The Spectrum

The News Letter of the Buffalo Astronomical Association

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In this Issue...

Big Love

Alan Friedman

For Dashiell Hammett it was a Maltese falcon, but for an astronomer, telescopes are the stuff that dreams are made of. Glass is in our blood, a passion and sometimes a distraction.

As I traveled around the northeast last year visiting colleges with Sophie I found myself drifting away from the campus tours of student unions to hunt out the ivy covered building with the funny domed roof. Most college campuses, even those set in metropolis, have one of these. Observatory directors generally understand the telescope disease - some are inflicted themselves. I found most to be generous with their time and willing to take a break from their work to show me around.

Sophie wound up at Northwestern University in Evanston Illinois, a beautiful campus just north of Chicago. My first chance to visit her was on Halloween. It was parent weekend and the agenda was packed with planned events, Chicago sightseeing and great food. Buried in small type on the list of activities were words that called out to me, Public Night at Dearborn Observatory. My puppy dog eyes must have won Sophie over and after a dinner of deepdish pizza we set out, campus map in hand, to find the place.

It had rained all day and we weren't expecting much but as we turned a corner around the huge technology center I was thrilled to see the old limestone building, its dome open and a glow of red light softly illuminating the inside walls. Dearborn Observatory is one of the oldest buildings on Northwestern's campus. The polished wooden floors and spiral staircase leading to the dome are vestiges of its 19th century pedigree. Inside the modern dome the view is spare and organized, dominated by a massive German mount holding the 27' optical tube. Public nights are run by a small group of affable graduate students who were fielding questions from a handful of visitors. The sky was completely clouded over… clearly there would be no observing but the students were in a cheerful mood and happy to

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Big Love continued...

talk telescope. The stories we heard painted a colorful portrait of Dearborn and its mighty instrument.

The history of Dearborn Observatory reaches back into the mid nineteenth century, when the world's largest refracting telescope was the 15 inch at Harvard College. In 1859 the president of the University of Mississippi, an ambitious man named Frederick Barnard (he went on to become president of Columbia University and the namesake of its sister school Barnard College), commissioned Alvan Clark & Sons of Cambridge, MA to build an objective 18.5" in diameter. Barnard's grand plan to locate America's largest telescope in Mississippi was scuttled by the onset of the Civil War. The finished lens remained unsold, stored at Clark's Cambridge workshop. It proved to be a marvelous optic. On the night of January 31, 1862, while testing the new lens, Clark's son Alvan Graham made the visual discovery of Sirius B, the previously predicted but never seen white dwarf companion to the brightest star in the night sky.

The 18.5" lens remained available. Clark hoped that Harvard might purchase it and mount his great lens close to its birthplace in Cambridge. Harvard was indeed interested but investment money was very scarce in Boston during the early years of the Civil War. Meanwhile, a founding member of the young Chicago Astronomical Society named Thomas Hoyne was on his way eastward to New York City to examine a lens for a planned observatory in Chicago. Hearing of this impressive lens, Hoyne changed his itinerary to visit Alvan Clark & Sons. He negotiated the sale for $11,187, a modest sum by today's standards, but hardly pocket change at the time. By comparison, the cost to design and construct the first Dearborn observatory with its 90 foot diameter dome was $18,000.

The Chicago Astronomical Society was at that time affiliated with the old University of Chicago. The University offered a site to build the new observatory and helped to raise the remaining funds for construction. The observatory was opened in 1864 and named in memory of Mary Ann Haven Dearborn, wife of the major benefactor of the project. Both Alvan Clark and his son traveled to Chicago to supervise the mounting of the lens. They remained for a month to see the work completed and the telescope prepared for first light. Dearborn Observatory opened in 1864 under management of the University of Chicago. Alvan Clark was awarded an honorary degree in 1866 – he was 62 at that time.

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CYNOSURE

Darwin Christy

Cynosure the Dog's Tail, an old constellation, actually this ancient constellation is one of our well known ones, Ursa Minor. This early and universal title, which was translated as the "Dog's Tail," continued as "Cynosura" down to the time of the Rudolphine Tables. Although it is known among us as Cynosure, it is really applied only to Polaris, the Pole Star. The true meaning of "Cynosure" as drafted into the English language, as the focus of attention. It was the focal point of the skies, where all eyes eventually turned.

As it might be notes in a figurative sense, it was used as equivalent to something which attracts general attention, drawing all eyes toward it. The Pole Star attracts attention of all the mariners. Perhaps, even the Nomads of the desserts used this very sense to follow over the sands of time, as the mariners follow their travel over the seas. The origin of the word is uncertain, as the star group does not answer to its name unless the dog, itself is attached. Still, recalling a variant legend of Kallisto and her Dog, there have been thoughts that here lay the explanation.

Ovid and Germanicus, both presented a name of "Cynosuris" for this Lesser Bear; both construed it as a dog, rather than a bear, but many of the records are lost pertaining to the constellation of old.

