science could develop a sensitive "neutrino telescope," we would have a device that would give us a far clearer image of the universe than ever before, free of interference from the interstellar dust and gas that blur the vision of our optical telescopes today. Various multi-national teams with acronyms like SNO, NESTOR, ANTARES and AMANDA are beginning to produce scientific results as they continue the struggle to build better "neutrino telescopes."

Minutes of the Monthly Membership Meeting of the Barnard-Seyfert Astronomical Society Held on Thursday, February 19, 2004

President Joe Boyd called the meeting to order at 7:40 P.M. at the Adventure Science Center and welcomed new members and visitors. Presentations Committee Chair John Harrington introduced Loren Ball from Decatur, Alabama who gave an outstanding lecture with a computer-assisted display on his asteroid hunting techniques, equipment, and software. Mr. Ball's presentation was followed by a question and answer session.

President Boyd initiated the discussion of business at 9:00 P.M. With the exception of correcting a minor misspelling, the minutes of the previous membership meeting on January 15, 2004 were approved as published in the February 2004 issue of the *Eclipse* newsletter. Membership Chair Bill Griswold reported that the society had 142 paid members.

Joe Boyd reported that all committees were meeting regularly and pointed out that committee schedules were posted on the BSAS' website. Mr. Boyd encouraged the committees to operate within their budgets and to contact the Finance & Budget Committee Chair if they needed more information. Mr. Boyd also reported that the BSAS had applied to participate in NASA's Nightsky Network, a space agency program that provides guidance and materials to astronomy clubs for public outreach activities.

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Joe Boyd reported that several visitors to the star party at Warner Park on February 13th apparently had difficulty keeping their cars on the road while driving with their headlights off. Consequently, Warner Park management has decided that visitors to future star parties must be allowed to keep their headlights on while operating their vehicles. In addition, Mr. Boyd commented that the BSAS and Warner Park management were discussing concerns and procedures for using electric extension cords at future star parties.

Joe Boyd announced that a volunteer was needed as an understudy during the 2004 Tennessee Star Party to learn how to manage this event for 2005. Mr. Boyd also noted that with two comets coming into view soon, outreach activities for these events would need to be planned. Mr. Boyd again encouraged members to serve on the BSAS' committees and to bring one or more visitors to the next meeting.

Treasurer Lonnie Puterbaugh reported that at Jan;uar;y 27, 2004 the BSAS had total monetary assets of $7675.60. Mr. Puterbaugh, as the Equipment Committee Chair, also reported that the BSAS had three loaner telescopes available for members to borrow: an 8-inch reflector, a 4.5-inch reflector, and a 70mm go-to refractor. Mr. Boyd commented that in addition to learning to use these telescopes themselves, borrowing members would also be expected to use them for outreach to educate and teach others whenever possible.

Dark Sky Committee Chair Powell Hall reported that this committee would meet on March 2nd. Mr. Hall noted that they were working closely with the International Dark Sky Association and the Society of Illuminating Engineers. Mr. Hall also announced that he had membership forms for anyone who wished to join the Association.

Mentoring Committee Chair JanaRuth Ford reported that this committee would meet next Thursday, February 26th and asked for volunteers who might have ideas for mentoring. Grants Committee Co-Chair Bob Rice reported that this committee would meet on Wednesday, March 10th. Outreach Committee Chair Heinrich Tischler reported that this committee would meet next Monday, February 23rd.

Lonnie Puterbaugh announced that the Messier Marathon was scheduled for March 20th. Mr. Puterbaugh explained that amateurs across the country performed this challenge every March just before a new moon in a race against the sun to see all 110 Messier deep sky objects in one night. He noted that a site had not yet been selected, but that it would be announced in the *Eclipse* newsletter. Joe Boyd recognized BSAS board member Mike Benson who will certify binocular-using marathoners seeking the Astronomical League award.

Joe Boyd announced that Kris McCall still had four copies of the RCAS Observers Handbook for sale at $16 each.

Kris McCall announced that the Adventure Science Center would celebrate Astronomy Day on April 24th with a reenactment of Otto von Guericke's 1657 vacuum-joined hemispheres demonstration. Ms McCall also announced that visitors from Nashville's sister city of Magdeburg, Germany would participate as part of German Culture Week. In response to a member's question, she commented that Tennessee mules would probably be used for the reenactment instead of German horses.

Kris McCall and Lonnie Puterbaugh announced that triple moon transit shadows would occur on Jupiter around 2:00 A.M. on March 28th and that those attending the earlier March 27th 5-planet star party at Warner Park might want to stay late to see this event.

