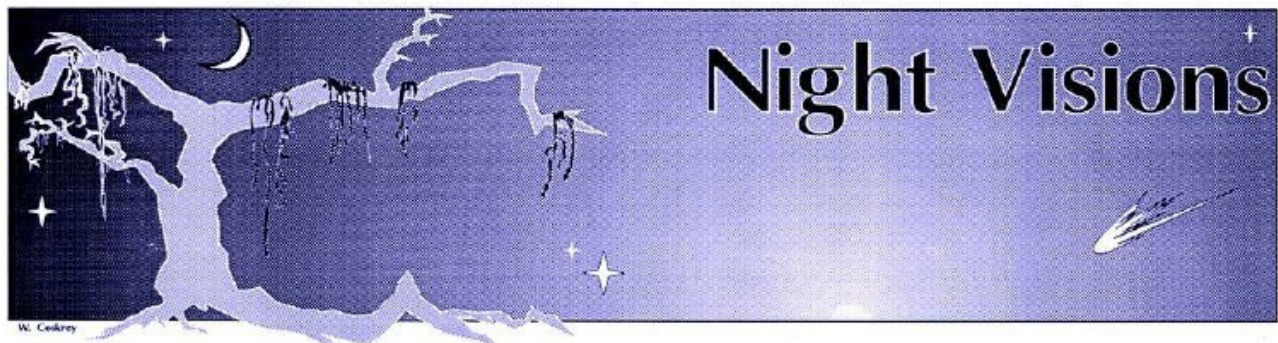


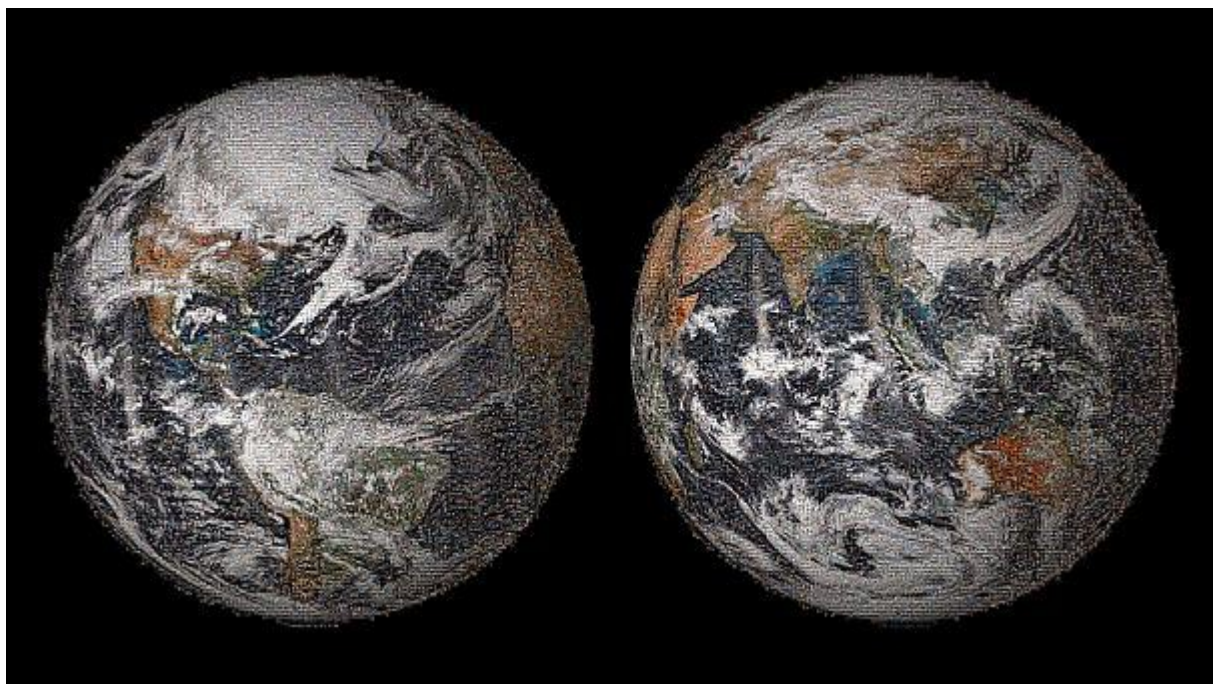


Newsletter of the Baton Rouge Astronomical Society



June, 2014

Next Meeting June 9th, 7PM at the HRPO



NASA's newly released "Global Selfie" image.

