Night Visions

Newsletter of the Baton Rouge Astronomical Society

January,2016

Next Meeting: Monday, Jan. 11th at 7pm at the HRPO

Club member Craig Brenden participating in some outreach at the LPB Family Fun Fest

What's In This Issue?

President's Message

Welcome to a new year! There is a lot to be excited about this year. Chris Deselles will be giving his talk on Astrophotography, going into more detail and depth on processing the image, at the Cajun Clickers Computer Club on Thursday, January 7th, at the Broadmoor Methodist Church, located at Sharp and Mollylea in the adult building in the back, at 6:30 PM. Come hear the talk and support Chris.

Annual retreat to the Rockefellers Wildlife Preserve will be on the first weekend in February, and Hodges Gardens Star Party in the beginning of April, details are on our website: www.brastro.org.

On May 9th, Mercury will do a transit of the Sun for the first time in 10 years. More info will be in the newsletter as we get closer to the date.

Dues are now due. You can bring them to the meeting on January 11th, or you can print out the application form on our website, and mail it with your payment to the address on the form.

BRAS still has an opening for an Outreach Co-coordinator. Anyone interested, let me know.

Check out the BRAS Dark Sky Advocacy website at www.darksky.brastro.org or you can get to it from the link on the BRAS website.

The Light Pollution Committee will meet at 6:30 on Jan. 11th, before the BRAS meeting.

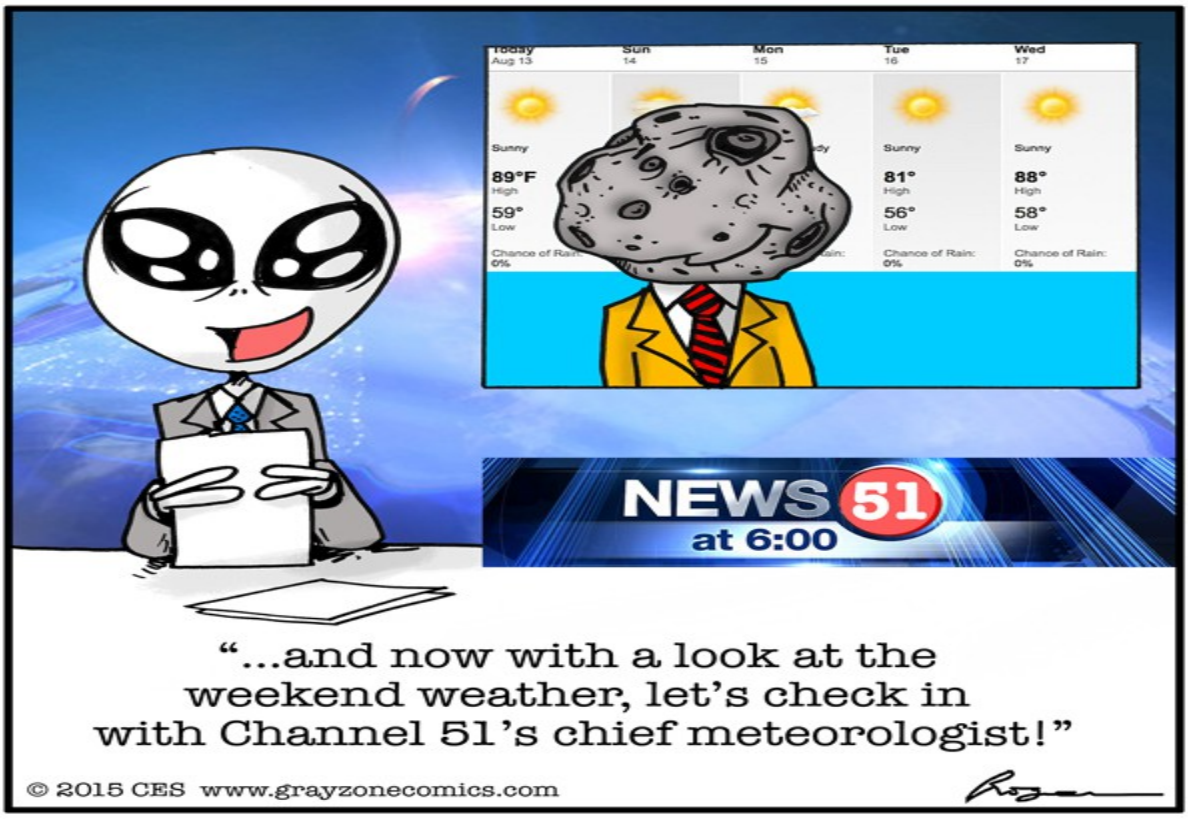
The January meeting's theme is "Care and Feeding of Your Telescope", and will cover collimation, cleaning of lens and mirrors, repairs, and improvements to your telescope. Come to the meeting and learn more about your equipment.

Clear Skies (for more than 1 day at a time)
John Nagle
BRAS President

Secretary's Summary of Dec. Meeting

- The meeting started off with dinner and socializing.
- At 8:30 there was the Ritual Showing of the Charter for the club, and then Merrill presided over elections for officers. All officers were voted in by acclamation without opposition. The new president is John Nagle, the new vice president is Don Weinell, Trey Anding remains the treasurer, and Ben Toman is the new secretary.
- Trey announced that there were four calendars still available for purchase ($10). He is also still collecting dues for the coming year for those that haven't paid yet.
- Chris announced that the 2016 Skywatch is in available; he has copies that you can purchase for $10.
- Chris Deselles is doing a reprise of his astrophotography lecture the first Thursday in January on the 7th at Broadmoor United Methodist Church (corner of Sharp and Mollylea) upstairs in the Adult Bldg. from 6:30 to 8:00 pm.
- There was a raffle at the end of the meeting. Rob Bourgeois won the 10-in. Dobsonian that Dave Dawson donated.

Roslyn Readinger
BRAS Secretary



Magnetically Levitating Black Holes

Lurking in the centers of most galaxies, including our own Milky Way, are supermassive black holes: monsters from several hundred thousand to several billion solar masses jammed into a volume equivalent to that of our solar system. Gas or stars drifting too close will find themselves caught in the grip of the powerful gravitational field, trapped in an inexorable death spiral ever faster and tighter down toward the black hole, until voraciously consumed in a last gasp of electromagnetic radiation. Right?