ELTs

By Randy Boswell

The next decade promises to see the introduction of a new generation of Extremely Large Telescopes (ELTs). These behomoths will have apertures ranging from 24 to 42 meters. Among the ones under development are the 24.5 meter Giant Magellan Telescope (GMT), the 30 Meter Telescope (TMT), and the European Extremely Large Telescope (E-ELT). In fact, the smallest of these, the GMT, will dwarf the Twin-Keck telescopes atop Mauna Kea in Hawii at 10 meters (33 feet) each and presently one of the most widely used telescopes. These ELTs will greatly expand our vision and understanding of the universe. They differ in detail, but share important features, including segmented mirrors, sophisticated control systems, and adaptive optic systems promising resolution better than the Hubble Space Telescope. (Hecht, 2009, p. 39).

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Sad news...

Scott A. Smith

Big Love continued...

The Dearborn telescope held the title of largest refractor in the world until the early 1880's. It witnessed both distant starlight and earthly troubles in its early years. The great Chicago fire of 1871 destroyed many records of its early history and brought terminal financial woes to the Old University of Chicago. As bankruptcy neared, the Chicago Astronomical Society took back ownership of the telescope and sought a more secure home, which was found to the north on the campus of Northwestern University. A new Dearborn Observatory was constructed - a massive Romanesque structure in limestone that was dedicated in 1889. The Chicago Astronomical Society continued to operate the telescope at Northwestern until the Great Depression, when financial pressures forced the club to relinquish title. Ownership of Dearborn Observatory was finally transferred to Northwestern, with the condition that the public would always enjoy free access to the instrument.

The telescope has seen many updates over the years. During a 1929 overhaul, the original wooden tube and equatorial mounting were replaced… the original parts were donated to the Adler Planetarium where they were preserved and mounted for exhibition. In 1939, the entire observatory was moved 100 yards to accommodate the massive new Technology building at Northwestern. Today the mighty 18.5" f17.5 telescope sits under a modern dome, gathering light for teaching and research. As promised, it remains open every Friday night for public tours and visual observation. The Chicago Astronomical Society is still going strong. It claims to be the oldest astronomical society in the western hemisphere.

As I write these notes from our visit to Dearborn Observatory, I am reminded of big glass closer to home… 8.75 inches on the rooftop of the Buffalo Museum of Science and 12 inches of handmade mirror at our own Beaver Meadow Observatory… instruments fashioned and maintained with a lot of love over many years. I bet they have many stories to tell.

Scott A. Smith (not the writer of this article) of Grand Island NY, entered into eternal rest on February 10, 2010; beloved husband of Rochelle D. "Shelley", brother of Russell J. (Danielle nee Scott) Smith of Lutz, FL and Suzette Hino (Wayne E.) of Hamburg, NY; uncle of Zachary J., D. Alexander and Joshua S. Smith, all of Lutz, FL and Simon E. Hino of Hamburg. Scott was an active volunteer counselor and Past Chapter Chair of WNY SCORE, member of the Grand Island Library Board and Friends of the Grand Island Library and the Buffalo Astronomical Association since 2003. Online condolences may be made to www.mem.com

I had a chance to briefly meet Scott at last year's dinner banquet at the Buffalo Museum of Science. From the few minutes we talked I could tell how kind and gentle this man was. I'm sure he will be sadly missed by all of the people he touched in his lifetime.

ELTs Continued...

The GMT will boast of a 24.5 meter (80-foot) primary mirror that will be comprised of seven 8.4 meter (28-foot) hexagonal segments. The telescope is a classic Gregorian, focusing light through a central hole in the primary. (Hecht, p. 41). A fixed compensation lens will correct for mirror aberrations, and yield a field of view of 20 arcmin. (Hecht, p. 41). The GMT is expected to provide a resolution ten times sharper than the Hubble Space Telescope (HST) and up to five times that of it's replacement, the James Webb Space Telescope (JWST). Moreover, it promises to have up to 30 times the resolving power of current telescopes.

The GMT is the offspring of the Carnegie Institution for Science in Washington, D.C., and is under the auspices of a nine-member consortium called the GMTO Corp., based in Pasadena, California. At a projected cost of $600 million it is to be built at Las Campanas Observatory in Chile and is scheduled for operation in 2018.

The TMT will have a 30 meter (99-foot) primary mirror composed of 492, 1.4 meter (5-foot) hexagonal segments. It will have a 3.1 meter (10-foot) secondary mirror. Based on technology largely drawn from the Twin-Keck telescopes the TMT will utilize real-time control to adjust the primary mirror to correct for wind, thermal, and mechanical disturbances to within 20 times a second. The TMT's f/1 primary mirror will be complemented by a concave Gregorian secondary that's "active" (deformable) to correct for subtle aberrations caused by mirror flexure. (Lowe, 2008, p. 22). An articulated tertiary mirror will then direct the telescope's corrected light beam to a suite of instruments positioned on stable platforms along the giant structure's altitude axis. (Lowe, p.22). At roughly half the wingspan of a Boeing 747 jet, the TMT will boast of a light gathering power nine times more than one of the single 10 meter Keck telescopes and capture objects ten times fainter and have three times better spatial resolution. At a cost of $1 billion, the TMT is under the aegis of the Association of Canadian Universities for Research in Astronomy, the California Institute of Technology (Pasadena) and the University of California. Slated to be built atop Mauna Kea in Hawaii, it is scheduled to begin operation between 2013 and 2018.

