The ASTERISM

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Update on AAI's Asteroid

By Dale Gary

As most AAI members know, some time around 2006 July 2 we got the word that Joe Montani, a past member of AAI who is now involved with the Spacewatch Project at University of Arizona, had named one of his asteroid discoveries for his old club. The asteroid, given the designation 1997 HC16 at the time of its discovery, was given an official number and named by Joe as 9667 Amastrinc, derived, of course, from the first letters of AMateur ASTRonomers INCorporated. Although we were all delighted, it was a bit of a disappointment to me to discover that, at the time of the announcement, it was an early morning object of visual magnitude 18.8, too faint for my telescope (a Meade 10" LX200GPS) and camera (SBIG STL-1301 CCD). Checking the ephemeris, I found that I would have to wait until its 2006 December opposition for the best view, and even then it would attain only a peak visual magnitude 17.2. I was encouraged that magnitude 17.2 was in reach of my system, therefore, I continued to look forward to December. (For those of you who think that magnitude 17.2 is still too faint, 9667 Amastrinc will have a favorable opposition on 2009 Aug 8, when it will be only 0.993 Astronomical Units (AU) from Earth, and magnitude 15.4).

An enlargement of two of the images from my observations are shown in Figure 1. These are the 6th and 9th images of the series, taken at 10:54 pm and 11:17 pm. You can see an animated GIF image of all 10 images at http://web.njit.edu/~dgary/astro_images/.

(Continued page 6: **Asteroid**)

Urgent: General Meeting December 15th Moved to NJIT. See Website for details.

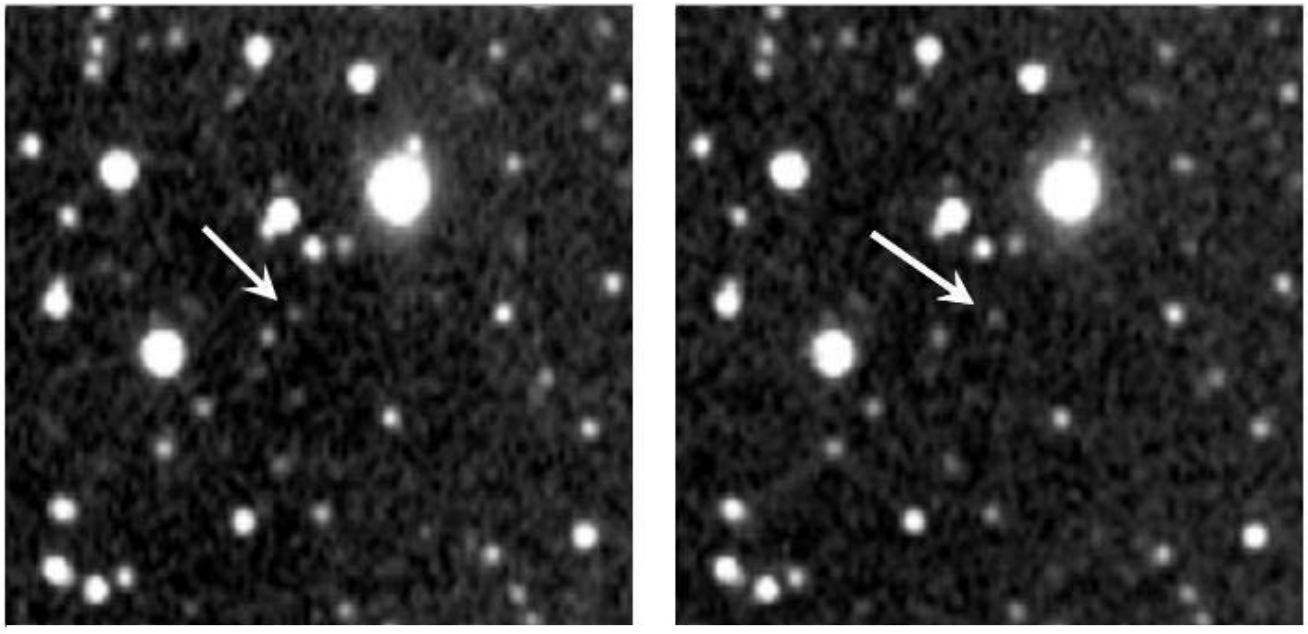

Figure 1: A small portion of two of the images of the 9667 Amastrinc field, taken on 2006 November 25 (UT date). The brightest star is TYC1320-00614, which is visual magnitude 10.23. Amastrinc is the barely visible moving dot pointed to by the arrows. Photo credit: Dr. Dale Gary