Not so fast. A new study of 76 supermassive black holes, combining analysis of observations with computer simulations, reveals that some galactic behemoths have magnetic fields powerful enough to counteract the enormous pull of their gravity—thereby allowing clouds of gas or other objects at the top of the magnetic fields to levitate temporarily in place above a supermassive black hole.

"This paper for the first time systematically measures the strength of magnetic fields near black holes," said co-author Alexander Tchekhovskoy, a Lawrence Berkeley National Laboratory (LBNL) postdoctoral researcher who helped interpret observations within the context of computational models. "Now we have evidence from not just one or two, but from 76 black holes."

Loud and twisted

Of interest are blazars: active galactic nuclei (AGNs) that beam extremely bright, energetic, collimated jets of gas at nearly the speed of light in the direction of the Earth. Such jets—which shoot out along the axis of rotation of a disk of gas accreting around a rotating black hole—emit powerful radiation at radio wavelengths. Only about one in ten AGNs have powerful radio-emitting jets.

From such radio emission independently observed by other astronomers at different frequencies using very long baseline interferometry (VLBI) from a vast network radio telescopes separated by thousands of miles, the authors determined the strengths of magnetic fields threading through the jets and central black holes of 68 blazars and eight nearby radio galaxies. Included were such famous galaxies as the beautiful spiral Messier 81 in Ursa Major, Centaurus A (the radio galaxy nearest to our Milky Way), and Cygnus A (a famous radio galaxy discovered in 1939 by radio astronomy pioneer Grote Reber).

The coauthors compared the predictions of the computer simulations to the measured magnetic field strengths and found good agreement. The simulations revealed that the magnetic fields, which are twisted by the rotation of a supermassive black hole, are strong enough to counteract the pull of gravity and retard the infall of gas. The twist also transfers black hole rotational energy to electromagnetic energy of the jets, which carry it out as far as several light-years away.

A heavy fluid (accreting gas) placed on top of a light fluid (a magnetic field) is an unstable configuration because the two fluids naturally want to change places, Tchekhovskoy explains. However, for a few hours, "the gas is slowed down by the presence of magnetic fields and even sometimes briefly stopped," he says, so that the gas "continuously trickles down to the black hole" instead of falling unobstructed.

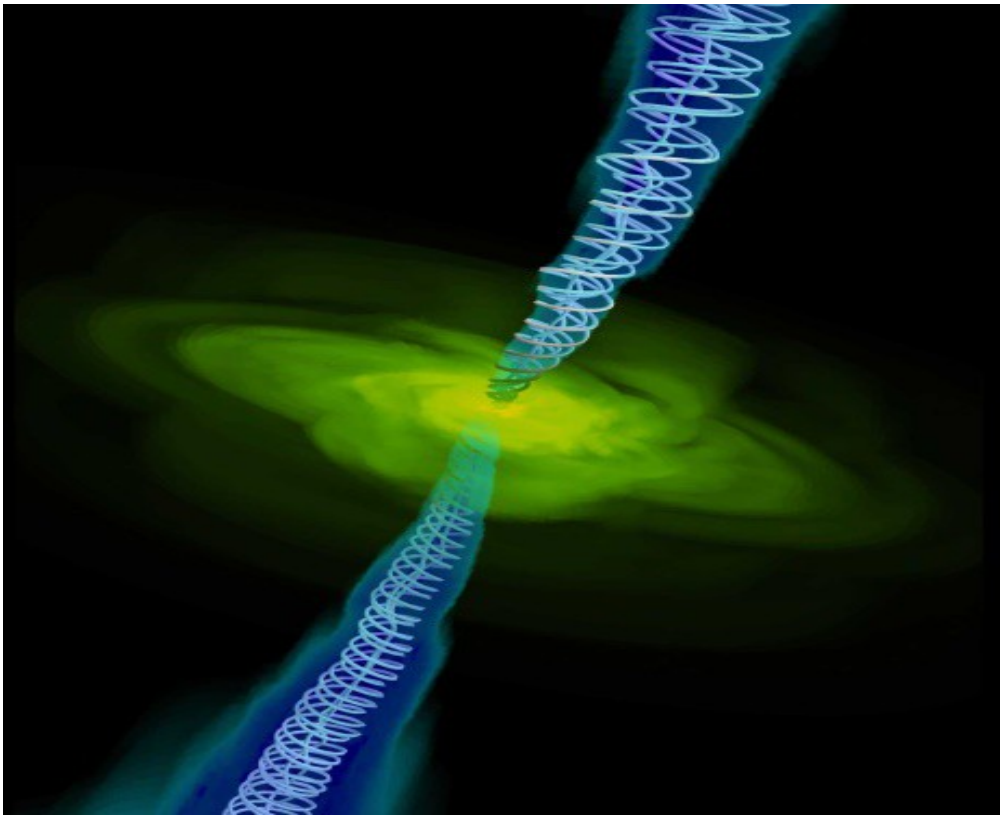
Back to the drawing board

Thus, "…the jet-launching regions of these radio-loud galaxies are threaded by dynamically important [magnetic] fields, which will affect the disk properties," the authors conclude. "These fields obstruct gas infall, compress the accretion disk vertically, slow down the disk rotation by carrying away its angular momentum in an outflow, and determine the directionality of jets."

Tchekhovskoy and his three coauthors from the Max Planck Institute for Radio Astronomy in Bonn, Germany, believe that the new results mean theorists must re-evaluate their understanding of how supermassive black holes behave. *–Trudy E. Bell, M.A.*

Further reading: The paper, "Dynamically important magnetic fields near accreting supermassive black holes," by M. Zamaninasab, Eric Clausen-Brown, T. Savolainen, and Alexander Tchekhovskoy, published in Nature on June 5, 2014, is accessible from http://www.nature.com/nature/journal/v510/n7503/full/nature13399.html . A press release from LBNL is at http://newscenter.lbl.gov/2014/06/04/black-holes/ and a release from the Max Planck Institute is at http://www.mpg.de/8256277/magnetic-fields_supermassive-black-holes.