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RoboScope Report

Daniel Marcus

The LX200 10" scope that the club was using for the RoboScope has a blown XC3030 programmable array chip. I have not been able to locate a programmed chip, and Meade will not fix it unless we send the whole scope back and fork over $400 + shipping and handling. After much discussion the board and the RoboScope committee decided that fixing the LX200 was a waste of money that could be used to purchase a much more reliable instrument that could be relied on for doing research as well as educating the public. Since any upgrade to a larger more robust mount meant bigger, it will not fit in the existing RoboScope observatory. The decision was made to replace the existing 12" which was has served the public and the club for over 50 years. The proposal is to purchase an AstroPhysics AP1200 mount, a Celestron C14HD telescope, a Takahashi TSA-102, and upgrade the MaxDL software. The plan is to update the observatory with modern equipment to allow us to better educate the public on how a modern observatory actually works. Technology has vastly improved over the last 50 years, it is time to bring our observatory up to modern day levels to help educate and recapture the interest of the general public. With the added advantage that the mount can be controlled remotely via the internet, it can become a teaching tool for our outreach programs. To facilitate this we will need a rock solid mount, with pinpoint accuracy and tracking. The choice of a cassegrain style was to facilitate balancing with heavy cameras. With the Newtonian

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RoboScope continued...

when you hang a heavy camera on the focuser it is very hard to balance the scope so it stays balanced at any point in the sky. With the focuser on the optical axis, you only have to move the scope assembly, or add a ring weight on the assembly. The intent is to use the existing camera and robofocuser on the new scope, and use the RoboScope building for club members who want to keep a mount permanently located at BMO so they do not have to set up each time they go out there. We can setup the upgrade scope so when you remove the camera, you can add just one weight assembly to get it to operate visually. We estimate the cost of this upgrade to come to around $25,000. Obviously we do not have quite enough money in the treasury yet to pay for this project. If you have any suggestions on fund raising ideas – T-shirts, raffles, split club, and/or want to help out raising some (LOTS) of money, or just plain donate $$$ please contact me at 773-5015 or DMa3141551@msn.com. I am in the process of getting all the equipment inventoried that the club owns. The intent is to see what we really do not have any use for, and see if we can turn it into cash before it gets lost or damaged. My thoughts on the subject are: we offer them to club members first- maybe we can have raffles??, then sell them online and reinvest the money to modernize Beaver Meadow Observatory. Rick Guerin and I have installed the

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ELTs Continued...

Finally, there is the European Southern Observatory's (ESO, Garching, Germany) European Extremely Large Telescope (E-ELT). This Goliath will have a primary mirror 42 meters across (138 feet) consisting of 906 hexagonal segments. It's secondary mirror will be 6 meters (19.8 feet) and as large as many primary mirrors on today's telescopes. The E-ELT uses a novel five-mirror design that gives better optical correction than is possible with three mirrors, at the cost of higher scattering and thermal emission. (Hecht, p. 43). The secondary mirror will focus the image to a 4.2 meter (13.8 foot) tertiary mirror imbedded in the primary mirror, which will in-turn direct the image to a fourth overhead 2.6 meter (8.5 foot) mirror using adaptive optics to correct it's shape to compensate for atmospheric turbulence. Lastly, a fifth 2.7 meter (8.9 foot) mirror will correct blurring caused by wind and directs the final image to an array of instruments.

The E-ELT is expected to yield images around 15 times better than the HST and possesses a light sensitivity up to 100 times that of today's large telescopes. The E-ELT alone is expected to cost 850 million euros ($1.15 billion), with another 150 million euros ($200 million) added for instruments. It is scheduled for operation by 2018 with Argentina, Chile, Morocco or Spain as possible sites under consideration.

In addition to their large apertures, an equally significant factor in the ELTs capabilities is their use of the adaptive optics system. Atmospheric turbulence makes stars appear to twinkle thereby producing a less clear or distorted image through a telescope. Currently in use on the world's major telescopes, adaptive optics corrects this by in-effect "de-twinkling" the stars. This involves creating an artificial image of a guide star by firing a laser beam into various layers of the atmosphere ranging from 50 to 90 km high (30 to 60 miles) in order to excite the sodium atoms at that altitude – which are the residue left by meteors entering the atmosphere – causing them to glow and producing an artificial star image. By monitoring the artificial star, the system determines how the air is churning and adjusts the telescope's optics more than a thousand times each second to compensate. (Ferris, 2009, Cosmic vision, p. 3). This is accomplished by using a deformable mirror that changes its shape to compensate for atmospheric distortion. The superior resolution this

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ELTs Continued...

technology enables means that, for the first time, "big ground-based telescopes will deliver better images than we're getting in space," says TMT advisor Richard Ellis of Caltech. (Raloff, 2009, p.32).

