



The Spectrogram

Birth of the World's Largest Fully Steerable Radio Telescope

In an isolated mountain valley, a giant telescope nearly as tall as the Washington Monument is about to start searching the sky for clues to the creation of the universe. The \$75 million Robert C. Byrd Green Bank Telescope - the world's largest fully steerable radio telescope - was being dedicated Friday 8/25/2000 after almost 10 years of construction.

The West Virginia Democratic senator was to be on hand, along with National Science Foundation Director Rita Colwell, NASA Administrator Daniel Goldin and National Radio Astronomy Observatory Director Paul Vanden Bout.

"We expect it to probe such mysteries as the birth of galaxies in the early universe, the birth of stars and the chemical composition of interstellar dust and gas," Colwell said. "These are the very elements created in the universe that eventually become the stuff of biological systems."

The telescope towers 485 feet, making it 70 feet shorter than the Washington Monument. Its 16 million-pound telescope's dish is 100 by 110 meters, larger than a football field.

"This telescope will allow scientists on Earth to touch the stars without leaving the hills of West Virginia," Byrd said.

The in-ground telescope at Arecibo Observatory in Puerto Rico, with a dish about 1,000 feet in diameter, is much larger but lacks the adjustability of the Green Bank Telescope.

Despite its size, the Green Bank Telescope can be pointed with an accuracy of one arcsecond, the width of a human hair seen 6 feet away.

The telescope has an unblocked aperture suspended from a side-mounted arm instead of the traditional tripod design on most telescopes. The single mount, common to small, backyard dishes, reduces interference.

The telescope also has 2,004 surface panels covering about 2 acres that can be individually adjusted by a system of 2,209 small pistons. A series of laser beams aids its fine-tuning abilities. The telescope replaces a 300-foot one - designed to last 10 years - that collapsed in 1988 after 26 years. The new telescope is designed to last at least 25 years. Scientists will submit proposals to a peer review group that will decide who gets to use the new telescope. The contractor, Sterling, Va.-based Comsat, is expected to complete painting and make final adjustments by Sept. 30. The observatory staff will then outfit the telescope with computers and radio wave receivers in phases. It should be fully operational within two years. The observatory is open for tours from Memorial Day through Labor Day and on weekends in September and October. Private group tours can be arranged at other times by calling 304-456-2150.

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Fact of the Month

The size and layout of the three Pyramids of Giza correspond to the position and magnitude of the three stars in the belt of the constellation Orion. They seem to have constructed the Pyramids with this fact in mind, as the position of the Nile in relation to the Pyramids is relatively the same as the position of the Milky Way in relation to the three stars in Orion's belt.

Important Announcements



- **Our next meeting** will be on Thursday, September 7th, at 8:00 PM at the Colts Neck Fire Company #2 on Conover Rd. in Colts Neck. This is the first meeting of the new club year. Coffee and other refreshments as well as cookies will be served. Directions: From Rt. 520, turn south onto Rt. 34. Conover Rd. is on the right, one light south of Rt. 520. From Rt. 537, turn north onto Rt. 34. Conover Rd. is on the left, two lights north of Rt. 537. The fire house is on the right, just a couple of blocks off of Rt. 34.
- **The Spectrogram wants you!** If you would like to contribute an article, or news item, or if you have questions or suggestions, please contact me via email at fblock@monmouth.com.
- **New Club Calendar on the Web!** We have a new calendar available to list meetings, and astronomical events, both in the sky and locally. The calendar also shows phase of moon, and soon will show local rise and set times for objects of interest (like the moon and sun). Thanks go to Mike Lindner for setting this up!
- **Updates to the Members Equipment** portion of the STAR web site we done by Rob Teeter. You can visit the new section by clicking the link for Members then select Equipment Pages. Thanks Rob! The work is appreciated!
- **John Batinsey recently had a story published in the latest ANJEC** (The Association of New Jersey Environmental Commissions) report. The title was, "Controlling Light Pollution in Eatontown". It covers all the effort that Eatontown is putting into preventing light pollution. John is looking to form a Light Pollution Committee within STAR that would guide other club members in what needs to be done. John can be reached at his home by calling 732-542-0607 and should be available at the next meeting to discuss this further.