The University of California High-Performance AstroComputing Center (UC-HIPACC), based at the University of California, Santa Cruz, is a consortium of nine University of California campuses and three affiliated Department of Energy laboratories (Lawrence Berkeley Lab, Lawrence Livermore Lab, and Los Alamos National Lab). UC-HiPACC fosters collaborations among researchers at the various sites by offering travel and other grants, co-sponsoring conferences, and drawing attention to the world-class resources for computational astronomy within the University of California system. More information appears at http://hipacc.ucsc.edu



A computer simulation shows gas (yellow) falling in the direction of a central black hole (too small to be seen). Twin jets (blue), strongly focused by spiral magnetic field lines, shoot out towards the top and bottom, perpendicular to the plane of the rotating accretion disk. *Credit: Alexander Tchekhovskoy / LBNL*

HRPO

HRPO is closed on Thursday 31 December and Friday 1 January.

FRIDAY NIGHT LECTURE SERIES

all start at 7:30pm

8 January: "2015—The Space Year in Review" Dawn arrives at Ceres…the twenty-fifth anniversary of Hubble…SOHO spots its 3000th comet…Orion's Launch Abort System is tested…the historic One-Year Mission begins…the ISS celebrates fifteen years of continuous human occupation. What is the biggest story of 2015? Give your opinion, both before and after this lecture!

15 January: "Star Clusters" A brand-new speaker comes to HRPO. LSU physics undergraduate Rory Bentley presents his own unique take on open clusters and globular clusters.

22 January: "Apollo 14" Crew members Alan Shepard, Stuart Roosa and Edgar Mitchell left Earth in January 1971 to investigate the Fra Mauro area of our Moon. We celebrate the forty-fifth anniversary of this mission with a wonderful talk from BREC Center Supervisor Tom Northrop.

29 January: "Wonders of the Winter Sky" BREC Education Curator Amy Brouillette will take the audience on a fascinating tour of Baton Rouge's winter season. She'll highlight the celestial gems that will sparkle throughout the next three months—gems visitors will be able to see live if they continue to visit HRPO!

SCIENCE ACADEMY

Saturdays from 10am to 12pm

For ages eight to twelve. $5/$6 per child.

2 January: "Galaxies"

9 January: "Constellations"

16 January: "Life Cycle of a Star"

23 January: "Expedition 4"

30 January: "Winter Day"

SOLAR VIEWING

For all ages. Free admission.

30 January, 12pm to 2pm

CALL FOR VOLUNTEERS

*Satuday, 16 January from 3pm to 7pm. *Three volunteers familiar with at least one telescope.* **Learn Your Telescope.** Patron instruction. Moderately difficult.

*Saturday, 23 January from 3pm to 7pm. *Two volunteers familiar with at least one binocular.* **Learn Your Binocular.** Patron instruction Moderately difficult.

2016 Amateur Astronomy Courses

Knowledgeable BRAS Volunteers Needed.

Saturdays from 3pm to 7pm
For ages eighteen and older.
$15.00 per in-parish registrant. $18.00 per out-of-parish registrant.

These exciting one-day classes are tailor-made to instruct the patron in the use of a personal telescope or binocular, or the basics of the unaided-eye Baton Rouge sky.

9 JANUARY: Learn Your Sky
This class is an introduction to the unaided-eye Baton Rouge sky. *This one-day course focuses specifically on the unaided-eye Baton Rouge sky.* **Limit thirty registrants. All registrants must be over eighteen; children are not allowed.**
Topics that will be covered include…
*major stars and constellations in Baton Rouge
*major lunar features and how to find them *basic skygazing terminology
*how to distinguish planets from stars
*what meteors, conjunctions and "visible passes" are, and how to see them
*major unaided-eye features of our Milky Way Galaxy
*solar viewing safety, and how to view the Sun without store-bought equipment
*how to darken the sky from your home *upcoming unaided-eye events
*benefits of belonging to an astronomy club
*actual practice identifying stars, asterisms and constellations (weather permitting)

16 JANUARY: Learn Your Telescope
This class is a hands-on introduction to the operations of your personal telescope. *This one-day course focuses specifically on telescopic views of the Baton Rouge sky.* **Limit ten households. Limit one telescope per household.**
Topics that will be covered include…
*how to set up your telescope *how to care for your telescope
*major telescopic features in the Baton Rouge sky, and how to find them
*how to darken the sky from your home *upcoming telescopic events
*actual practice aiming and focusing on celestial objects (weather permitting)

23 JANUARY: Learn Your Binocular
This class is a hands-on introduction to the operations of your personal binocular. *This one-day course focuses specifically on binocular views of the Baton Rouge sky.* **Limit twenty households. Limit one binocular per household.**
Topics that will be covered include…
*how to operate your binocular *how to care for your binocular
*major binocular features in the Baton Rouge sky, and how to find them
*how to darken the sky from your home *upcoming binocular events
*actual practice aiming and focusing on celestial objects (weather permitting)

Recent Entries in the Forum

Below are selected recent additions to the BRAS Forum. There are also nine active polls.

BRAS Forum Reaches 1500 Topics
Flight Structure for James Webb Space Telescope Arrives at Goddard
Taylor-Hess-Pursell Portable Photographic Platform Summarized
New Efficient Lighting Video Released
International Year of Light Ham Radio Contact Award Offered
Comments Solicited for Government Street "Road Diet"
Several Editions of "Real Martian Moment" Available for Watching
"NASA's Journey to Mars" Outlines Planned Steps
Cassini Says Goodbye to Enceladus
Six Visible Passes Spotted in Nine Nights from HRPO
Cygnus CRS-4 Cargo Craft Launches
Time to View Neptune this Season Grows Short
World Celebrates 112th Anniversary of Wright Brothers Flight
Mars Now Visible Above Thirty Degrees for Over a Hour Each Night
Series of Leaks Postpones InSight Mission
Uranus Visible for Another Month
January Great Red Spot Viewing Times Posted
BRAS Members Catch Lunar Occultation of Venus
Christmas Day Full Moon has Intense Northern Libration
Clouds Thwart Viewing of ISS Transit
Video Simulates Flyby of Plutonian Surface
Comet Catalina Graces the Morning Sky
Algol Gives Growing Brightness on Upcoming Nights
Culmination Times Posted for the Christmas Tree Cluster

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20/20 Vision Campaign

GLOBE at Night: 1 January to 10 January
SUCCESS!: Louisiana is in the "Over 100 Club"!
2016 GOAL: 200 Measurements.