There being no further business, the President declared the meeting adjourned at 9:35 P.M.

Respectfully submitted,
Bob Rice
Assistant Secretary

Dressing for the Messier Marathon

by JanaRuth Ford

The best way to dress for a Messier Marathon or winter star party is in layers. This will give you more flexibility to add or remove layers depending on the weather and your level of activity (e.g. turtleneck, sweater, and jacket).

Your base layer should be a synthetic material rather than cotton. Synthetics not only feel good next to the skin but also absorb moisture and dry quickly keeping you dry and therefore warm.

Wear a headband or hat. If your head is warm then the rest of you will likely to stay warm since 60% of heat loss is through the head. Wear gloves, warm socks (again not cotton) and shoes or boots.

Bring snacks and hot chocolate, coffee, or tea.

Lawnchair Astronomy

by JanaRuth Ford

It is possible to explore the moon, visit a star cluster, or take a trip to another galaxy without ever leaving your backyard. All you need is curiosity and patience. It 's as simple as going out into your backyard or some place with a dark sky and looking, really looking, at what all is up there. The night sky that awed our ancestors is still available to modern explorers today called Lawnchair Astronomers.

Lawnchair Astronomy goes back to ancient times. As far back as 1800 B.C., the Babylonians sketched on ancient cuneiform tablets the earliest known Lawnchair Astronomers being carried out under the night sky by their scantily clad servants. A favorite activity of the time was predicting the time that the first crescent moon could be seen. These early Lawnchair Astronomers developed a fairly accurate calendar and were able to predict eclipses with a great degree of precision.

Anyone can be a Lawnchair Astronomer. Expensive equipment is not necessary. A star chart (map may be obtained from the Adventure Science Center, www.SudekumPlanetarium.com) is necessary for a lawnchair trip through the heavens, though, as is a red-beam flashlight with which to see the map. There are thrilling sights in a dark sky that are visible to the unaided eye. In fact, much of what the sky has to offer is best seen with your eyes alone. Meteor showers, lunar eclipses, bright comets, the Milky Way, and satellites as well as the constellations are best seen without a telescope. Binoculars will increase the view substantially. This is the best time of year to check out the Pleiades star cluster, which, through binoculars, looks like dozens of sapphires against a black velvet background. So, turn off the TV and look, really look, at the sky. Bring your family and friends along for Lawnchair tour of the night sky, for it is best when shared.

This month the brightest star visible in the night sky, Sirius, is easy to spot in the constellation Canis Major, the Big Dog. It follows its master, Orion the Hunter, across the evening sky. If you enjoy colorful stars, then study the stars of Orion. His belt is comprised of blue stars. The bright star Rigel, which is in his right leg (or foot), is also bluish. In contrast, Betelguese, the bright star in his left shoulder (or armpit), is quite red. This color difference is most easily seen with the unaided eye. Take time to really study the different star colors in the night sky as you take your lawnchair for an interstellar spin.

29 January 2004 Mentoring Committee Meeting

by JanaRuth Ford

Introductory Packet: Planisphere, Red-beam flashlight, Other? These would be given to new club members along with club information and "How to Get Started in Astronomy".

Interest Survey Topics: Members can indicate their interest in learning more about specific areas of astronomy or in being instructors in such areas as Equipment, the Night Sky, Solar System astronomy, Deep-Sky astronomy, etc.

In order to have a functioning loaner program, members should be certified as follows.

Certification Program: Introductory (Dobsonian), Intermediate (Equatorial), Advanced (Go To), Astrophotography and Video Imaging, Photometry.

Committee members thought it would be best if the instructional classes were held in conjunction with the regular monthly membership meetings rather than at a separate time or place. The instructor(s) would simply meet with a small group before or after the main program and then arrange for an additional observing session if it is needed.

Instructional Classes: Learning the Night Sky, Binocular Astronomy, Solar System Astronomy, Deep Sky Astronomy, Ancient and Medieval History of Astronomy. The first four should be offered *at least* once a quarter and be seasonal in nature.

Special Event Classes: Messier Marathon, Meteor Showers/Meteorites/TN Impact Craters, Comets, Near Earth Asteroids, Eclipses. These would be offered as the opportunity arises, perhaps in conjunction with star parties.

A Book/DVD Library and "Textbooks" (NightWatch for example) are needed.