Upcoming Events and Star Parties



- **September 2, 2000 – Star Party -- Keystone State Park, Pennsylvania**
The Amateur Astronomers Association of Pittsburgh hosts this star party to provide guests with the opportunity to examine the skies with telescopes that the association will make available to the public. Contact: Pam Primas at 724.668.2566; e-mail: kpnature@nb.net
- **September 29 - October 1, 2000 – Connecticut Star Party 2000 -- Camp Bobriwka, Colebrook, Connecticut:** To help foster an interest in amateur astronomy, The Astronomical Society of New Haven will hold a star party, which will take place at Camp Bobriwka, Colebrook, Connecticut. Contact: sunandmoon@freewwwweb.com
- **September 29 – October 1, 2000 New Jersey:** The South Jersey Astronomy Club will host the **Fourth South Jersey Star Party** to be held at Belleplain State Forest, near Woodbine in southern New Jersey. For details and registration information please visit our web site at <http://members.aol.com/sjastroc/> or send email to paostwald@aol.com.
- **October 21, New York:** The sixth annual **American Urban Star Fest** sponsored by the Amateur Astronomers Association in cooperation with the New York City Urban Park Rangers and the Hayden Planetarium will be held from 6:00 to 9:00 p.m. in Central Park's Sheep Meadow, Manhattan. Admission is free. The event features stargazing sessions, informal talks, and light music. Bring your favorite binoculars, telescopes, lawnchairs, blankets, and sweaters/jackets. There are food vendors at the park and adjacent streets. Sheep Meadow is serviced by all buses and trains to the southern or western side of Central Park; there is no access for cars. For details call 212-535-2922 or go to <http://www.aaa.org>.

What's Happening at STAR?



STAR Mentioned in Sky & Telescope (Again) - *By Mike Lindner*

If you read the Astronomy on the web section of the August Sky & Telescope you will see that STAR Astronomy is mentioned for hosting the ATM (Amateur Telescope Making) Web-Ring. In fact, the ATM Web-Ring logo at the top of the page is directly off of our home page.

Stellafane Star Party Report – *By Steve Walters*



Make that Stella-rain. David Britz and I suffered through what was a pretty bad convention. Friday night was ultra clear. As a result, I skipped most of the Friday evening talks. I usually try to hear all these talks because they are short 15 minute talks by a dozen speakers. There can be a lot of chaff in with the wheat, but normally something interesting shows up there that I can get excited about. But clear skies were too strong a draw for me and I set up my scope. Skies were clear until around 2 am or so. Off to bed. No rain yet. Saturday am swap tables got David B all worked up. He got a slit spectrometer for \$50, a really great buy. My other friend, Cliff Ashcraft, got some good buys on eyepieces. I didn't buy anything. Sat afternoon talks had two good ones. A speaker from Italy showed some really spectacular planetary shots he'd taken from Florida using a 10" Newtonian and a MX5 CCD camera. These have been published in S&T. They look like hubble photos. Incredible detail. You could see splits in the polar caps of Mars. Really amazing. Gordo: Take note, this guy uses your strategy of shooting lots of images and discarding all but the best. But he only keeps around 1% of his images. He said that on most evenings, he will take around 900 images and sometimes he has kept only 4. But what results! The second talk I liked was on a method for stressing a sphere into a parabola. This guy epoxies a fixture on the back of the mirror and uses a bolt to pull the sphere into a parabola. His fixture is simple but too hard to describe here, but this is a great improvement over the earlier method using a simple bolt epoxied to the center of the mirror. He ground a 1/40th wave sphere which "pulled" to a 1/20th wave parabola. Pretty cool. The evening talks were a bust for me. It started raining early in the talks and I couldn't even hear the discussion. But they are spending entirely too much time on baloney before getting to the main speaker. I left after about 2 hours and they were still rambling on about how so-and-so fell off the tractor clearing land and what a big laugh everyone had. Some of this is ok, but it just goes on and on. Regarding the rain, the phrase "torrential downpour" is an understatement. I think we got a foot of rain in about 1 hour. You couldn't see more than 10 feet. It was really bad. I had planned to go down to Shady Pines on Sunday and stay most of the week but the forecasts are for thundershowers and rain daily through Thursday. So I'm home now trying to dry out and waiting for it to clear. In spite of this, I actually had a good time. Chatting with Cliff, David and others was nice. And the skies Friday night were really good. There's always next year.....