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President's Message

I tried to set up a picnic/star-b-cue at LIGO for our June meeting but that didn't work out. We will do that in July instead. Instead we will meet as usual on the second Monday of June 9, 2014 at the Observatory, 7 PM.

Trevor McGuire brought up an excellent idea that sprang from a discussion he had at the Hodges Garden Star Party. Almost everyone has some stargazing gear, books, videos, etc. they are not using anymore but just never got around to moving it on to someone else. So, how about an astronomy garage sale? I propose we hold it among BRAS members first and if anything is left over, find a venue and open it to the public. I think our July meeting under the pavilion at LIGO would be an excellent place to hold it. Plus some PAS members will be there, so they will be able to add into it. Some of them have some neat stuff too.

A lot of us were excited about the prospects of the "new" meteor shower of May 23-24. The source of the shower was Comet 209P/Linear, which was only discovered in 2004. This comet has a short period of 5.1 years, but it is pretty small. The excitement arose because this would be the first time earth passed through this part of the dust cloud left behind from a passage of the comet from sometime in the late 1700s or early 1800s. That increased the likelihood of a higher than usual peak rate count and perhaps brighter meteors. Predictions ranged from 10 meteors per hour to a couple of thousand. Well it turned out the lower rate was more accurate. Technically, it wasn't a fizzle, but almost everybody expected more. However, the timing was spot on, so at least those models are becoming more accurate.

Congratulations to BRAS member Chris Desselles, whose astrophoto of "Lunar maria lava flows" was published in May 23, 2014 Reader Gallery Photos of the web edition of Astronomy Magazine. I haven't seen a print copy but I assume it is in there as well. Chris' highly detailed lunar photo is especially unique because he brought out subtle details in the maria (seas) and even some color. Oh, you didn't think the Moon had any color? Well, it does. It is very pale but it is there.

We had announced last month we would raffle a nice binocular next, but in the meantime the Lundt solar telescope arrived. So the binoculars got bumped and the solar scope will be our next big ticket raffle item. We will have the scope at the next meeting so you can take a look at it. Tickets are \$5 per ticket or 5 tickets for \$20. We set that price instead of the usual 6 for \$25 because 20 dollar bills are easier for most people. Besides at the \$20 price, if you buy \$100 in tickets you get one more ticket than at the \$25 price. We have set a reserve price on them, so as soon as we sell enough tickets to meet that reserve, we will draw for the winner. You will not need to be present to win. You will need to buy a ticket though.