James Gunn

By Gordon Bond

At a time when the sciences seem to grow more specialized, James Gunn's place in astronomy is difficult to pin down. He is able to move with a certain authoritative ease from the realm of theory into designing the instruments to test those ideas, and then on to the grunt work of taking the actual observations. It was this grasp of the bigger picture that The Peter Gruber Foundation cited when they awarded Gunn their 2005 Cosmology Prize. "From his pioneering early work on the intergalactic medium and on gravitational lensing," the official citation noted, "through his use of new technology to study distant objects with the world's largest telescopes, to his design of the instruments used to carry out definitive cosmological surveys from the ground and from space, he has set the highest standards for the field and provided the ideas and data to inspire new generations of cosmologists."

AAI is pleased that Dr. Gunn, from Princeton University, will be our speaker at the December 15, 2006 General Meeting. But this isn't the first time he has been with us. In November of 2001, he spoke at the Jersey Astronomy Conference and Showcase (JACS) event AAI held at the time. His subject was the Sloan Digital Sky Survey (SDSS) and, if he had done nothing else in his career, this alone would have been enough to establish his name for all time. I had the opportunity to sit down and interview Dr. Gunn for The Practical Observer. It seems a corny irony to describe anyone in astronomy or cosmology as being "down to earth," but it's an apt phrase for the personable Gunn.

Born in Texas in 1938, Gunn's childhood was one of constant motion as his exploratory geologist father led the family throughout the US, leading a team searching for oil with Gulf Oil company. It was rare that he would spend enough time in any one place to finish a school term, yet, with the support of his father, he developed a love of science - astronomy in particular. "[W]e started building telescopes when I was about six." he told me in 2001, "and it's just sort of gone on from there."

When the sophisticated instruments his father's search parties used broke down in the field, they had to be in a position to fix them. It was in the "pretty complete machine shop in a trailer" they brought all over the country that Gunn learned the ways of the resourceful tinkerer - and where his lifelong interest in building instruments took root.

After briefly entertaining a career in writing when he worked on a high school newspaper, Gunn earned his Bachelor's Degree in physics and mathematics from Rice University in 1961. By 1966, he had a Ph.D. in astronomy and physics from the California Institute of Technology (CalTech). His choice of thesis topic reflects that his interests went beyond making instruments and into what one could actually do with them: "On the Statistical Distribution of Galaxies in Space and Some Cosmological Implications."

Dr. James Gunn at JACS in November 2001
(Photo credit: Gordon Bond)

He came to Princeton University as an assistant professor, where he got to do a little instrumentation work, but it was mostly theoretical. By 1970, he was back at CalTech because, as he told me, "being in the astronomy department at CalTech gives you access to the 200-inch." Soon after, he began designing cameras and spectrographs for the Hale telescope. When, in 1975, NASA put out word that they were looking for proposals to build a Wide Field Camera for what was to become the Hubble Space Telescope, Gunn and Jim Westfall took up the challenge and won the contract. The camera, known as WIFPIC, was leading edge technology. "[T]his was the first time that CCDs had flown [in space]." he recalled, noting that what he learned would later be applied to the Sloan survey.

(Continued on page 5: **Gunn**)

What If There Was No Moon And Nobody Explained

by Bonnie B. Witzgall

MSNBC was on a mission… a Moon Mission. In November 2006, AAI Observatory Committee Chair, Tony Espinoza received a call from the cable station. The TV station wanted to do a feature story, which asked "What if there was no Moon" in orbit around the Earth. Their requests were considerable. They needed a large working telescope located in the New York metro area, clear skies, a favorable phase of the Earth's Moon, and advice on how to capture a digital image through an observatory class instrument. They also required a local astronomer to become the "Moon expert" and talk proficiently about the subject, but angle the explanation toward children and the novice public. Luckily, the TV producers contacted the proper people, and AAI stood up to the challenge.

Club President Vince Henderson suggested that Al Witzgall help the film crew with all the photo logistics and lunar information. Just the Friday before, Al presented an informative lecture on Lunar Geology for the AAI Friday night public visitors. He is well versed in the latest Moon facts and enjoys narrating to the people, so Al agreed to become the evening's "Moon expert" for the TV crew.