Shady Pines Star Party Report - *By Don Odegard*



After checking weather maps and images and weather web pages I my son, Dan P. went to Shady Pines for the Rockland Star party or what was left of it. John G. was to meet us up there. As we got north it got clear and We were surprised by the amount of people that had hung in at the pines from the stories we heard it rained every day and very hard at times. Friday past they got to observe till 1 and it was only a fair night. So we set up and the sky was not that great and we now called for partly cloudy skies. It cleared enough to look at stuff and it came and went till about 2:30 am and then that was it. The next day I had to go to Vermont and Dan and John went site seeing. I had a great ride up to Rutland but the clouds where rolling in fast low and dark not a good sign but after I finished my chore and headed back to the Pines the sky was clearing. Sat. night was great a all-nighter and we saw some stuff and more stuff. People where taking CCD images, Film and others had no idea what they where doing. A lot of rookies and some serious observers. An Interesting mix which was funny at times. I had a great time, good company and it could not have worked out better as I had to go up that way anyway.

Hubble Spies Brown Dwarfs



Last March, Philip Lucas (University of Hertfordshire) and Patrick Roche (University of Oxford) reported how they used the United Kingdom Infrared Telescope (UKIRT) in Hawaii to probe the Great Orion Nebula with a new infrared camera. They discovered more than 500 faint objects littering the field. Most of them are brown dwarfs, stars having masses less than 8 percent of the Sun (about 80 Jupiters' worth). Objects smaller still in the field are believed to be loose planets (See the July issue of *Sky & Telescope*, page 18). The Hubble Space Telescope had turned its gaze toward the center of the Orion Nebula as well, and its infrared view of the substellar swarm was released today.

The HST release was accompanied by the announcement that astronomers had used Hubble's Near Infrared Camera and Multi-Object Spectrometer to peer at another young star cluster and uncovered another bumper crop of brown dwarfs. Joan Najita and Glenn Tiede (National Optical Astronomy Observatories) and John Carr (Naval Research Laboratory) examined IC 348, a 7th-magnitude complex of stars and nebulosity in Perseus (adjacent to Omicron Persei). The NICMOS spectra allowed the astronomers to sift through the cluster and find the coolest stars, 30 of which they note are brown dwarfs. For more information, see the online press release; their results will appear in the October *Astrophysical Journal*.

What's in the Sky This Month (*From Astronomy.com*)



- **Jupiter and Saturn rise before midnight**, reclaiming their roles as the most fascinating objects in the sky. After midnight on September 5/6, Jupiter sports two small black eyes, caused by the shadows of Io and Europa. The moon dance and shadows of the four Galilean worlds are a continual source of delight.
- **On the evening of the 5th and 6th**, the modestly sized asteroid 113 Amalthea grazes the southeastern flank of the bright globular cluster M75. At a magnitude of 12.4, Amalthea will be handily brighter than the individual distant supergiant stars of M75. Don't mistake it for the 11.6-magnitude star that lies 4' to the southeast. Amalthea passes within half of that distance of the cluster's core. On any given night two to three asteroids are normally within reach of a moderate-sized telescope. The Path of the Planets tracks a number of them every month. In mid-September, five 9th-magnitude asteroids drift near the ecliptic. Starting in the west, asteroid 8 Flora dances along the border between Capricornus and Sagittarius. Further east and a bit brighter is 3 Juno in Aquarius, the third asteroid to be discovered. Asteroid 21 Lutetia, the dimmest on our list, comes next in Cetus. If you took the time to search out Mira this fall, take some extra minutes to pinpoint Lutetia. Rising above the eastern horizon later in September are the constellations Aries and Perseus, which tote asteroids 192 Nausikaa and 324 Bambergia, respectively.
- **September can never compete with August for meteors**, but it does have the persistent rain of sporadic meteors, plus a notable minor shower. The Delta Aurigids meteor shower peaks around September 8. The rate is expected to be about six meteors per hour. This year the waxing gibbous moon sets as the radiant in Auriga rises — a favorable situation. By dawn the radiant is practically overhead, giving the best chance for viewing members of the shower during early morning hours. The occasional bright meteor may leave a persistent train, but generally the shower produces faint and swift trails.