Clear skies,

Merrill Hess
President

Secretary's Summary of May Meeting

- Merrill began the meeting by talking about the interesting International Astronomy Day we had had at the Observatory the previous Saturday. We had a pretty good turnout in spite of the intermittent rain going on during the afternoon and evening,
- Trey mentioned in the Treasurer's report that we had approximately \$5,000 on hand. Roughly \$200 was donated for Orion Astroblast telescope that was raffled off at the end of IAD festivities at the Observatory.
- Trey also spoke about an outreach event taking place this coming Saturday (the 17th) at the Glen Oaks High School football Stadium for Security Dads' Family Day there. Usually there are about 500 people that show up at this event; he was hoping that BRAS would be able to set up a table with information. There was a signup sheet going around as well as information on details and a map to the school.
- Trevor mentioned that there was an outreach event related to scouting down at Lamar-Dixon the week of June 9th. It didn't matter which day one wanted to help; he was looking for someone to assist.
- The next BRAS meeting will be on the 3rd Saturday in June (the 21st). This will be the annual picnic at the pavilion at LIGO in Livingston Parish at 11:00 am. The meat/main entrée will be supplied; everyone attending is encouraged to bring edible side items to share with the group.
- From late May to mid-July there will be several outreach events at various branches of the East Baton Rouge Parish Library. If you can volunteer to help at one or more of these events, it would be greatly appreciated.
- There is a raffle scheduled for this evening. The Lunt solar telescope is in so we'll be starting the raffle for that tonight. There will also be two other prizes for this evening, a monthly astronomy calendar and a Stars and Planets guidebook.
- There was some discussion here about the lighting ordinance that came up a couple of months back. There was a suggestion to maybe have BRAS give out a "bad" lighting award to help the public fight bad lighting. Mention was made of the ordinances that they have in Tucson and other places in Arizona. Evidently they have similar laws here; they're just not being enforced. John has some links for light maps to overlay Google maps.
- Mention was made again that we are running low on raffle items.
- Dr. Madhan R Tirumalai from the University of Houston gave the lecture this month on extreme environments.
- The meeting adjourned without a raffle.

Roslyn Readinger
Secretary

Outreach Report

We have an event coming up the week of June 9th. We have some play with the exact date, time, and activities. It will likely be a daytime event at the Lamar-Dixon Expo center for a scout campout. My ability to attend is in limbo at the moment, but I'll do what I can.

As always, if you want to be informed about outreach events as they come up, email me at outreach@brastro.org to get put on the outreach notification listserv.

Additionally, I will be moving away at the end of the summer, and if no one volunteers to handle the outreach requests that come in through the outreach email, we will revert back to the old system of various people receiving requests individually with no group-wide cohesion.

Trevor McGuire
Outreach Chairperson



Drying Out the Moon?

For decades, planetary scientists and geologists assumed that the Moon was about the driest and dustiest place in the solar system. Then around 2010, a spate of independent observations from spacecraft and elsewhere uncovered evidence of hydrogen in lunar rocks. Taking hydrogen as a proxy for water (H_2O), the evidence suggested that ice might be buried at the lunar poles—and that indeed, the material from which the Moon formed might have been as wet as that which formed Earth.

The lunar mineral richest in hydrogen is apatite: a compound of calcium, phosphorus, and oxygen that also incorporates either fluorine, chlorine, or hydroxyl (an oxygen-hydrogen group). For those who like chemical formulas, apatite is written as $\text{Ca}_5(\text{PO}_4)_3(\text{F}, \text{Cl}, \text{OH})$.

Apatite is attractive as a tracer of volatile elements in many environments because it appears in many rocks brought back by the *Apollo* astronauts, ranging from the relatively young lunar maria (lava seas) to the ancient highlands. Thus, apatite was regarded as a good tracer of hydrogen. Indeed, apatite was the *only* hydrous mineral (one with water or water's constituents) in lunar samples.

A new computational model of how apatite crystalizes, devised by Jeremy W. Boyce in the Department of Earth, Planetary, and Space Sciences at UC Los Angeles and four coauthors now indicates that apatite is a misleading indicator of water in the Moon.

No appetite for apatite

Boyce's model simulates how apatite crystalizes out of cooling molten lunar magma, incorporating fluorine, chlorine, or hydrogen into its structure. Modeling revealed that during fractional crystallization—in which newly formed crystals separate from the melt—apatite preferentially incorporates fluorine first.

“Early-forming apatite is so fluorine-rich that it vacuums all the fluorine out of the magma, followed by chlorine,” explained Boyce. “Apatite forming later doesn't see fluorine or chlorine and becomes hydrogen-rich because it has no choice.”

The model also makes specific testable predictions. For example, it predicts that apatite crystals grown at different times in the same magma should have different abundances of fluorine, chlorine, and hydrogen—abundance differences observed almost ubiquitously in lunar rocks. It also suggests that if crystallization is quick or diffusion slow, the core of a crystal should be rich in fluorine while its rim is fluorine-poor and hydrogen rich—zoning indeed observed in basalts brought back from *Apollo* missions 11, 12, and 14.