MSNBC sent two video photographers who were, themselves, very interested in the sky and in learning the basics of astronomy. While the Friday night public slide presentation took place in the main room at Sperry Observatory, Al and the TV crew filmed their segment privately in the east dome. They used the 10-inch refractor, which is a good instrument for planetary imaging… and it looks really commanding and royal through the TV camera lens! They addressed questions to Al, and speculated about "What if there was no Moon?" How would its absence affect the weather, tides and Earth's orbit? They also asked whether Al wanted to visit the lunar surface himself. Al Witzgall answered all the questions properly, but shrewdly geared his statements toward the act of having the viewers finding out the data for themselves. Al's punch line included an invitation for all interested parties to visit Sperry Observatory on a Friday night, and receive a free informative talk on the sky. Yet, he also said people should explore the night sky anytime and anywhere. He told the TV audience they could examine the Moon with their unaided eye. As Al explained, people should just observe and visually explore the surface for themselves because "experiencing the joy of discovery is fantastic!"

General Meeting

DECEMBER 15, 2006

"Cosmology: a Fifty Year Perspective" - Dr. James E. Gunn, Astrophysicist, Princeton University

The interplay between measurement of the Cosmic Microwave Background with COBE and WMAP, which gives us a picture of the universe at early times, and large-scale galaxy surveys like the Sloan Digital Sky Survey, which tell us in detail about the universe today, will be explored.

See Gordon's article about Dr. Gunn on page 2

Room GITC 3720/30 at NJIT

After the interview and the lunar video session, the MSNBC crew thanked Al and AAI for their first-rate service. The team vowed to return to Sperry, film more Moon images, and then finalize the videotape for broadcast. They were very pleased with all the images and Al's personalized interview. The video team will contact Tony again to schedule a second visit. Their TV segment may answer the question "What if there was no Moon?" Yet, it implores the question "What if there was no AAI or Sperry Observatory to serve the media and to educate the audience in the New York area?". How would the club's absence affect the uncaring atmosphere, local trajectory and the educational tides? Talk about a planetary upheaval!

☆☆☆

Mr. Martin's Gift by Ray Shapp

Several months back, Gordon Bond turned his considerable skill to designing and producing a poster depicting the story of AAI's asteroid, Amastrinc. I mentioned in email to its discoverer, Joe Montani, that I displayed the poster during Science Family Day at the Franklin Institute in Philadelphia, and that Gordon was offering to send an image of the poster to Joe. That prompted Joe to tell me about a wonderful act of kindness that he received from "Mr. Martin" many years ago. Here's Joe's story:

"Interesting that you mention that the poster may travel to the Franklin Institute; on a class trip in elementary school, I visited there and was treated to a planetarium show; I also saw one of the telescopes they have (had?) there, and met an astronomer, the first astronomer I had ever met. He gave me a diffraction grating, the first I had ever seen, mounted in a 35mm slide holder, produced by Edmund Scientific; this was in about

1962 or 1963. I carried the diffraction grating with me in my wallet for many years, and used it on occasion to determine if a light-source was a continuum source or a line-emitting source, and in case I ever saw a UFO (never did...), I'd have it available to see if the "ship" glowed by incandescence or ionization. The Franklin astronomer (Mr. Martin) even signed the grating's mount with his name for me, in red ink. The grating "wore-out" years ago, but I still carry another one, also made by Edmund".

"…I'm not sure if I ever was able to identify, through the later years, just who he was, so that I could thank him more profoundly and catch him up on how good Science has been to me, and remind him of the importance and eventual consequences of small gestures made to small people".

A thumbnail of the poster is included here. Please visit Sperry Observatory to appreciate Gordon's work and the amazing story of Amastrinc in its 22x28-inch rendition.

☆☆☆

Lights! Camera! Reaction!

By Bonnie Witzgall

(Ed note: The first part appeared in the November issue)

Here were active AAI members, well trained on the scopes and well educated in the subject they love. A local news crew now advised them to ease off on the proper descriptions, and just provide fluffy entertainment rather than hard truths for the audience's evening news. Should AAI comply?

Many of our club members were uneasy with the TV crew's suggestion. Could the AAI members endorse an easy explanation? Did the QOs on duty agree to the 'dumbing-down' for the TV audience and the public visitors at Sperry Observatory? A washed-out explanation to the masses is better than no education at all, and AAI could use some positive exposure on New York metro television. However, if the TV crew felt overwhelmed, they could always edit out all the imposing astronomers' dialogue from the final broadcast.