One of the major goals of ELTs is to search for earthlike or extrasolar planets orbiting other stars. NASA's Kepler mission, launched in March 2009 and surveying 100,000 stars in the constellations of Cygnus and Lyra has presently catalogued more than 345 extrasolar planets. However, Kepler can only spot planets that are around Jupiter-sized and larger. Moreover, these bodies are in orbit around their suns at about 24 to 119 astronomical units (AU) and not in the range of 1 AU which is the distance from the earth to the sun. The aim of ELTs is to detect extrasolar planets that are around the size of the earth and at a distance around 1 AU to their parent suns. This requires telescopes that can image objects about 3000 times smaller than the giant extrasolar planets detected and that are not obscured by the parent star's light. Currently, this is not possible with even the largest telescope of today, the 10.4 meter Gran Telescopio Canarias in Spain's Canary Islands. ELTs, on the other hand, with their large light- gathering abilities and high resolution promise to accomplish the task.

By searching for approximately earth-sized planets around 1 AU or so from their suns astronomers hope to find exrasolar planets in "habitable" zones, i.e., where the temperature is not hot enough to boil water, nor cold enough to freeze water. Astronomers consider this to be one of the factors that would make them amenable for life. Astronomers are also interested in studying the composition of their atmospheres for the presence of biosignatures such as methane, ozone and oxygen which could indicate the presence of life. ELTs will allow astronomers to perform spectroscopic studies of their atmospheres to test for these biosignatures.

Another objective of ELTs is the study of super massive black holes at the center of nearby galaxies by making detailed studies of the velocities of stars around their cores. Today's telescopes can only carry out such measurements on the black hole at the heart of the Milky Way. (Ananthaswamy, 2008, scrn. p. 3).

ELT observations may also yield more accurate measurements of the expansion rate of the universe. ELTs

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RoboScope continued...

Meade 8" with the Great Polaris mount in place of the LX200 10". We are currently waiting for a clear night to polar align and test the pointing capabilities of the scope. If the pointing really is bad, we will try mounting the astrovid with a lens on it as there already is a cable for it going to the old warming room. We can use the astrovid to identify the field we are looking at, and then center object in the camera field. The next RoboScope meeting will be on Thursday February 25 at 7:30pm. If CLEAR, it will be at the Observatory, if cloudy it will be at my house at 772 Ransom Road, Grand Island, NY. Call 773-5015 to get directions and location. The RoboScope group will now meet 2 hours before public nights at BMO. There will be an additional meeting on Saturday March 20 at 6:00pm.

"100 Years of Norton; a century of astronomy as seen from the pages of a book"

2010 marks the centennial anniversary of the classic amateur star atlas affectionately known as "Norton's". From the hand drawn maps of 1910 to the computer generated charts of the 21st century, Norton's reflects the changing face of amateur astronomy and gives us a glimpse of ourselves.

John Gauvreau is a long time amateur astronomer, past president of the Hamilton Centre of the Royal Astronomical Society of Canada and currently the Observing Director of the Hamilton Amateur Astronomers.He taught astronomy

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BAA ANNALS

Rowland A. Rupp

5 YEARS AGO - Our speaker at the 2005 March dinner meeting was Dr. Warren Marcus whose topic was "The Cassini/Huygens Mission to Saturn and Its Moons." Fairdale Banquet Center was the venue. Dr. Judith Pipher spoke the following month on the Spitzer Space Telescope. Thom Bemus had coordinated another Cedar Key Star Party in Florida in February. Larry Carlino contributed an evaluation of the Williams Optics 80mm Megrez II ED Optical Tube. Larry approved of the telescope as a frugal compromise between a true APO and an achromat. Gus Cenkner wrote on several approaches to reduce the effect of dew formation on telescope optics. His analyses covered dew shields and electrical heaters including hand held hair dryers. Rowland Rupp reviewed a book by James Gleick entitled Isaac Newton, that he considered less informative about the great scientist's personal life than Isaac Newton - The Last Sorcerer by Michael White.

10 YEARS AGO - Apparently

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100 Years Continued...

at the community college in Hamilton for 20 years and now does children's shows based on the work of Galileo for groups as diverse as elementary schools, nature parks and the Ontario Science Centre.

ELTs Continued...

will enable astronomers to detect quasars that lie at the edge of the universe and study the changes in the red shift of their light over time to calibrate their receding velocities. A decade or two of measuring the velocity of quasars might reveal changes in their velocity, giving us the first direct measurement of the Hubble constant of the expanding universe. (Hecht, p. 43).

ELTs will explore the universe as a whole and will undertake such things as detecting primordial stars and galaxies and studying their evolution over time and studying the nature and distribution of dark matter and energy that permeates the universe.

ELTs will open up new and distant vistas on the universe. Whereas the HST's Deep Field View provides an astonishing picture of newly-formed galaxies as they were some 11 billion light years ago – a few billion years after the Big Bang, given the estimated age the universe at 13.7 billion years – ELTs aim to peer even deeper into the early universe with a sensitivity and clarity than ever before. The first few billion years of the nascent universe poses many questions for astronomers. This new generation of telescopes promises to answer some of those enduring questions as well as herald new discoveries.

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Note: All materials can accessed online via: www.buffalo.lib.org and selecting: research.

BAA Volunteers Wanted For Upcoming Events!!!