For the calendar year 2015 Louisiana turned in over 115 GLOBE at Night measurements! I'm happy to state a *vast* majority came from Baton Rouge and within about thirty kilometers of Baton Rouge. Good work. Let's set a goal for 2016 of 200 measurements. (Don't forget, BRAS will speak about light pollution in January to the Federation of Great Baton Rouge Civic Associations—specifically about how homeowners can reduce light pollution on their properties. A member alert will be send giving date, time and location.)

Auriga – the Charioteer

Position: RA 04 37 54.43 to 07 30 56.19, Dec. 56 16 48.33 to 27 89 13.12
Named Stars:
Capella (Alpha Aur), "al-'Ayyug", "The Goat", mag. 0.08, 05 16 41.30 +45 59 56.5, is the sixth brightest star in the night sky, and is a known source of X-rays. **Capella** consists of two binary pairs of stars. Primary and secondary (mag. 0.18) are a spectroscopic binary with a period of 104 days, with both components being yellow giant stars. The two components have a separation of 110 million kilometers, almost 75% of 1 AU. A third component (called **Capella H**) is a pair of red dwarf stars (both about mag. 10) located 11,000 AU (0.17 light years) from the main and secondary stars, and has a separation of 2.7". **Capella** marks the Charioteer's left shoulder or the goat he is carrying. The goat he is carrying represents Amalthea, the goat that suckled Zeus.
Menkalinan (Beta Aur), "mankib dhu al-'inan", "Shoulder of the Rein Holder", mag. 1.90, 05 59 31.77 +44 56 50.8, is a triple star system. The two main components, white sub-giant stars, form an eclipsing binary system, with a separation of 1/12th AU – 7.5 million miles – and a period of 3.96 days. The third component is a 14th magnitude red dwarf star, at a separation of 13.4 arc seconds (333 AU) from the primary. There is a fourth component - an optical companion - at mag. 10.5 and a separation of 184 arc seconds that is unrelated to **Beta Aur.**
El Nath (Gamma Aur), "Alnath", now assigned as **Beta Taurii.**
Prijipati (Delta Aur), "The Lord of Creation" in Sanskrit, mag. 3.72, 05 59 31.55 +54 17 05.9, is an orange giant star with three widely spaced optical companions. One is a double star at mag. 11 and a separation of 2 arc minutes from the primary. The other component is a mag. 10 star at a separation of 3 arc minutes from the primary.
Almaaz (Epsilon Aur), "Al Maz", "(billy) goat", "he goat", mag. 3.03, 05 01 58.13 +43 49 23.9, is an eclipsing binary star, and forms the apex of the "Haedi" asterism (the Three Kids). The primary is a white supergiant star, and the secondary may itself be a binary star within a large dusty disk. **Epsilon Aur** is the longest-period eclipsing binary known (27.1 years). **Epsilon Aur** also has a non-eclipsing component, a 14th magnitude companion separated from the primary by 28.6 arc seconds. It is still not known if there is a star, or binary star, or even a proto-star contained within the eclipsing dusty disk.
Sadatoni (Zeta Aur), "Haedus I", "the second arm of the Charioteer", mag. 3.69, 05 02 28.68 +41 04 33.2, is the westernmost "kid" held by the Charioteer. **Zeta Aur** is another eclipsing binary with the primary being an orange giant star and the secondary a smaller main sequence blue star, with a period of 972 days (2.7 years) and a separation of about 500 million miles. **Zeta Aur** is the proto-type of a class of supergiant stars that eclipse their main sequence companions.
Haedus II (Eta Aur), "Mahasim", "wrist", *haedus* is Latin for kid, mag. 3.18, 05 06 30.874 +41 14 04.7, is a blue-white main sequence dwarf star. This is the third star in the asterism "the Kids", and forms a naked eye pair with **Zeta Aur** (¾° from **Eta Aur**), with **Eta Aur** being the eastern star of the pair.
Mahasim (Theta Aur), "The Wrist", sometimes called "Bogardus", mag. 2.62, 05 59 43.24 +37 12 46.0, is a double star with the primary being a white main sequence dwarf star and the secondary a main sequence dwarf star at mag. 7.2 and a separation of 4 arc seconds and a period of 1.37 days and an orbit of 11 to 12 centuries. There is a second optical companion, a yellow main sequence dwarf star, at mag. 9.2, at a separation of 130.7 arc seconds. The primary is a chemically peculiar star with a strong magnetic field and a strong strontium, silicon, and chromium spectral lines. **Theta Aur** is the eastern vertex of the constellation's pentagon.
Kabdhilinan (Iota Aur), "Hassqleh", Al Kalb", "the ankle of the rein holder", mag. 2.69, 04 56 59.62 +33 09 58.1, is an orange luminous bright giant star and a hybrid star – an X-ray producing giant star.
Al Hurr (Lambda Aur), "fawn", mag. 4.69, 05 19 08.08 +40 06 02.4, is a double star, the primary being an intermediate between a sub-giant and a main sequence star, with weak emissions in the infra-red spectrum. **Lambda Aur** is reaching the end of its hydrogen fusing lifespan and has a rotational period of 26 days. There are several optical companions; the brightest companions are at mag. 10, separated by 175 and 203 arc seconds from the primary. The dimmer companions are at mag. 13 and 14, with an 87 and 310 arc seconds

separation from the primary.

Deep Sky:

M 36 (NGC 1960), "The Pinwheel Cluster", mag. 6.0, 05 36.18 +34 08.24, 12' in size, is an open cluster of 60 stars; detached, weak concentration of stars; large range in brightness; bright, very large; mag. of brightest star is 8.9. Has a 10 arc minute wide knot of bright stars in its center, anchored by **Struve 737**, a double star with components separated by 10.9 arc seconds. **M 36** lies about 5° southwest of **Theta Aur** and some 2.3° distant from **M 38**. About 1° west and slightly north is **NGC 1931**. A nebulous object with a star and tail like structure, and a high-velocity, bi-polar outflow was discovered in the southwest portion of **M 36** in 1995. Named "Holoea", which is Hawaiian for "flowing gas". The object is coincident with an infra-red source (IRAS 05327+3404), and optical spectroscopy shows it to be a strong emission-line source, and also indicates the velocity of the bi-polar outflow is about 650 km/sec. Recent sub-millimeter radio observations indicate the presence of at least two partially embedded young stellar objects (YSO) and one pre-stellar condensation within the nebula. These observations suggest that at least two of the budding stars are in the process of making the transition to partially exposed pre-main sequence stars, while a third may still be a collapsing proto-star.