Please send comments on any long term Issues/Goals/Objectives that have been overlooked for discussion at the next meeting. (Please send agenda items to chair by Tuesday, February 24) The Mentoring Committee will meet at the Jefferson Square Clubhouse on the fourth Thursday of each month at 7:00 pm. Once classes have formed we will meet less often. Next Meeting: Jefferson Square - February 26 at 7:00 pm.

Happy Birthday Joseph Fraunhofer

by Robin Byrne

This month we look at the life of a man whose ability in creating quality optics allowed him to make an important discovery. Joseph von Fraunhofer was born on March 6, 1787 in Straubing, Bavaria. The eleventh child of Franz Fraunhofer, who was a glass manufacturer (or glazier), Joseph grew up helping his father in his workshop rather than going to school.

By the time Fraunhofer was eleven, seven of his siblings and both of his parents had died. Joseph went to work as an apprentice for a wood turner, but soon left to work for a glazier, who made lenses and mirrors. While an apprentice, the house he lived in with his master collapsed. Fraunhofer was remarkably unhurt. Witnessing this event was a man named Utzschneider, who took it upon himself to unofficially educate Fraunhofer about optics and physics.

Utzschneider had a workshop where he manufactured geodetic and other scientific instruments. Fraunhofer began working for the company, grinding and polishing the optics for the instruments. The first instruments with his optics were sold to an observatory near Budapest, Hungary.

Fraunhofer became more and more particular about the methods used to manufacture optics, and developed new methods in grinding and polishing to make the production more reliable. He also devised better materials to use for the polishing of lenses, and the gluing of multiple lenses together. Within a few years, the excellence of his optics improved immeasurably.

In 1809, Fraunhofer was taught how to melt glass by a master in the field. Soon Fraunhofer was again improving upon the process to achieve superior results, even developing new types of glass that could be used to make larger lenses. He soon became a partner in the business and was increasing production to one instrument per day. The company manufactured a wide range of instruments. Besides small telescopes, they also produced microscopes, opera glasses, loupes, and eventually began producing large telescopes, the smallest having a 6.5 inch aperture. The large telescopes were designed with a spring-loaded lens mount to help maintain collimation.

In 1812, while continuing to develop superior optics, Fraunhofer looked at the spectrum of the Sun. He noticed several dark lines. Some of these had been observed as early as 1802, when Wollaston had documented seven such lines. Fraunhofer, however, could see over 500 of these absorption lines, and was able to accurately measure the wavelength of 324 of them. He labeled the strongest of these with letters. This system is still used today when identifying what are now known as Fraunhofer Lines. These are now used to identify the chemical make-up of not only our Sun, but of other stars as well. In 1821, Fraunhofer built the first diffraction grating, which he used to further study the solar spectrum.

Meanwhile, in 1817, Fraunhofer created the design for an achromatic lens. This lens was constructed for a telescope to be used at an observatory in Russia (now in Tartu, Estonia). The objective was finished in 1819. In November of 1824, the telescope was dismantled and shipped to Russia. Within three years, this telescope was used by Struve to measure the distances of over 3000 double stars. This telescope was recently restored in 1993.

In 1823, Fraunhofer received the honor of being appointed director of the Physics Museum in Munich and was given the honorary title of Professor. The following year he was elected as a member of the Civil Order of the Bavarian Crown and was knighted.

Joseph Fraunhofer died of tuberculosis on June 7, 1826. Our understanding of stars and the Sun owe much to this man who had no formal education, but whose amazing abilities in constructing and designing optics has allowed us to understand our universe in a much deeper way.

References

Joseph von Fraunhofer Web Page http://www.hao.ucar.edu/public/education/sp/images/fraunhofer.html

Fraunhofer, Joseph von Web Page by Chris Plicht http://www.plicht.de/chris/35fraunh.htm

Deep Space Network 2-for-1 Sale!

By Patrick L. Barry

Deep Space Network 2-for-1 Sale! By Patrick L. Barry Call it a "buy one, get one free" sale for astronomers: Build a network of radio dishes for communicating with solar-system probes, get a world-class radio telescope with a resolution nearly as good as a telescope the size of Earth!

That's the incidental bonus that NASA's Deep Space Network (DSN) offers the astronomy community. Designed to maintain contact with distant spacecraft in spite of the Earth's rotation, the large, widely spaced dishes of the DSN are ideal for performing a form of radio astronomy called "very long baseline interferometry" (VLBI).