Come join the fun with fellow BAA members as we share our passion for astronomy.

Astronomy Outreach Programs:

Sun-Earth Day 2010
March 20, 2010
11-3 P.M.
Buffalo Museum of Science

Rooftop Solar Observing, Space Weather News Desk, Anatomy of the Sun, Telescope Show and Tell, Various Astronomy hands on Projects, Astro Face Painting

For more info:
http://www.sciencebuff.org/calendar/detail/538/
http://sunearthday.nasa.gov

Astronomy Day 2010
April 24, 2010
11-3PM
Buffalo Museum of Science

"Celebrate the Cosmos!"

Fascinate space travelers of all ages by sharing your passion for astronomy as we celebrate Astronomy Day 2010. Members of the BAA will be on hand to conduct rooftop solar and lunar observing, engage in hands on astronomy activities, demonstrate how craters are formed, display and discuss the different types of telescopes we use, exhibit astronomical photography, and much more. It's a great time to promote our club as well as all aspects of the hobby of amateur astronomy.

For more info on National Astronomy Day:
http://www.astroleague.org/al/astroday/astroday.html

Annals Continued...

there was no Spectrum in March 2000, so what program we may have had that month is unavailable. There must have been a meeting because a College of Fellows report in the April issue noted that Marilou Bebak and Lynn Sigurdson were inducted as members, and Rowland Rupp received the award for his work in bringing astronomy education to schools. The topic for April was "UFOs - a serious look" by Robert Galganski. Tim McIntyre became Editor of The Spectrum and, as usual, there was a plea for articles. That transition of editors may explain the missing issue. Peter Proulx donated a refurbished Pentium II computer to the observatory. New computers, probably including Peter's, were installed at the observatory according to Observatory Director Mark Swiderski. We had raised $2000 in support of the Audubon Society's expansion project and hoped to get to $3000. Astronomy Day was scheduled for Tifft Farms on May 13 with Bob Hughes in charge.

Carl Klingenschmitt and Rowland Rupp wrote an article highlighting some of the technical difficulties inherent in radio searches intended to detect transmissions from extraterrestrial intelligences. The inverse square law, noise, antenna gain and beamwidth, bandwidth and frequency were all analyzed. Bill Smith noted that SETI could be augmented using home computers. No success yet after more than a decade of trying! Alan Friedman reported on observations of Orion and Auriga made at BMO using our 20-inch telescope on a frigid night in late January.

15 YEARS AGO - The 1995 March dinner meeting was held at Ilio Dipalo's restaurant in Blasdell where Jack Mack spoke on the improvements made to the Hubble Space Telescope. For April, new BAA member Richard Jones talked about the major telescopes he visited while he lived in Arizona. He also wrote for The Spectrum about his astronomy experiences before coming to Buffalo, and had already offered to form a WNY space forum for the BAA on the internet. Dan Marcus scheduled two classes at BMO on the use of our CCD camera, and Bill Smith planned a Messier Marathon at his home in Jamestown for early March.

Carl Milazzo sent in an article on the Messier list, which was appropriate in anticipation of Bill Smith's coming marathon. Bill wrote about the appearance of several constellations and finished with a favorable critique of H. A. Rey's innovative depiction of the constellations in his popular book, The Stars. He also submitted "A Cruise Down the Milky Way," citing many star clusters as he traveled. Part III of Steve Kramer's article on David Rittenhouse, this one on his orreries, also appeared in this Spectrum.

25 YEARS AGO - Dan Marcus was our March 1985 speaker. An expert astrophotographer, the subject of Dan's talk was "Astrophotography Geared toward Halley's Comet." Rochester's Richard Karlson dealt with eyepieces when he spoke in April. A BMO policy change was instituted to reduce the number of public nights from every Saturday year around to the first and third Saturdays from April through October, except for July and August when the observatory would be available every Saturday due to high public demand. Approximately 2750 members of the public visited BMO during the past 3 ½ years. A Niagara Frontier Council of Amateur Astronomical Associations meeting was scheduled for May 11 at the Buffalo Museum of Science.

President Ken Biggie wrote the first installment of a two part article on the controversional object SS-433. Edith Geiger wrote a profile of Evan and Adrienne Morris. They, in turn, jointly wrote an article on "Telescope Size and Magnitude Limit." Carl Milazzo wrote about his observation of Comet Levy-Rudenko 1983t having faded to magnitude 9.4, and Michael Idem reported on a number of observations he