How *did* AAI's 'Team E' handle their TV début? The world may never know AAI's response. The film clip was to air on the July 15th WCBS news TV broadcast, but was not shown. It also did not appear on the WCBS web site under their Global Warming e-story. If you can't guess the AAI Qualified Observer's reaction that night, here is a hint: As the TV producer and crew took their leave of Sperry Observatory, they were each bestowed a copy of "A Union Made in Heaven" compiled by Union County College President Emeritus Roy Smith. This book, available at our sales table, is a written history of AAI. It chronicles all the passion, growing pains and triumphs of a club in the business of learning and sharing astronomy for more that fifty years. We thought the crew could glean information about AAI in preparation for their news program. Maybe they would also learn a bit more about our steadfast pursuit for accurate knowledge. So, how did 'Team E' deal with the suggestion of 'dumbing-down' the astronomical facts? We reported, you decide.

☆☆☆

Gunn (continued from page 2)

It is no hyperbole to proclaim that the Sloan Digital Sky Survey has revolutionized astronomy. At 2.5 meters, the telescope is modest, as professional instruments go. In fact, when it's pointed straight up, the metal box enshrouding the tube to dampen vibrations from the wind makes it look a bit like an air conditioning unit on top of a high-rise. Yet, what makes Gunn's telescope unique, perched atop a 9,200 foot peak in the Sacramento Mountains of New Mexico, is what's hooked up to it. Using a sophisticated CCD camera of Gunn's design, the SDSS spent five years creating the first three-dimensional map of the universe. Well, not all of it - it's limited to the northern hemisphere for starters. Nevertheless, it has churned out data so far on 180 million celestial objects covering over 6,500 square degrees. The high-quality spectra of some 850,000 objects has allowed for a three-dimensional view of unprecedented accuracy.

Sifting through the piles of data has been likened to drinking from a fire hose at full blast. In the five years of the survey, Gunn and his team have given present and future generations of astronomers, cosmologists and physicists a proverbial goldmine. It will likely be the wellspring for more than a few Ph.D.s for decades to come. It has pretty well replaced the Palomar Observatory Sky Survey (POSS) for those portions of the sky it has covered. When the POSS was started in the 1950s, it was pushing the limits of photographic technology. SDSS represents the next generation of that idea.

And there is an AAI connection with the SDSS! Constance Rockosi was part of Gunn's team, working on the assembly of the thirty CCD chips in the $4 million camera for close to a six year period. Connie used to be a member of AAI (she has also given a presentation for us) and was a pupil of our own Al Witzgall in the QO course. So, encourage our younger members - you never know whose career you might help launch!

Back in 1965, when James Gunn was still a graduate student at CalTech, he and a fellow student, Bruce Peterson, had an idea. Cosmologists had long theorized that in the first billion or so years following the Big Bang, our universe must have gone through a sort of "Dark Ages." The early universe was full of a thick hydrogen gas that was particularly efficient at absorbing the ultraviolet part of the spectrum. This gas provided the raw materials for the first star formation, but their light would be almost immediately absorbed by the surrounding hydrogen fog. Eventually, these stars would become energetic enough that they could break down the hydrogen into protons and electrons, effectively lifting the fog and allowing photons to travel freely throughout the universe for the first time.

What Gunn and Peterson thought, was that not all the hydrogen would be broken down and that even one surviving atom out of every 100,000 would still have an observable effect on distant spectra. They surmised that there ought to be a "trough" in the spectra - a blank spot in the ultraviolet where the absorption would be greatest. The problem, however, was finding a spectrum that was far enough away to coincide with the time when the fog should have been lifting. Quasars were the obvious candidates, but no one could seem to get a good enough spectrum to test the theory.

Then came SDSS. In the summer of 2001, a team led by Robert Becker of the Lawrence Livermore National Laboratory in California examined distant quasar spectra taken by the Sloan. Sure enough, there was the "trough." It has become known as the "Gunn-Peterson Effect" or the "Gunn-Peterson Trough" in honor of the two who first theorized it should exist.

Ironically, as Gunn has extended our vision in cosmology, it has also become more difficult to just "look." He laments the lack of funding for such research these days. As the frontiers get pushed back, it seems the questions become more esoteric and it becomes tougher to sell potential funding agencies that it's money well spent. "You can't get much more un-applied than astronomy," he recently pointed out.