VLBI produces very high resolution images of the cosmos by combining the output from two or more telescopes. The result is like having a giant "virtual" telescope as large as the distance between the real dishes! Since bigger telescopes can produce higher resolution images than smaller ones, astronomers need to use dishes that are as far apart as possible.

That need dovetails nicely with the DSN's design. To maintain continuous contact with deep space missions, the DSN has tracking stations placed in California, Spain, and Australia. These locations are roughly equally spaced around the Earth, each about 120 degrees of longitude from the others-that way at least one dish can always communicate with a probe regardless of Earth's rotation. That also means, though, that the straight-line distance between any two of the stations is roughly 85 percent of Earth's diameter-or about 6,700 miles. That's almost as far apart as land-based telescopes can be.

"We often collaborate with other VLBI groups around the world, combining our dishes with theirs to produce even better images," says Michael J. Klein, manager of the DSN Science Office at NASA's Jet Propulsion Laboratory. "Since our 70-meter dish in Canberra, Australia, is the largest dish in the southern hemisphere, adding that dish in particular makes a huge difference in the quality of a VLBI observation."

Even though only about 1 percent of the DSN's schedule is typically spared from probe-tracking duty and scheduled for radio astronomy, it manages to make some important contributions to radio astronomy. For example, the DSN is currently helping image the expanding remnant of supernova 1987A, and Dr. Lincoln Greenhill of the Smithsonian Astrophysical Observatory is using the DSN dishes to explore a new way to measure the distances and velocities of galaxies.

And all this comes as a "bonus" from the dishes of the DSN.

To introduce kids to multi-wavelength astronomy, NASA's website for kids, The Space Place, has just added the interactive demo, "Cosmic Colors," at spaceplace.nasa.gov/cosmic .

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Astronomy Day at Adventure Science Center

Astronomy Day @ ASC, April 24, 2004, will feature reenactment of the Magdeburg Hemispheres Experiment coordinated with Sister Cities of Nashville. This event will feature live animals (probably Tennessee mules) and lots of pomp and ceremony. Set this date on your calendar and plan to come.

Activities and Events

March 1 — 31, 2004

3/1 Conj., Moon & Saturn
3/2 BSAS Board meeting, 7:30 pm at Jefferson Square, Joe Boyd 386-3134)
3/3 Mercury at superior conj., Jupiter at opposition; Long range planning & Equipment comm., Lonnie Puterbaugh
3/6 FULL MOON; Conj., Moon & Jupiter
3/8 Presentations comm. John Harrington
3/10 Grants comm.
3/13 LAST QUARTER
3/17 ST. PATRICK'S DAY; conj. Moon & Neptune
3/18 BSAS meeting, 7:30 pm at Dyer Observatory; conj. Moon & Uranus
3/20 NEW MOON; Vernal equinox 12:49 am ; Messier Marathon — all night, L Puterbaugh
3/21 Conj., Moon & Mercury
3/22 Outreach comm. Heinrich Tischler
3/23 Public Relations comm. Adventure S.C.
3/24 Conj., Moon & Venus
3/25 Conj., Moon & Mars, Mentoring comm. JR Ford
3/27 6:30 to 9:30 pm - star party for FIVE naked eye planets and the Moon @ Warner Park
3/28 FIRST QUARTER; Conj., Moon & Saturn
3/29 Mercury at greatest E. elongation (19%); Venus at greatest E. elongation (46%)

April 1 — 30, 2003

4/1 BSAS Board meeting, 7:30 pm at Jefferson Square, Joe Boyd 386-3134)
4/2 Conj. Moon & Jupiter
4/4 Daylight saving time begins.
4/5 FULL MOON
4/6 Dark-sky Committee, Powell Hall
4/7 Conj., Mars & Aldebaran; Long Range Planning & Equipment comm. Lonnie Puterbaugh
4/11 Easter Day; LAST QUARTER
4/13 Conj., Neptune & Moon
4/14 Conj., Uranus & Moon; Grants comm.
4/15 BSAS meeting, 7:30 pm at Dyer Observatory
4/16 Mercury in inferior conj.; Conj., Venus & Aldebaran
4/19 FULL MOON
4/22 Lyrids meteors; Mentoring comm. JR Ford
4/23 Conj., Mars (s) & Venus (n) of Moon; Public Relations comm. & 8:00 to 10:00 pm - Spring Star Party @Adventure S.C.
4/25 Conj., Moon & Saturn
4/26 Outreach comm. Heinrich Tischler
4/27 FIRST QUARTER
4/29 Conj., Moon & Jupiter

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