M 37 (NGC 2099), mag. 5.6, 05 52 18 +32 33 12, 28' in size, is an open cluster of 150 stars; detached, weak concentration of stars; small range in brightness; has a dark area near the center; brightest star is mag. 9.2. **M 37** is located 4½°south and 1° west of **Theta Aur.** The cluster contains at least 21 white dwarf stars. Interestingly, they have a hydrogen-rich atmosphere, which contrasts with stand-alone field white dwarfs whose atmospheres are typically helium-rich.

M 38 (NGC 1912), "The Starfish Cluster", mag. 6.4, 05 28 43 +35 51 18, 20' in size, is an open cluster of 100 stars; detached, no concentration of stars; moderate range in brightness; very large and bright; mag. of brightest star is 9.5. The brightest stars in **M 38** form the shape of an oblique cross, or the letter Pi. **NGC 1907** accompanies **M 38**, it is a smaller and dimmer cluster that lies ½° south-southwest of **M 38**, and has a magnitude of 8.2 and is 6.0 arc minutes in diameter, containing about 40 stars.

NGC 1664, mag. 7.6, 04 51.1 +43 42, 18' in size, is an open cluster of 40 stars; detached, no concentration of stars; small range in brightness; pretty large; mag. of brightest star is 10.6.

NGC 1778, mag. 7.7, 05 08.1 +37 03, 7' in size, is an open cluster of 25 stars; detached, no concentration of stars; moderate range in brightness; mag. of brightest star is 10.1.

NGC 1857, mag. 7.0, 05 20.2 +39 21, 6' in size, is an open cluster of 40 stars; detached, weak concentration of stars; moderate range in brightness. A finder will show it as a hazy patch surrounding an orange 7.4 magnitude star.

NGC 1893, "The Letter Y Cluster", mag. 7.5, 05 22 34 +33 24 42, 10' in size, is an open cluster of 60 stars; detached, weak concentration of stars; moderate brightness range; large; mag. of brightest star is 9.3. **NGC** 1893 is involved in a very large (40' x 30') emission nebula, **IC 410**. **NGC 1893** is located 4.9° north of **Elnath (Beta Taurii),** or 2.7° southwest of **M 38.**

NGC 1907, mag. 8.2, 05 28.0 +35 19, 7' in size, is an open cluster of 30 stars; detached, weak concentration of stars; small range in brightness; irregularly round; involved in nebulosity; mag. of brightest star is 11.3; located about 0.5° south-southwest of **M 38.**

NGC 1931, "The Fly Cluster", CR 68, Stock 9, Sharpless 2-237, 05 31 26.6 +34 14 58, 3' x 3' in size, is a nebula and a cluster; very bright; contains a very bright, large, and round cluster; mag. of brightest star is 11.5. **NGC 1931** is located slightly more than 1° west of **M 36**. The nebula has a "peanut" shape, and is both an emission and a reflection nebula.

NGC 2281, "Broken Heart Cluster", mag. 5.4, 06 49.3 +41 04, 15' in size, is an open cluster of 30 stars in a crescent shape; detached, strong concentration of stars; large range in brightness; mag. of brightest star is 7.3.

IC 405, "The Flaming Star Nebula", SH 2-229, Caldwell 31, 05 16.2 +34 16, 30' in size; very large, very faint; use an O III or H-beta filter if possible; Illuminated by a 6.0 magnitude star. **IC 405** is an emission/reflection nebula that surrounds the star **AE Aurigae.**

IC 410, 05 22.6 +33 31, 40' x 30' in size, is a very faint, large emission nebula (resembling the Rosetta Nebula) surrounding the large (10') open cluster **NGC 1893 (The letter Y Cluster).NGC 1893** is embedded within a clearing in the dusty emission nebula **IC 410**. There are two dramatic tadpole shaped streamers of cool gas near

the cluster, cataloged as **SIM 129and 130**. This is one of the youngest clusters observed in the optic range, although in 10 and 12 inch telescopes the nebula will show only a mottled haze around the vicinity of the cluster. Deep Sky filters like O III will give the nebula a bit more visual presence.
IC 417, 05 28.1 +34 26, 12' x 9' in size, is a very large, diffuse, faint nebula; includes wedge-shaped filaments.
Berkeley 17, 05 20 32.0 +30 34 20, 13' in size, is an open cluster of 100 stars, located just 2° northwest of **Beta Taurii. Berkeley 17** is one of the oldest, if not the oldest star cluster in the**Milky Way**.
B 29, 05 06.2 +31 44, 10' in size, is a dark nebula with high opacity, and has a circular shape.
B 34, 05 43.5 +32 39, 19' in size, is a dark nebula with medium opacity, circular shape; includes a globule. It is located about 2° west of open cluster **M 37.**
Cr 62, mag. 4.2 (photo), 05 22.5 +41 00, 28' in size, is an open cluster of few stars; not well detached; large brightness range.
SH 2-224, 05 27.3 +42 59, 19' x 3' in size, is a bright nebula, the remnant of a supernova, showing an incomplete oval ring.
SH 2-231, 05 39.4 +33 56, 10' x 5' in size, is a bright nebula of irregular shape, extended north-south; very diffuse and faint.
SH 2-235, 05 41.1 +35 52, 10' in size, is an irregular shaped bright nebula.
SH 2-241, 06 04.1 +30 15, 10' in size, is a fan shaped, very faint and diffuse bright nebula.
vdB 31, 04 55.7 +30 33, 8' x 5' in size, has a mag. 6.8 star involved in nebulosity.
In the deep sky, there are objects as follows: 5 Berkeley; 1 Basel; 3 Cederblad; 14 Collinder; 5 Czernik; 2 LDN; 12 Hershel (including 6 on the Herschel "400" list); 11 Melotte; 1 NGC beyond mag. 10; and 1 IC beyond mag. 10 – as always, see me for the info.