Now in his late 60s, Gunn appreciates his supporting role in advancing the science of cosmology. But with all the data collection he has facilitated, he has some areas of research he is still personally interested in. When I spoke to him in 2001, he was curious as to what could be learned about the grand structure of the universe from the data on galaxy clustering.

James Gunn's December 15th presentation at AAI is entitled, "Cosmology: A Fifty Year Perspective." Given the role Gunn has played, he seems well-situated to provide just such a perspective!

☆☆☆

Asteroid (continued from page 1)

During the Thanksgiving holiday, we had some days of clear weather, so I decided to check Amastrinc's position and magnitude. On the night of Friday, 2006 November 24, my planetarium software was predicting that it would be available around 10pm local time, at the top of Orion's upraised club, at visual magnitude 17.5. This was more bad news, since that put it right in the middle of the winter Milky Way, full of faint stars against which I would have to identify a 17.5 magnitude object. This magnitude is just about the limit of my system, but I decided it would be worth a try.

me that the scale was 2.45" per pixel, with a residual error in the star positions of 0.24" in RA and Dec. The photometric residual error was 0.23 magnitudes. This program can also identify known objects, and showed me exactly where Amastrinc should be. Sure enough, there was a small dot exactly at the nominal position. I repeated the measurement on two other images and submitted the measurements to the Minor Planet Center. Such reports are very terse. Table 1 contains my entire report. Note that the magnitudes agree with the expected magnitude of 17.5 within the 0.23 magnitude residual error.

Table 1: Minor Planet Center Report, in full, for these 9667 Amastrinc observations

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COD H93
CON D. Gary, 14 Honeyman Place, Berkeley Heights, NJ 07922 [dgary@njit.edu]
OBS D. Gary
MEA D. Gary
TEL 0.25-m f/10.0 reflector + CCD
ACK MPCReport file updated 2006.11.25 08:14:03
AC2 dgary@njit.edu
NET USNO-A2.0
09667       C2006 11 25.13677 05 56 24.87 +20 09 21.2       17.5 R     H93
09667       C2006 11 25.16307 05 56 23.45 +20 09 20.3       17.7 R     H93
09667       C2006 11 25.18411 05 56 22.32 +20 09 19.0       17.4 R     H93
----- end -----
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To improve the sensitivity, I decided to run the camera with 2x2 pixel binning. That night I got the telescope pointed to the location of the asteroid at about 10:15pm, and started taking 20-second exposures in the "luminance" filter. I took a total of 200 exposures, ending the imaging at about 11:32pm. The asteroid was much too faint to see on individual 20-second exposures, so, after calibrating each frame for bias, darks, and flats, I coaligned and combined the first 20 expo-sures in MaxIm DL, for a total integration time of 400 seconds. I could tell that the combined images looked good -- one of those tiniest dots should be Amastrinc, but which one? I combined all of the other 180 images in groups of 20, to give 9 additional images for a total of 10 images, each 400 seconds apart.

The next step was to use a shareware program called Astrometrica to do a "plate solution" on each image (that is, accurately solve for the scale, orientation, and nonlinear distortion of the image, using known locations of stars from the USNO A2.0 star catalog). I noted above that this was a crowded field -- the program found and fit 1247 stars out of 1307 reference stars, whereas I am used to images with only a few hundred stars. The program also told

Asteroid 9667 Amastrinc is a main-belt asteroid whose orbital eccentricity is 0.1779, and inclination (tilt relative to Earth's orbital plane) is only 2.387 degrees. One interesting question we can ask is, how big is it? After all, we may want to build a summer home there someday. Unfortunately, I could not find a report of an albedo measurement, and that is needed in order to assess how intrinsically bright the asteroid is. However, I looked up some properties of asteroid albedos in general, which are summarized in Table 2 (page 7). One can see that the albedos typically range from, say 0.05 to about 0.2, so we can make a size estimate for each value of albedo and get an idea of the size.

Of course, we also need to know the distance from the Sun to the asteroid (since the Sun is the illumination source), and the distance from the Earth to the asteroid (since the closer we are the brighter it will appear). If you would like to read more about determining the size of asteroids, you can read a laboratory write-up for my observational astronomy course, at:

http://web.njit.edu/~dgary/322/assets/Lab_5.pdf

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Table 3 implies that Amastrinc is about 8-20 km in diameter, with the larger sizes being appropriate if Amastrinc is of Carbonaceous type (C-type), and the smaller sizes being appropriate if it is one of the other types.