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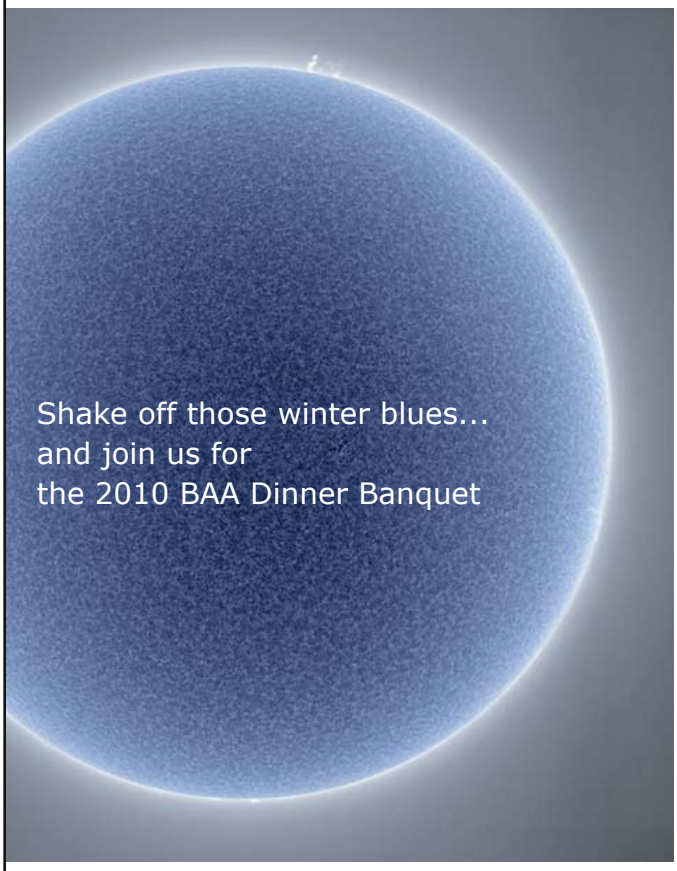


The Buffalo Astronomical Association
invites you to join us for our 2010 Dinner Banquet
with special guest speaker

Don Paul
Chief Meteorologist, WIVB TV
"Even the Uncertainties are Uncertain"

Record snows, cold and solar minimum... nature always seems to deliver surprises to alter the expected trends. So why are so many climate and atmospheric scientists still confident that global warming is virtually inevitable?

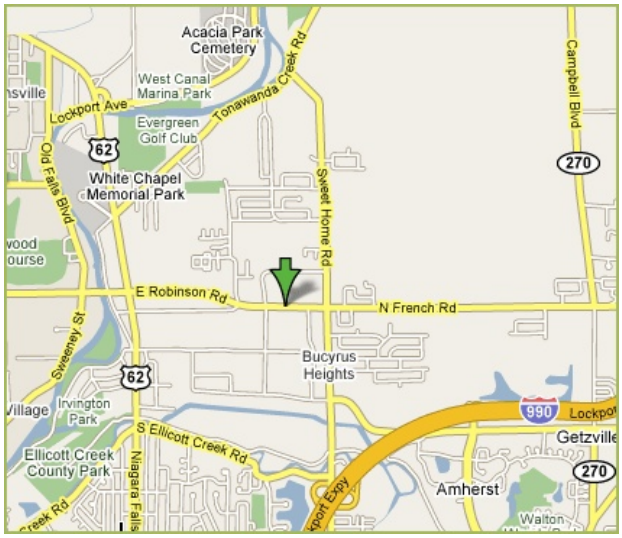
Saturday, March 13, 2010

Banchetti Banquet Hall
550 North French Road, Amherst, NY

Cash bar opens at 6:00 pm
(enjoy one complimentary beverage courtesy the BAA)
Sumptuous buffet dinner served at 7:15 pm
followed by speaker and program
Tickets $23 for BAA members and guests

*Reservations must be received by March 8, 2009
call 716. 639. 0866 or email info@buffaloastronomy.com for additional information

Our menu, coordinated by Banchetti and Janice Gardner:
Carved roast pork loin with balsamic glazed pears
Bourbon Glazed Chicken
Herb Roasted Haddock
Pasta in Red Sauce
A wide variety of salads
Fruit and Vegetable trays
Roasted Red Smashed Potatoes
Green Beans Almondine
Fruit Cobbler with Ice Cream
Coffee and Tea



Annals Continued...

made in January and February. Back in those halcyon days of 1985 the museum was still offering classes in continuing education; nineteen were listed in The Spectrum for the coming semester. The deaths of members Bob Burdick and Lorne Moore were reported.

35 YEARS AGO - Just as there was no Spectrum in March 2000, there was none in 1975 either. March must be a tough month for newsletters. The April issue announced that Francis (Frank) Bajer from the museum would speak on lasers at the forthcoming meeting. The club had raised $2625 toward building the observatory at Beaver Meadow, a project that had been unanimously approved by the BAA membership. The club was planning for an astronomy course at the Fred T. Hall building at the meadow to be conducted by John Riggs. Ernst Both concluded his article, "Of Moon Cities and Selenites", in which he highlighted the infamous "moon hoax" of 1835 when Sir John Herschel was falsely reported to have seen winged selenites and bovine-like beasts fluttering and roaming around the moon. Warren Steinberg's Instrument Section report noted that, in addition to mirror testing, plans for the observatory, yet to be built, were discussed.

Thomas Henry Huxley

"The great tragedy of science - the slaying of a beautiful hypotheses by an ugly fact."

What's up?

Mike Benz

March 15 - New Moon

March 20 - The Vernal Equinox occurs in the northern hemisphere at 17:32 UT. There will be equal amounts of day and night. This is also the first day of spring.