Most importantly, the model demonstrates how apatite could form with orders of magnitude more hydrogen than expected from a melt actually having little water. “Because it is not required that late stage $\text{H}_2\text{O}_{\text{melt}}$ [the amount of water in the melt] be elevated in order to explain the elevated abundances of $\text{H}_2\text{O}_{\text{ap}}$ [the amount of water in the apatite], hydrogen-rich apatite cannot be cited as evidence for elevated $\text{H}_2\text{O}_{\text{melt}}$ a priori,” state Boyce and his co-authors in their paper in the April 25, 2014 issue of *Science*.

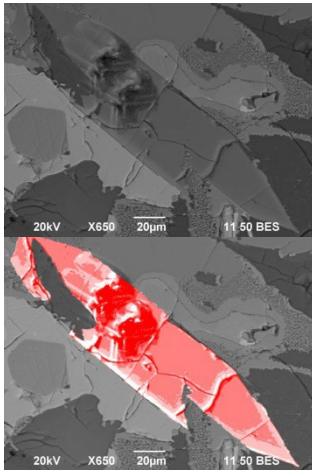
So does the Moon have water?

Does this finding about apatite mean the Moon is as arid as thought before about 2010? Likely, no, says commentator Mahesh Anand in a perspective article in the same issue of *Science*. Olivine crystals, “which were some of the earliest-formed crystals in lunar volcanic glasses, point to a wet lunar interior,” Anand pointed out, as does spectroscopic analysis of plagioclase crystals and other observations.

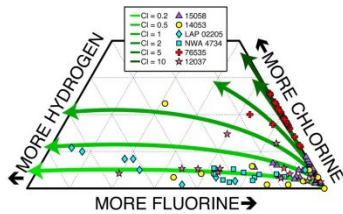
What the finding does mean is that apatite—the most widely used method for estimating water in lunar rocks—“cannot be trusted,” Boyce declared.

“We're knocking out one of the most important pillars of evidence regarding the conditions of the formation and evolution of the Moon,” he concluded. “Next, we plan to determine how badly apatite

has distorted our view of the Moon and how we can best see past it to get at the Moon's origin.” —
Trudy E. Bell, M.A.



Photomicrograph of Apollo 11 lunar sample 10044,644 maps density of its polished surface: denser materials reflect more electrons and look lighter gray. Pinkscale version of image highlights density variations for a crystal of apatite. Such variations would be expected had the crystal formed through fractional crystallization—a process that ruins apatite's ability to record volatiles, including hydrogen. Credit: Jeremy Boyce, UCLA



Measurements of hydrogen, fluorine, and chlorine in different lunar samples are shown as different symbols. Green curves represent how composition of apatite changes because of fractional crystallization. Shades of green depict models with different amounts of Cl, but all models have identical water. Changing the amount of fractional crystallization and the Cl content, one can model any apatite found now on the Moon, whether water rich or water poor—but all could have come from magmas with the same water content. Thus, apatite is a poor indicator of magmatic water. Credit: Jeremy Boyce, UCLA