Other Stars:
Psi Aur is the designation shared by 9 stars, located near the border with the Lynx constellation:
Psi^{1} Aur, mag. 4.92, 06 24 53.90 +49 17 16.4; **Psi^{2} Aur,** mag. 4.80, 06 39 19.83 +42 29 20.4; **Psi^{3} Aur,** mag. 5.34, 06 38 49.19 +39 54 09.3; **Psi^{4} Aur,** mag. 5.04, 06 43 05.01 +44 31 28.3; **Psi^{5} Aur,**mag. 5.24, 06 46 44.34 +43 34 37.3; **Psi^{6} Aur,** mag. 5.22, 06 47 39.58 +48 47 22.1; **Psi^{7} Aur,** mag. 4.99, 06 50 45.96 +41 46 53.6; **Psi^{8} Aur,** mag. 6.46, 06 53 57.074 +38 30 18.3; **Psi^{9} Aur,** mag. 5.85, 06 56 32.06 +46 16 26.4; and the 10th star is designated as **16 Lyn.**
Omega Aur, mag. 4.93, 04 59 15.38 +37 53 25.7, is a binary star, associated to **EUVEJ0459+37.8** – a UV emission source, also known as **4 Aur**. Secondary is mag. 8.1.
AE Aur, mag. 5.99, 05 16 18.15 +34 18 44.0, is a blue, main sequence dwarf star, and an eruptive variable star that lights the **Flaming Star Nebula (IC 405).** It is likely that **AE Aur** entered the nebula only recently, because it is a "runaway" star – suspected of coming from a young cluster in the **Orion Nebula** around 2.5 million years ago. It is suspected that two binary systems in **Orion** were involved in a collision, ejecting **AE Aur** and **Mu Columbae** – **Iota Orionis** and its spectroscopic companion would be the surviving binary system – both stars in the **Iota Orionis** system have orbital velocities similar to the space velocities of **AE Aur** and **Mu Columbae,** 100 km/sec.
Andrew's Star, HR 1938, mag. 6.07 to 4.0, 05 40 35.9 +31 21 29.5, is an unpredictable flare star. Discovered by A. David Andrew on March 1, 1964, when it was noted that **HR 1938's**magnitude changed by 3 full magnifications between photographic plates taken 2 hours apart. In 1989, Dr. Bradley Schaefer listed it as a "flasher" star – visual magnitude 6.0; flash amplitude 2.2, 1.2 magnitudes; rise or fall time: 300 seconds.
HD 30453, mag. 5.84, 04 49 19.06 +32 35 17.8, is a spectroscopic star with a period of 7 days.
HD 35519, mag. 6.16, 05 26 54.33 +35 27 26.3, is a star in two clusters, **NGC 1912** and **NGC 1907.**
HD 40979, mag. 6.74, 06 04 29.994 +44 15 37.6, has one planet in orbit with a separation of 0.83 AU and a period of 263.1 days.
AB AUR, mag. 7.06, 04 55 45.8 +30 33 04.29, has a dust disk in which planets or brown dwarfs may be forming.
V420 Aur, mag. 7.45, 05 22 35.23 +37 40 33.62, is a high mass X-ray binary and a BE variable star.
HD 45350, mag. 7.88, 06 28 45.71 +38 57 46.7, has one planet in orbit with a separation of 1.92 AU and a period of 890.76 days.

HD 43691, mag. 8.03, 06 19 34.68 +41 05 32.3, has one planet in orbit with a separation of 0.24 AU and a period of 36.96 days.
HD 49674, mag. 8.10, 06 51 30.52 +40 52 03.9, has one planet in orbit with a separation of 0.058 AU and a period of 4.94 days.
KELT-2A, mag. 8.77, 06 10 39 +30 57 25, has a transiting planet in orbit.
HAT-P-9, mag. 12.34, 07 20 40.479 +37 08 26.17, has a transiting planet with a separation of 0.053 AU and a period of 3.92 days.
GD 66, mag. 12.02, 05 20 38.31 +30 48 24.1, is a white dwarf star with a possible planet in orbit.

Meteor Showers: The Aurigids – peaks on Sept. 1st, beginning on Aug. 28th. Maximum zenithal hourly rate is 2-5 meteors/hour, fast movers (42 miles/sec.), with a radiant at about 2" north of **Theta Aur**, associated with the comet Kiess (C/1911 N1).

The Zeta Aurigids –is a weak shower with northern and southern branch lasting from Dec. 11th to Jan. 21st. Peaks on Jan. 1st, slow meteors with a max. rate of 1-5 meteors/hour.

The Delta Aurigids – is a faint shower from Sept. 22nd through Oct. 23rd, peaking on Oct. 6th and 15th.

Iota Aurigids – is a hypothesized shower occurring in mid Nov.; parent body may be asteroid 2000NL10. They may instead be a faint stream of Taurids.

Sky Happenings:

Jan. 1st – Comet **Catalina** is ½° from **Arcturus** in the predawn hours
Last Quarter Moon occurs at 11:30 PM CST.

Jan. 2nd – The **Moon** is at apogee (251,206 miles from Earth) at 5:53 AM CST,
Earth is at perihelion (91.4 million miles from the Sun) at 5 PM CST.

Jan. 3rd – The waning crescent **Moon** is 2° from **Mars** and near **Spica** in the dawn sky, to 8:30 PM CST,
The **Moon** passes 1.5° north of **Mars** at 1PM CST.

Jan. 4th – The **Quadranid Meteor Shower** should peak around 2 AM CST. The rise of the waning crescent moon will not interfere with the late night viewing of the shower.
Mercury is stationary at 11PM CST.

Jan. 5th – Pluto is in conjunction with the **Sun** at 9 PM CST.

Jan. 6th – The waning crescent **Moon** is near **Venus** and **Saturn** in the dawn sky,
Venus passes 6° north of **Antares** at 11 AM CST,
The **Moon** passes 3° north of **Venus** at 6 PM CST,
The **Moon** passes 3° north of **Saturn** at 11 PM CST.

Jan. 7th – The thin waning **Moon** hangs low in the southeast, to the left or lower left of **Venus** and **Saturn**, which are less than 2° apart.

Jan. 8th and 9th – Venus and **Saturn** are ½° apart both mornings in the dawn sky.

Jan. 8th – Jupiter is stationary at 2 PM CST,
Venus passes 0.09° north of **Saturn** at 10 PM CST.

Jan. 9th – Look low in the southeast before sunrise to find **Venus** and **Saturn** less than ½° apart. **Antares** winks red about 7° to the right or lower right of the planetary duo,
New Moon occurs at 7:31 PM CST,
Jupiter begins retrograde motion.