Over the next month, 9667 Amastrinc will approach closer to Earth. It reaches opposition on 2006 December 11, and will be about 2 degrees south of M1 (the Crab Nebula) on December 15. Unfortunately, it does not move out of the crowded Milky Way field until later in December, when it is getting fainter again. Perhaps the best plan is to wait for the 2009 August 8 opposition. Meanwhile, those who have CCD imaging capability should take on the challenge of imaging it during the next month.

☆☆☆

Table 2: Asteroid Albedos

Type	Make-up	Typical Albedo	Frequency
S-type	Stony	0.1 – 0.22	17% of asteroids
C-type	Carbonaceous	0.03 – 0.1	75% of asteroids
M-type	Mixed	0.1 – 0.2	8% of asteroids

Table 3: Amastrinc Size

Albedo	Radius
0.05	8.39 km
0.10	5.93 km
0.15	4.84 km
0.20	4.19 km

The required parameters for the observation date are:

Distance on night of observation: d = 1.6917 AU
Distance from Sun: r = 2.6116 AU
Magnitude: m = 17.5

Given these, the equation to be solved is: $R = 2\,(r/r_e)\,d\,10^{-(m+26.72)/5} / \sqrt{A}$

Where $r_e = 1\,AU$ is the orbital radius of the Earth.

Inserting these known parameters, one arrives at the simple relation: $R = 1.89 / \sqrt{A}$ km

where R is the radius of the asteroid, and A is the unknown albedo.
Table 3 gives the radius for various possible albedos.

How High The Moon?

By Dr. Lew Thomas

We all know that the Sun rides high in our skies in summer and low in winter, but what about the Moon? The full moon is a moon of opposites. It rises at sunset and sets at sunrise. When we tilt toward the Sun in summer, we tilt away from full moon which is in a direction just opposite that of the Sun. In winter, when the Sun is low, the full moon must ride high -- but just how high?

The celestial equator is directly above the Earth's equator. At any northern latitude, it is highest in the south and stands at an altitude of 90° minus Observer's latitude. For our location at about 40° latitude, this becomes 50°. If the Moon were on the celestial equator, its highest altitude would then be 50° The Moon is nearly on the ecliptic which is 23.4° above the celestial equator when the winter solstice occurs on December 21. So the full moon at that time can be 50°+23.4°= 73.40° high.

But we are not finished yet. The Moon's orbit is tilted 5.15° to the ecliptic. So, if the node of the Moon's orbit is on the horizon at midnight, the Moon will be another 5.15° higher. This makes the maximum possible altitude of the full moon to be 73.4°+5.15°= 78.55°.

To conclude, if the full moon occurs on December 21, and if its orbital node is on the horizon, the full moon will be 78.55° high at midnight. In all cases, the full moon that occurs nearest to the winter solstice will be at its highest possible altitude for that year. Look for it! ☆☆☆

Stewart's Skybox

By Stewart Meyers

Last April, the folks at the Binary Research Institute (BRI) made yet another attempt to convince people that the Sun has a companion star that no one has ever seen. This time, they claimed that the unusual orbit of Sedna in the outer solar system can only be explained by the gravitational effects of this putative companion though no such star has ever been found, even in modern astronomical surveys that cover huge swaths of sky to dim magnitudes such as the Sloan Digital Sky Survey (well known to us at AAI).

If this baloney about the Sun having a companion sounds familiar, it is because BRI also put forth the absurd "Great Year" theory which claims that precession was due to this companion (January 2006 Skybox column).

Though it may seem that the people at BRI are the kind who consider Coast to Coast the epitome of news radio and think the Stargate franchise is based on fact, some good can come out of their stupidity as it offers an excuse to discuss double stars.

SEEING DOUBLE: THE EARLY DAYS

Some double stars have been known since antiquity. Alcor and Mizar in Ursa Major have been known since antiquity. Alpha Capricorni is also a double known from the distant past. However, except for the use of Alcor and Mizar as a vision test by early Arabs, these doubles were just curiosities.

Even though telescopes were in use since 1610, it wasn't until 1650 that the first telescopic double star was discovered when Giambattista Riccioli found that Mizar was a double. However, only a few double star discoveries were made for the remainder of that century, and, since it was thought that all doubles were chance alignments, nobody took them seriously. Near the close of the 18th century, that would change.