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>

Message from the HRPO

HRPO

FRIDAY NIGHT LECTURE SERIES

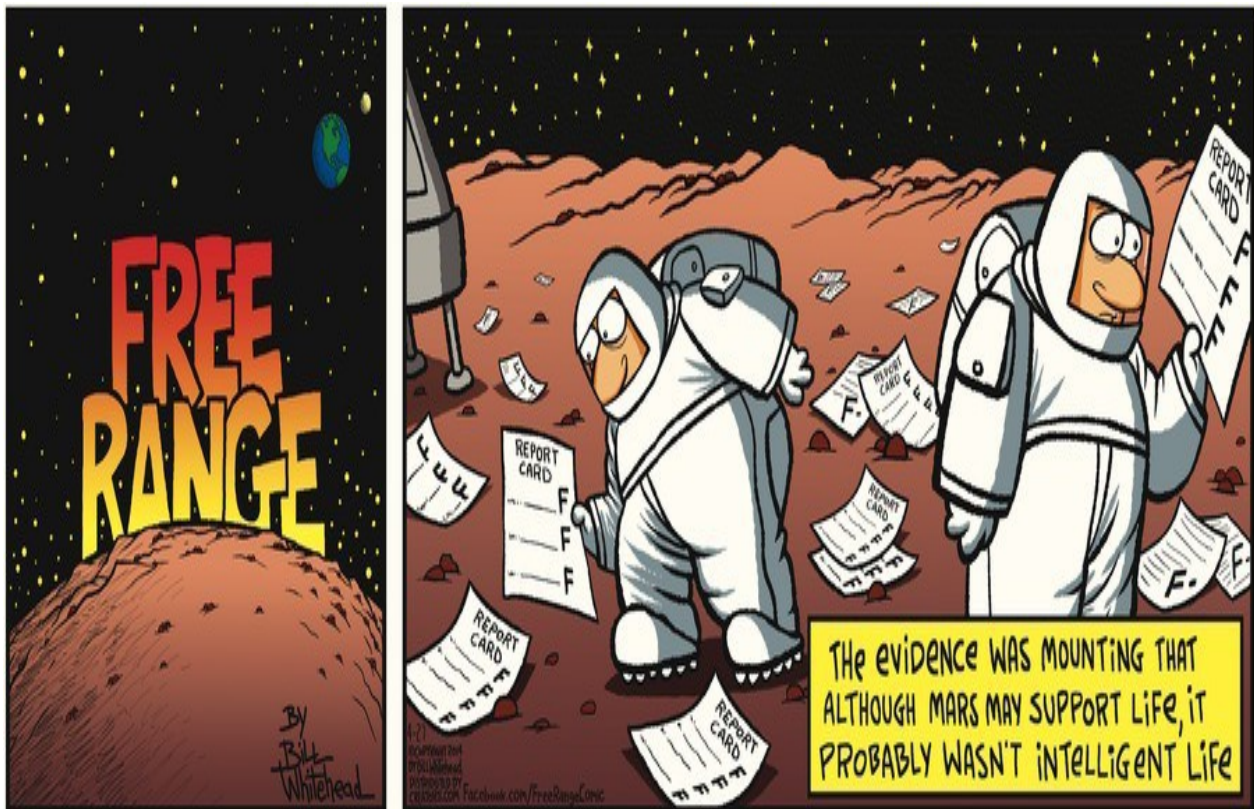
all start at 7:30pm

6 June: "The Chandra X-Ray Observatory"

All other Fridays TBA.

CALL FOR VOLUNTEERS

***Saturday, 7 June from 6pm to 10pm. *Two volunteers in addition to regular BRAS compliment.* Evening Sky Viewing Plus. Marshmallow roast, demonstration tables; small telescope; setup and takedown. Easy; training provided.**