Jan. 10th/11th – Three of **Jupiter's** moons transit across **Jupiter's** disk.

Jan. 13th – The **Moon** passes 2° north of **Neptune** at 9 AM CST.

Jan. 14th – Mercury is in inferior conjunction at 8 AM CST,

The **Moon** is at perigee (229,671 miles from **Earth**) at 8:14 AM CST.

Jan. 15th – The **Moon** passes 1.5° south of **Uranus** at 12:00 midnight CST.

Jan. 16th – First Quarter Moon occurs at 5:26 PM CST.

Jan. 19th – Asteroid **Pallas** is in conjunction with the **Sun** at 4 AM CST,

The waxing gibbous **Moon** occults **Alderbaran** for most of **North America** – we are on the grazing line – and if we can see it, it will happen around 8:20 to 8:30 PM CST, with the reappearance happening around 8:30 to 8:40 PM CST,

The **Moon** passes 0.5° north of **Alderbaran** at 9 PM CST.

Jan. 23rd – Full Moon occurs at 7:46 PM CST,

Night – **Regulus** shines through the glare of the waxing gibbous **Moon** at about 3° to the right of the **Moon.**

Jan. 27th – The **Moon** passes 1.4° south of **Jupiter** at 7 PM CST,

Late night – the **Moon** shines about 4° below **Jupiter.**

Jan. 30th – The **Moon** is at apogee (251,377 miles from **Earth**) at 3:10 AM CST

Dawn – the waning gibbous **Moon** is about 4° to the upper left of **Spica. Mars** is about 1.5° from the fainter **Alpha Librae.**

Jan. 31st – Last Quarter Moon occurs at 9:28 PM CST.

Mercury – Mercury shines at mag. -0.4 on New Year's Day, with a disk appearing 7" across and is about ½ lit, at about 10° above the horizon at about 30 minutes after sunset. On Jan. 5th, just 25% of **Mercury's** disk will be lit. On Jan. 8th, it is only up at about 5°, and sets less than an hour after the **Sun**, having being dimmed to a faint +1.8 magnitude by now. **Mercury** will race through inferior conjunction, 3° south of the **Sun** on Jan. 14th. At its next inferior conjunction on May 9th, we will see **Mercury** do its first transit of the **Sun** in 10 years. **Mercury** approaches **Venus** at the end of Jan. **Mercury** will pass 0.5° north of **Pluto** (invisible in the twilight) on Jan. 30th. **Mercury** stands 9° high above the horizon at about ½ hour before sunrise on Jan. 31st – it will be 7° to the lower left of **Venus**, shining at mag. 0.0.

Venus – On Jan. 1st, **Venus** lies in **Scorpius** and rises around 4:30 AM local time, at mag. -4.0. On Jan. 5th, at dawn, **Venus** leaves **Scorpius** and enters **Ophiuchus**, heading toward **Saturn.**On Jan. 9th, at dawn, **Saturn** (mag. +0.5) shines less than ½° to the upper right of **Venus**, with **Antares** 7° to the lower right of them. **Venus** (79% sun lit) appears slightly less than 14" tall, and the pale **Saturn** more than 15" wide, encircled by the well tilted rings that span 35". Starting Jan. at barely more than 1° from **Beta Scorpii, Venus** races deep into **Sagittarius**, passing near **M 20 (Triffid Nebula)** on Jan. 24th, and arrives north of the teapot asterism's handle by month's end.

Mars – Mars rises about 1:30 AM local time on Jan. 1st, in **Virgo,** 6° east-northeast of **Spica.** At mag. 1.3, **Mars** will have a distinct ruddy hue, while **Spica** shines blue-white. **Mars**crosses into **Libra** on Jan. 17th, ending the month 1.3° north of mag. 2.6 **Alpha Librae (Zubenelgenubi)**, at mag. 0.8. **Mars** starts the month with a disk of 5.6", but ends the month with a disk of 6.8".

Jupiter – Jupiter enters into the sky's stage earlier each evening, rising around 9:30 PM CST on Jan. 1st, but around 7:30 PM CST by Jan. 31st. **Jupiter** brightens in mag. from -2.2 to -2.4 this month. **Jupiter** is stationary in the extreme southeast of **Leo** on Jan. 8th, and then slowly starts a westward retrograde motion. **Jupiter's** apparent equatorial diameter increases from 39" to more than 42" during Jan. On Jan. 10th/11th, three of**Jupiter's** moons will transit in rapid succession. **Europa** starts it all at 10:37 PM CST with a transit that lasts until 1:21 AM CST. Less than an hour later, at 2:04 AM CST, **Callisto** starts across **Jupiter's** northern polar region, with a two hour transit. **Io's** shadow falls on cloud tops starting at 3:22

AM CST. **Io** itself begins to transit **Jupiter** at 4:27 AM CST.

Saturn – Saturn rises around 5:15 AM local time on Jan. 1st, in **Ophiuchus,** at mag. 0.5. The gap between **Venus** and **Saturn,** after **Venus** enters **Ophiuchus** on Jan. 5th, starts to close. On Jan. 6th, a waning crescent **Moon** will be 7° above **Venus** with **Saturn** standing 3° below **Venus.** On Jan. 9th, **Saturn** will shine less than ½° to the upper right of **Venus**, with **Antares** 7° to the lower right of the pair of planets. **Saturn** appears 15" across with a ring system that spans 35".

Uranus – Uranus rides high in the south as darkness falls, in **Pisces. To find** Uranus, start with the **Great Square of Pegasus**. Draw an imaginary line that spans the 20° separating **Beta**and **Gamma Pegasi** (the square's northwest and southeast corners), then extend it 15° until you reach a line of 3 modestly bright stars. The middle star is **Epsilon Piscium** (mag. 4.3). **Uranus** lies 2° south of **Epsilon** all month. **Uranus** will show a distinctly blue-green hued disk that spans 3.5".

Neptune – As **Mercury** dips below the horizon on Jan. 1st, **Neptune** stands 30° high in the southwest. **Neptune**, at mag. 7.9, glows against the backdrop of **Aquarius**, some 4° southwest of 4th magnitude **Lambda Aquarii**. During the final two weeks of Jan., **Neptune** lies close to 6.9 mag. star **SAO 146230**. This star resides a bit more than halfway along the line joining**Lambda** and 5th magnitude **Sigma Aquarii**. The planet lies 13' due west of the star on Jan. 19th, and passes 5' due north of it on Jan. 26th. To identify **Neptune**, it will show a blue-grey disk that spans 2.2".