March 22 - Saturn at Opposition. The ringed planet will be at its closest approach to Earth. This is the best time to view and photograph Saturn and its moons. Saturn's rings will be nearly edge-on this year and will be very difficult to see.

March 30 - Full Moon

April 1 - 30 - Global Astronomy Month. The month of april this year has been designated Global Astronomy Month. This global outreach event hopes to generate interest in astronomy for people all over the world. Check their Web site for details.

April 14 - New Moon

April 21, 22 - Lyrids Meteor Shower. The Lyrids are an average shower, usually producing about 20 meteors per hour at their peak. These meteors can produce bright dust trails that last for several seconds. This year's shower should peaks on the night of April 21 and the morning of the 22nd, although some meteors can be visible from April 16 - 25. The quarter moon will set early in the evening, leaving a dark sky for the best possible viewing in dark locations. Look for meteors radiating from the constellation of Lyra after midnight.

April 24 - Astronomy Day Part 1. Astronomy day is a grass roots movement to share the joys of astronomy with the general public. Two days this year have been designated as Astronomy Day. On these days astronomy and stargazing clubs and other organizations around the world will plan special events. You can find out more about April's events by checking the Web site for for AstronomyDay.org and the Astronomical League.

April 28 - Full Moon

Binary Stars Then and Now

Leslie Martin

While reading a 1929 popular astronomy book, The Universe Around Us, by Sir James Jeans, I discovered he explained the formation of binary stars by a fission process whereby the original star spun so rapidly that it first elongated and then part of it was flung off to form a two star system. Jeans postulated a second scenario for the formation of double stars. In this, he proposed that when stars formed out of the "primeval nebulosity" two formed so nearby that they were gravitationally bound from birth and remain so today.

When Jeans speaks of the primeval nebulosity he is referring to the state of the universe before the formation of stars, all of which formed at the same time five to ten millions of millions of years ago. That's equivalent to five to ten trillion years ago in our system of labeling huge numbers. (Jeans was English which accounts for the difference in nomenclature.) The Big Bang was unthought of in 1929. Jeans concluded this enormous age based on a somewhat complicated "equipartition of energy", a concept I covered in an article in the January-February 2008 Spectrum. He was unwilling to concede that stars are continually being formed because, if they did, the equipartition of energy would not operate long enough to achieve the observational results he believed supported that idea. So Jeans explained close binary stars, those with periods of revolution less than 100 years, as the product of fission, and widely separated pairs with longer periods as the result of individually formed stars that were close enough to be held together forever by gravity.

This prompted me to do a bit a research to find out if other ideas of binary star formation preceded Jeans, and what our ideas about the subject are now. Of course, I realize that Jeans's notion of stars forming trillions of years ago from the primeval nebulosity has long been discarded, as has the idea that all the stars formed at the same time. Today, stars are still believed to form from condensations of gas and dust, but it is an on-going process with constant enrichment from the by-products of stars that have gone before.

The oldest source I found was The Elements of Natural or Experimental Philosophy written by Tiberius Cavallo around 1803. All he offered was that double or multiple stars can be seen in telescopes, and have "peculiar colors, or tints." There was good reason for this paucity of information because, until William Herschel made his extensive searches of the heavens with his superior telescopes in the late eighteenth and early nineteenth centuries, only a few double stars were known. One author suggested the number was four, others claimed up to 100, but the latter may include some of the earliest discoveries by Herschel. Herschel was credited with adding an astonishing 500 more to that list, however scant. Moreover, he made position angle and separation measurements that showed some double stars travel around each other in elliptical orbits. They were designated "binaries;" this concept of gravitationally bound stellar pairs was proposed before their discovery was confirmed.

By mid-nineteenth century, Hiram Mattison, in a text designed for "high school and academy students," distinguished between "optical doubles," those that merely look close because of perspective, and true binaries that revolve around each other. By this time 6000 doubles were known. He noted that the concept of stars revolving around each other is a "comparatively new idea" credited by him to a Dr. Dick. Like Cavallo, Mattison commented on the "various colors" of double star components, but suggested this may be a phenomenon of the eye - anticipating the well known color contrast effect that occurs when observing double stars.

Several authors in the 1870s noted that doubles with separations less than 45 arc seconds are unlikely to be accidental alignments; they are almost always binaries. An author early in the decade noted that the shortest period binary was 36 years and the longest over 1000 years,

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but a couple of years later a binary was observed to have a fourteen year period, although few had periods shorter than 100 years. The number of doubles was still cited at 6000, of which 650 were confirmed binaries.

Still, no one had any suggestion of how binaries were formed. Progress was being made, however, in other areas of binary star research. Authors commented that when we know the distance of the stars from Earth it is possible to determine the dimensions of the orbits which are often very elongated, particularly so for those having widely separated components. In addition, the relative masses of the two stars can be determined and, in some instances, their individual masses can be found. To be able to measure the masses of stars other than the sun must have been a stupendous breakthrough. Astrometry advanced to the point where the wobble in Sirius's proper motion implied the presence of a companion long before its discovery. Its orbit was computed in 1851, eleven years before the star, which turned out to be the first known white dwarf, was actually seen.