ENTER HERSCHEL

By the mid 1700s, the heliocentric model of the solar system was widely accepted, due in part to the success of Sir Isaac Newton's law of gravitation. However, one objection, which was raised by the Catholic Church when they went after Galileo in the 1600s, was unresolved. It went like this. If the Earth orbited the Sun, the stars should show a cyclical shift in their positions over the course of a year. This is known as parallax. However, none was seen. The reason for this non-detection was that the stars were so far away that their parallaxes were too small to be seen with the unaided eye or with small telescopes. However, William Herschel thought he had the solution. Realizing that the current measuring technology was insufficient for the job, Herschel thought that double stars could be observed at several times in the year. If a double star was a chance alignment, the dimmer star would likely be much further away than the brighter star. Any change in the relative positions would indicate parallax. So, Herschel got to work. He eventually noticed that some double stars did not budge. However, others did. As he studied the changes in position, Herschel realized that this shift was not parallax, but actually orbital motion. He had visual evidence that stars can orbit other stars and obey Newton's laws.

While confirming that Newtonian physics worked beyond the solar system was big news back then, the discovery of actual binary star systems was of practical use. By studying the orbital motions, the relative masses of the two stars could be deduced. Later, when astronomers knew the actual distances, these orbits could be used to determine actual masses. This has been a major aid in understanding stars and stellar evolution.

DYNASTY

No, this isn't about Linda Evans and Joan Collins, but rather it's about some major players in the history of binary star observations. Once binaries were found to be useful, many astronomers studied them. But few were more involved than the Struve family.

In 1824, Friedrich George Wilhelm (F.G.W) Struve set up shop at the Dorpat observatory in Tartu, Russia. At the time, the observatory was equipped with an excellent 9-inch refractor on a good equatorial mount, which gave it advantages over the instruments used by William Herschel. Also, it was equipped with a measuring micrometer so angles and apparent separations of objects in the field of view could actually be measured, rather than merely estimated. In 1837, F.G.W. Struve published his observations, which included detailed measurements of 3,314 double stars. His son Otto Wilhelm followed in his father's footsteps, but was a comparative underachiever, discovering and measuring an additional 500 doubles. The next two generations of the Struve family were also involved in astronomy and the dynasty lasted until the death of Otto Struve in 1963.
Others active in the field included William Dawes (discoverer of the Dawes Limit), and Friedrich Bessel

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who cataloged 32,000 double stars. In the 1870s, men like S.W. Burnham made vast surveys of double stars and added thousands to the lists. However, one class of binaries went unseen and it would take a new method of observing to reveal them.

SEEING THE UNSEEN

In some binary star systems, the stars are so close together that no single telescope could ever split them. But just before the end of the 19th century, spectroscopy was ready for astronomical prime time. Since this technique could give the composition and other parameters of stars, astronomers made extensive use of it (and still do). As a result, those close binaries were discovered when astronomers noticed the combined spectral lines of the component stars.

GOING OUT WITH BANGS

Being in a close binary can greatly affect the life and death of stars. For example, as mentioned in an earlier column, all Type I supernovae and all novae originate in binaries where one component is a white dwarf and the other is a red giant. Also, many X-ray sources are close binary systems where one member is either a neutron star or black hole that accretes matter from the normal star. The high-energy emissions come from material as it is being drawn onto the compact object.

TWO CAN BE BETTER THAN ONE

When stars pair up, by chance or gravity, the results range from pretty pairings that impress crowds on public nights to systems that have advanced our understanding of the stars and have given insight into some of the stranger objects in our galaxy.

☆☆☆

MEMBERSHIP DUES

Regular Membership:	$21
Sustaining Membership:	$31
Sponsoring Membership:	$46
Family Membership:	$5
Sky & Telescope:	$32.95
Astronomy subscription:	$34
First Time Application Fee:	$3

Dues can be paid in person to Membership Chair or Treasurer, or by mail to: AAI P.O. Box 111, Garwood, NJ 07027-0111

DR. LEW'S SEMINARS

Some of the topics for upcoming seminars include:

- Review of celestial coordinates, circumpolar requirements etc.
- What is the "Harvest Moon"
- Determining RA and Dec of any solar system object given orbital elements

FRIDAYS AT SPERRY

December 8, 2006
Solar/Terrestrial Connection via Radio Jove and Ham Beacon Monitoring Dr. Mary Lou West
December 22 & 29, 2006
Holiday Fill-In
January 26, 2007
Seeking Astronomy Gems in London While Irish: How I Learned to Stop Worrying and Love the Queen Kathleen Quinn Vaccari