Astronomical Fact and Fiction – *by Paul J. Nadolny*

Over the summer, I was debating which of many topics to tackle for this first column. My answer came while reading the September 2000 issue of *Astronomy* magazine. On page 70, Martin Ratcliffe and Alister Ling write, "From the outer reaches of the solar system the sun appears merely as a bright star. At this edge of darkness three planets, Uranus, Neptune, and Pluto..."

The solar system is very big with a huge amount of empty space. In diagrams, the sizes of the sun and planets (relative to their orbits) are always exaggerated, because they would appear microscopic if drawn to scale. So authors in general have resorted to other means to convey the vastness of the solar system. Stating that from the outer planets the sun appears merely as a bright star certainly does that. Unfortunately, that's taking things a bit too far.

Let's look at the facts. (I promise to spare you the gory details!) In this article, I will consider two important qualities of stars that make them appear different from the sun: apparent brightness and apparent size.

The sun's apparent brightness (or magnitude) is about -26.7 . That's bright enough to damage your unprotected eyes. How bright would the sun be from the outer planets? From Uranus, the sun would appear to be magnitude -20.3 , and from Neptune, -19.4 . Pluto is a bit trickier because its orbit is so elliptical, but the sun's magnitude would range from -19.4 to -18.3 . So what do all these numbers mean? So from Uranus, the sun would appear $1/370$ th as bright, from Neptune $1/900$ th as bright, and from Pluto an average $1/1550$ th as bright as from Earth. That sounds pretty dim, but let's compare it to other celestial objects. The full moon is about magnitude -12.5 . Venus at its brightest is -4.6 , and the brightest star in the night sky is Sirius at -1.6 . If the sun were magnitude -18.3 , it would still be 200 times brighter than the full moon, 300,000 times brighter than Venus, and 4,700,000 times brighter than Sirius. I think that a magnitude -18.3 sun qualifies as a dimmer sun, but it would certainly light up Pluto's landscape unlike any bright star can possibly do.

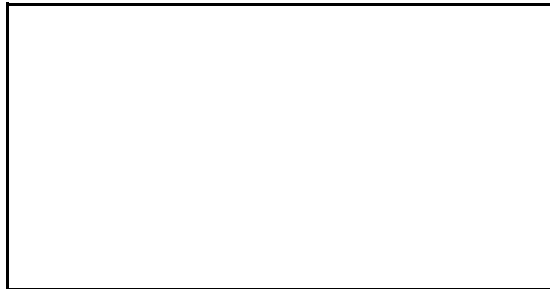
The second criterion that I mentioned is apparent size. From Earth, the sun appears to be 1920 arcseconds in diameter, or just over half a degree. How big would the sun appear to be from the outer planets? Using some simple trigonometry, the diameter of the sun from Uranus would appear to be 100 arcseconds, from Neptune 64 arcseconds, and from Pluto a range of 64 to 40 arcseconds with an average of about 50 arcseconds. Wow, that seems small compared to the sun from Earth! The unaided, young human eye can barely discern a disk that is 60 arcseconds wide, so it would seem that the sun would indeed appear starlike from the outer planets. Or would it?

The planets Jupiter and Venus (viewed from Earth) present disks comparable in size to the sun from the outer planets. Although the disks are too small to make out with the eye, they greatly reduce the amount of twinkling compared to stars. The planets usually shine with a steady light, while stars scintillate all over the sky. So having a disk, albeit small, makes a difference.