Pluto – Pluto is in conjunction with the **Sun** on Jan. 6th and unobservable all month.

Moon – The **Moon** is a thick waning crescent just a few degrees from **Mars** and **Spica** on the morning of Jan. 3rd. On Jan. 6th, a much thinner lunar slice hangs above the **Venus-Saturn**pair and closer to the lower left of them on Jan. 7th. The waxing gibbous **Moon** passes through the **Hyades** and occults **Alderbaran** for most of **North America** on Jan. 19th. The waning gibbous **Moon** is to the left or lower left of **Regulus** late in the evening of Jan. 25th.

Asteroids: Asteroid **5 Astraea** passes 1° due south of 1st magnitude **Regulus** on Jan. 25th, but even closer (0.75°) a few days later. **Astraea** glows at 9th magnitude, and on Jan. 16th, Astraea will be about 1° from the star **31 Leo.**

Comets: Comet **Catalina (C/2013 US10)** crests the eastern horizon just after **New Years**. **Catalina** is at 5th magnitude, and only 0.5° from **Arcturus** in the pre-dawn hours of Jan. 1st.**Catalina** will cruise northward at better than 2°/day. On Jan. 14th – 17th, **Catalina** passes near **M 51 (The Whirlpool Galaxy)** and **M 101.** On Jan. 15th, **Catalina** will be about 1° west of Eta Boötes.

Meteor Showers: The **Quadrantid Meteor Shower** peaks before dawn on Jan. 4th (at about 2 AM CST), with the **International Meteor Organization (IMO)** predicting the peak at this time. The **Moon** will be a thick waning crescent rising about 2 AM local time, but should not pose any great problem. Maximum rate at peak is 120 meteors/hour. The radiant lies in northern **Boötes,** below the **Big Dipper's** handle.

When to View the Planets:

Evening Sky	Midnight	Morning Sky
Mercury (southwest)	Jupiter (east)	Mercury (southeast)
Uranus (south)		Venus (southeast)
Neptune (southwest)		Mars (south)
		Jupiter (southwest)
		Saturn (southeast)

Dark Sky Viewing: Primary – Jan. 9th, Secondary – Jan. 16th

Auriga – The Charioteer

This prominent constellation has several identifications in mythology. The most popular interpretation is that he is Erichthonius, the legendary king of Athens. He was the son of Hephaestus, the god of fire, better known by his Roman name of Vulcan, but he was raised by the goddess Athene, after whom Athens is named. In her honor, Erichthonius instituted a festival called "The Panathenaea".

Athene taught Erichthonius many skills, including how to tame horses. He became the first person to harness four horses to a chariot, in imitation of the four horse chariot of the Sun, a bold move which gained him the admiration of Zeus and assured him a place among the stars. There, Erichthonius is depicted at the reins, perhaps participating in the Panathenaic games in which he frequently drove his chariot to victory.

Another identification is that Auriga is really Myrtilus, the charioteer of King Oenomaus of Ehis and son of Hermes. The king had a beautiful daughter, Hippodamia, whom he was determined not to let go. He challenged each of her suitors to a death-or-glory chariot race. They were to speed away with Hippodamia on their chariots, but if Oenomaus caught up with them before they reached Corinth, he would kill them. Since he had the swiftest chariot in Greece, skillfully driven by Myrtilus, no man had yet survived the test.

A dozen suitors had been beheaded by the time Pelops, the handsome son of Tantalus, came to claim Hippodamia's hand. Hippodamia, falling in love with him on sight, begged Myrtilus to betray the king so that Pelops might win the race. Myrtilus, who himself was secretly in love with Hippodamia, tampered with the pins holding the wheels on Oenomaus' chariot. During the pursuit of Pelops, the wheels of the king's chariot fell off and Oenomaus was thrown to his death.

Hippodamia was now left in the company of both Pelops and Myrtilus. Pelops solved the awkward situation by unceremoniously throwing Myrtilus into the sea, from which he cursed the house of Pelops as he drowned.

Hermes put the image of his son Myrtilus into the sky as the constellation Auriga. Germanicus Caeser supports this identification because, he says, 'you will observe that he has no chariot, and, his reins broken, is sorrowful, grieving that Hippodamia has been taken away by the treachery of Pelops'.

A third identification of Auriga is Hippolytus, son of Theseus, whose stepmother Phaedra fell in love with him. When Hippolytus rejected her, she hanged herself in despair. Theseus banished Hippolytus from Athens. As he drove away his chariot was wrecked, killing him. Asclepius the Healer brought blameless Hippolytus back to life again, a deed for which Zeus struck Asclepius down with a thunderbolt at the demand of Hades, who was annoyed at losing a valuable soul.

Auriga contains the 6th brightest star in the sky, Capella, a Roman name meaning 'she-goat' (its Greek name was Aix). Ptolemy described this star as being on the charioteer's left shoulder. According to Aratus, it represents the goat Amaltheia, who suckled the infant Zeus on the island of Crete, and was placed in the sky as a mark of gratitude, along with the two kids she bore at the same time. The kids, frequently known by their Latin name of Haedi (Eriphi in Greek), are represented by the neighboring stars Eta and Zeta Aurigae.

An alternative story is that Amaltheia was the nymph who owned the goat. Erastosthenes says that the goat was so ugly that it terrified the Titans who ruled the Earth at that time. When Zeus grew up and challenged the Titans for supremacy, he made a cloak from the goat's hide, the back of which looked like the head of a Gorgan. This horrible looking goatskin formed the so-called aegis of Zeus (the word aegis actually means goatskin). The aegis protected Zeus and scared his enemies, a particular advantage in his fight against the Titans.

Some early writers spoke of the Goat and Kids as a separate constellation, but since the time of Ptolemy they

have been awkwardly combined with the Charioteer, the goat resting on the charioteer's shoulder, with the kids supported on his wrist. There is no legend to explain why the charioteer is so encumbered with livestock.

Greek astronomers regarded one star as being shared by Auriga and Taurus, representing the right foot of the charioteer and the tip of the bull's left horn, as old star maps show it. Modern astronomers now assign this star exclusively to Taurus.