All schedules above were accurate at time of publication. Please check www.asterism.org for latest information (click on "Club Activities")

SPECIAL THANKS

Ink-saving Logo for *Asterism* credit: Justin Shapp

DOME DUTY SCHEDULE

Jan. 5	Team A
Jan. 12	Team B
Jan. 19	Team C
Jan. 26	Team D

CLUB EMAIL ADDRESSES

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This issue is being posted for online reading on December 5th. The earliest hard copy will be delivered eight days later. To relinquish home delivery, send email to ray@asterism.org

Theater In The Sky

by Ron Ruemmler

January 2007 brings to a close one of the longest, driest periods for primetime skywatchers in recent memory. The first two hours of complete evening darkness have been totally devoid of visible planets since the second week of October, when Jupiter started falling behind the Sun. Add to this the usual dearth of bright autumn stars and how long can you get excited about watching the Summer Triangle move toward the west?

All this ends with a glorious double-whammy. Venus and Saturn are back! Venus doesn't set until at least an hour after the Sun as it begins its long march into the evening sky. By the middle of May, the "Evening Star" will not set until fifteen minutes before midnight.

Venus also has an unusual amount of company. For the last two weeks, Mercury is less than twelve degrees to the lower right of Venus, drawing to within seven degrees by month's end. As the sky becomes dark on the 20th, look carefully at the thin crescent Moon just to the upper left of Venus. Right below the Moon, find Deneb Algedi, the tail of Capricornus, the Sea Goat. Its neighbor, Gamma Capricorni, is to its lower right, just to the left of Venus. That's four objects all within a single binocular field of view.

Saturn has been a morning object since August, but now it rises before 8:00 PM. The Ringed Planet is also getting brighter as it nears its opposition next month. Don't confuse Saturn with nearby Regulus which is the lower and dimmer of the two bright objects.

Jupiter is now an easy morning planet rising three hours before the Sun. Far to its lower left is Mars, a very challenging dawn object. It will take the Red Planet more than a full year to go from its first, feeble flicker as a "Morning Star" last November to its glorious opposition just before Christmas. Try to spot it on the 16th, far to the left of the thin crescent Moon.

If you had a telescope on the Sun (!), you might spot Uranus at its greatest possible distance below the ecliptic, the plane of the Earth's orbit. This is worth noting only because it happens only once every 84 years. A true once-in-a-lifetime event.

The Earth reaches perihelion, its closest approach to the Sun, every January, but this time is a bit special. At 91,399,744 miles, it is 6,209 miles closer than it was last year. In fact, it is the closest perihelion since 1996, or until 2020. That might have something to do with the Full Moon six hours earlier.

JANUARY SKY CALENDAR

3 Wed 8:57 AM Full Moon
3 Wed 3:00 PM Earth at perihelion; closest to the Sun
5 Fri 7:21 AM Latest Sunrise
5 Fri 10:00 PM Moon above Saturn
6 Sat 10:00 PM Moon below Saturn and just left of Regulus
7 Sun 1:00 AM Mercury at conjunction beyond the Sun; enters evening sky
10 Wed 3:00 PM Uranus at greatest latitude below the ecliptic plane
11 Thu 7:44 AM Last Quarter Moon
15 Mon 6:00 AM Crescent Moon lower right of Jupiter and just below Antares
16 Tue 6:20 AM Mars far left of thin crescent Moon
18 Thu 11:00 PM New Moon
19 Fri 4:59 PM Sunset; Muslim year 1428 A.H. begins
19 Fri 5:15 PM Very thin crescent Moon far lower right of Venus and just left of Mercury
20 Sat 6:00 PM Tight cluster of crescent Moon, two stars and Venus (see text)
25 Thu 6:02 PM First Quarter Moon
31 Wed 6:30 PM Almost Full Moon below Castor and Pollux

October THEATER IN THE SKY Column Was Altered

The text of the October THEATER IN THE SKY column that appeared in the printed version of the combined September/October *Asterism* contained 24 errors of punctuation, grammar, and misspellings which were not in the original document submitted by Ron Ruemmler. We apologize sincerely to Ron for this unethical breach. The online version of Ron's article contains the error-free document as it was originally submitted. View current and back issues of Asterism at www.asterism.org. Click "Newsletter".