Just how big are the disks of stars anyway? A little research uncovered that Betelgeuse and Mira are the stars with the largest apparent diameters from Earth. They both have disks in visible light about 60 milliarcseconds wide. That's 0.06 arcseconds, which makes the sun from the outer planets 650 to 1750 times wider than the widest stars. In contrast, the sun from Earth appears 20 to 48 times wider than the sun from the outer planets. Clearly the sun from the outer planets is much closer to being a small sun rather than a big star. So how far away from the sun must one travel to make it appear as just a bright star? It turns out that from a distance of 107,000 AU (1.7 light years) the sun would appear as dim as Sirius, and from 32,000 AU (0.5 light years) the sun would be as small as Betelgeuse. Since the outer planets are just 20-50 AU from the sun, one would have to be much, much farther away for the sun to appear as a just bright star. So remember: within the solar system, it's always sunny!

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Here it is! This month's issue of...

THE SPECTROGRAM

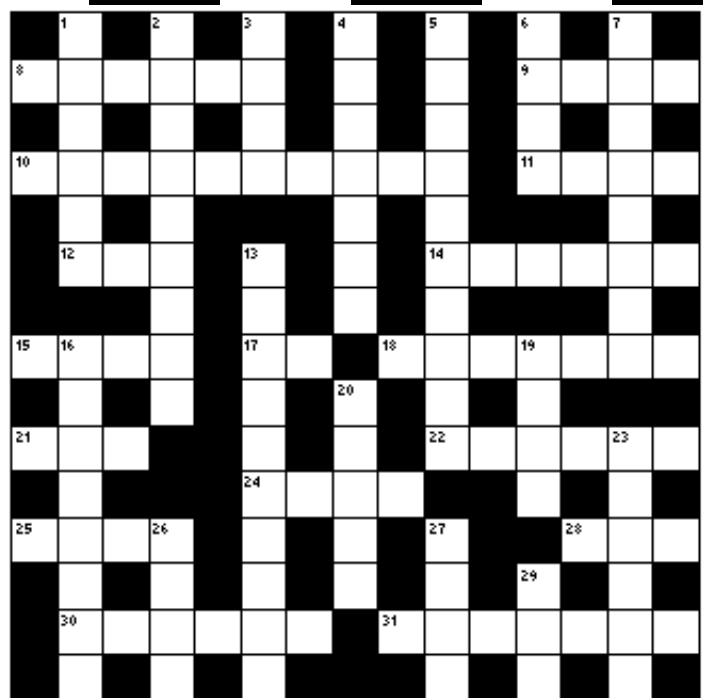
Crossword Puzzle for the month of September

Across

- 8 Falling star (6)
- 9 Crab Nebula caused by a ____ I supernova (4)
- 10 Most things in space are travelling at _____ speeds (10)
- 11 The red planet (4)
- 12 Sky measured in degrees, ____ minutes and ____ seconds (3)
- 14 Used in balloons (6)
- 15 ____ sky (4)
- 17 Abbr of second element (2)
- 18 Star _____ (7)
- 21 Aircraft sometimes used in astronomy (3)
- 22 Cast during an eclipse (6)
- 24 Energized molecules high in the atmosphere (4)
- 25 Receives radio signals from outer space (4)
- 28 Time left on a journey, abbr (3)
- 30 Mars _____; group of people (6)
- 31 A white dwarf or neutron star is extremely this (7)

Down

- 1 Huge patch of lit dust in space (6)
- 2 Observing tool (9)
- 3 Asteroid due to be visited by spacecraft (4)
- 4 After a rainfall, hopefully (7)
- 5 Not even light can escape these, pl.(10)
- 6 A molecule is made of these (4)
- 7 Controls the amount of light going into telescope (8)
- 13 If you lived on another world you are an? (10)
- 16 What you look through on a telescope (8)
- 19 Ball of nuclear fusion (4)



Down Continued

- 20 Permanent massive greenhouse effect (5)
- 23 The better these are, the better the view, pl.(6)
- 26 Comet ____/Bopp (4)
- 27 Just a second away for light to travel (4)