By 1891 Charles Young noted in his General Astronomy text that there were 10,000 double stars known. They had a wide range of magnitude and color differences. He pointed out that, in general, the dimmer of the pair was "higher in the spectrum," in other words bluer than the primary. Also, if the orbit of each of the two stars is known the relative masses of the stars can be determined. In most instances the orbital plane is tilted, so the primary star is not at the focus of the orbit, but the orbit is still elliptical and Kepler's second law (equal areas are swept in equal times) still applies. There was an odd footnote in this text stating, "It is not fully demonstrated that the motions of binary stars are due to gravitation, . . ." In another footnote Young contended that the binaries whose orbits are tilted with respect to the observer do not allow us to demonstrate that the central force varies according to the inverse square law. Apparently the maxim that the laws of physics apply everywhere in the universe had not yet been fully accepted.

Finally, in David Todd's 1906 New Astronomy I found a reference to how binary stars came to be. Todd wrote, "Originally the system was a single rotating nebulous mass, which became modified into a dumbbell figure as a result of its own contraction." He also noted that binary systems that are nearly edge-on show double absorption lines spectroscopically as one star approaches us and the other recedes. By knowing the period of revolution of the pair and measuring their velocity (sometimes as much as 300 to 400 miles per second) from the displacement of the lines with respect to their position at rest the orbital dimensions can be determined.

Why did it take a century of books addressing double stars before anyone wrote about their origin? Granted, there may be a few astronomy books written in the nineteenth century that I missed, but I think the real answer is that nineteenth century astronomy was devoted to where the stars are, not to what they are. Astrophysics didn't come into its own until the very end of that century, and blossomed in the twentieth century. Another factor, I think, is that religion played a much stronger role a hundred and fifty years ago than it does now. With the deep belief that the Almighty created the world and the rest of the universe in one massive gesture, there was little incentive to figure out an alternative to how double stars were formed.

That brings us back to Jeans who argued that long period binary stars, those that are widely separated, should have had their orbits elongated by the gravitational influence of passing stars, so that, in time, all eccentricities from the smallest to the largest should be represented. He noted that orbits with eccentricities exceeding 0.6 were rare, which he concluded meant insufficient time had elapsed since the formation of the stars for enough of these stellar encounters to have occurred, even

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though he contended that all the stars were formed at once several trillion years ago. Close binaries should have even more circular orbits because to disrupt such tightly bound objects the passing star would have to approach much more closely, a far less probable occurrence. He claimed observations of binary star orbits supported his hypothesis.

Another unusual idea emanated from his mistaken assumption that the stars had been expending their energy for trillions of years. He realized that only some kind of conversion of mass to energy must account for this incredible output for so long. The actual discovery of the process of stellar energy production was a decade in Jeans's future. Concluding this, he asserted that stars were losing mass over this incredible time frame and, as their mass decreased, the stars in a binary system would move apart because the size of the orbit is inversely related to the sum of the mass of the components. Further, the masses of the stars would tend to equalize because the more massive one would convert mass much faster than its lighter companion because it is more luminous. If the stars shrink they must rotate ever faster to conserve angular momentum. As they do they "subdivide" by spinning off part of their material. This explained to him why multiple star systems usually have two widely separated components (the original pair) while the other components (those ejected later) are much more closely bound to the original stars of the system. For these processes of division and subdivision to happen Jeans erroneously concluded that stars had to be liquid, not gaseous.

I consulted some astronomy texts from the second half of the twentieth century: Robert Baker's Astronomy, 1955 and Frank Shu's The Physical Universe, 1982 Both agreed that short period pairs result from fission and that long period binaries were born that way from cosmic gas and dust. Baker alluded to astronomers who think that as rapidly rotating stars elongate they may divide, an obvious reference to Jeans. He also commented in regard to stars forming out of "cosmic dust" that this was a "new idea." Baker contended that in time close binaries would recede from each other because of "tidal friction," just as the moon gradually recedes from Earth. I was surprised to find no reference at all about how binary stars form in a couple of recent commonly used college texts.

Lastly I cheated - to get the latest view on this subject I resorted to the internet. Here I found an article that neatly summed up the current opinion on this slippery issue that presents a new version of formation. It is currently thought that close binaries may form from accretion discs of the kind we believe give birth to planets, except the accretion disc has to be enormously massive in order to form a star. This idea replaces the long standing idea by Jeans and others about stars splitting in two from rapid rotation. The problem with that hypothesis, according to this article, is that simulations show the elongated star doesn't split; it forms an accretion disc instead. Long period binaries are still thought to result from the condensation of cosmic gas and dust that produces two stars bound by gravity, just as Jeans said eighty years before. In fact, the author suggests that perhaps this process may also account for close binaries if the accretion disc hypothesis proves to be untenable. Time will tell.

So reading what sounded to me to be a hokey idea by Sir James Jeans led me to investigate haphazardly the history of astronomers' understanding not only of the nature of binary star formation, but also something of the history of our knowledge about them.. Today we think the majority of stars have companions. They appear, for the most part, to be born together, sort of like a litter of puppies. The difference is they stick together throughout their long lives.

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