GLOBE At Night

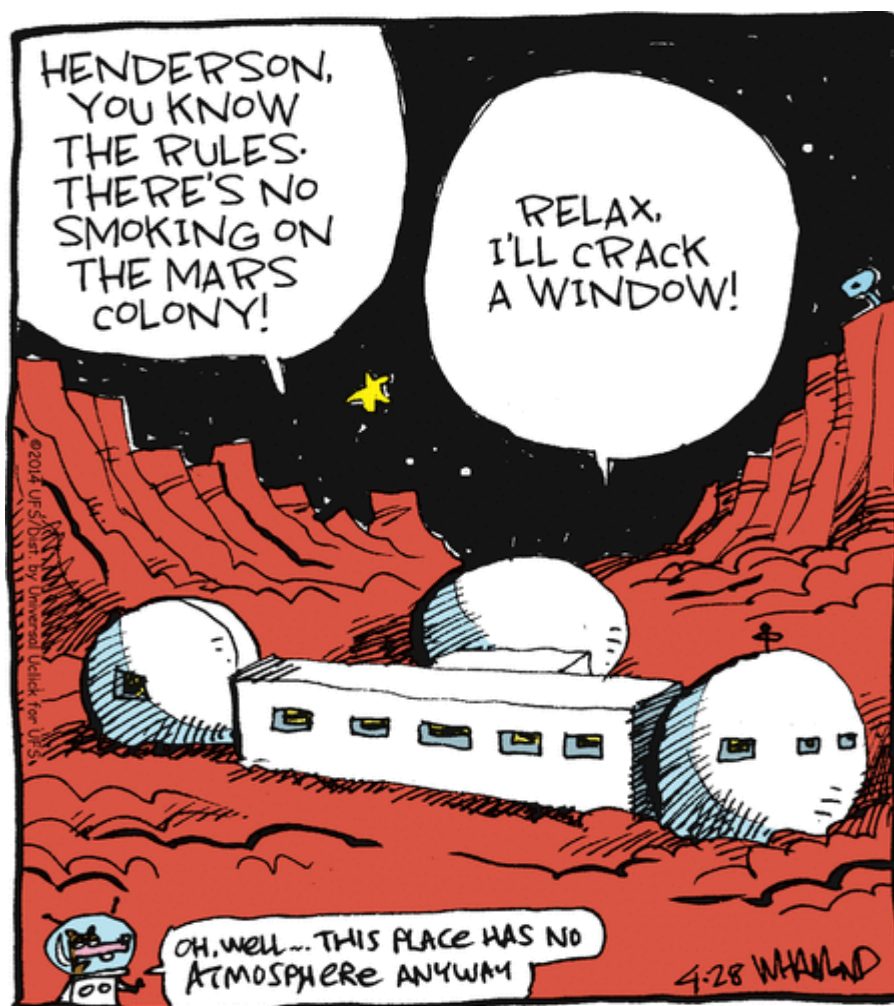
17 June to 26 June

Everyone's favorite winter light pollution exercise is back...except it's no longer just for winter. During 2014 the GLOBE at Night staff will collect observations during *all twelve* New Moon periods!

This is an excellent time to start compiling a good historical record of sky glow in Baton Rouge. Each BRAS member should take at least one measurement per season during 2014. The GLOBE at Night website makes it as easy as possible, with step-by-step instructions and an downloadable instruction manual.

In June participants use the constellation Hercules.

The heading on this page hyperlinks to the BRAS Forum thread devoted to GLOBE at Night. Visit there regularly for updates and answered questions.



East Baton Rouge Parish Library

Children's Reading Program

The theme for this year's reading program is "Fizz, Boom, Read!" and as usual the Baton Rouge Astronomical Society will present a physical science demo session at each of the system's branches during the reading program. The sessions are for ages six to eleven. If weather permits, solar viewing will be part of the session. And since GLOBE at Night is now year-round, for the first time session participants and their families will learn about this special citizen science exercise.

Below is the schedule, which is subject to change. All sessions start at 2:30pm.

Wed 28 May, Eden Park Community Library [231-3260]
Thu 29 May, Central Community Library [262-2660]
Wed 4 Jun, Zachary Community Library [658-1860]
Mon 9 Jun, Main Library [231-3760]
Tue 10 Jun, Pride-Chaneyville Community Library [658-1560]
Wed 11 Jun, Carver Community Library [389-7460]
Thu 12 Jun, Jones Creek Regional Library [756-1160]
Wed 18 Jun, Baker Community Library [778-5960]
Wed 2 Jul, Delmont Gardens Community Library [354-7060]
Wed 9 Jul, Scotlandville Community Library [354-7560]
Mon 14 Jul, Fairwood Community Library [924-9386]
Tue 15 Jul, River Center Community Library [389-4959]
Wed 16 Jul, Greenwell Springs Regional Library [274-4460]
Thu 17 Jul, Bluebonnet Library Regional Library [763-2260]

Registration is required for these sessions; parents should contact the branch directly to register. Also, keep in mind there are summer reading programs in the YA and adults sections as well.

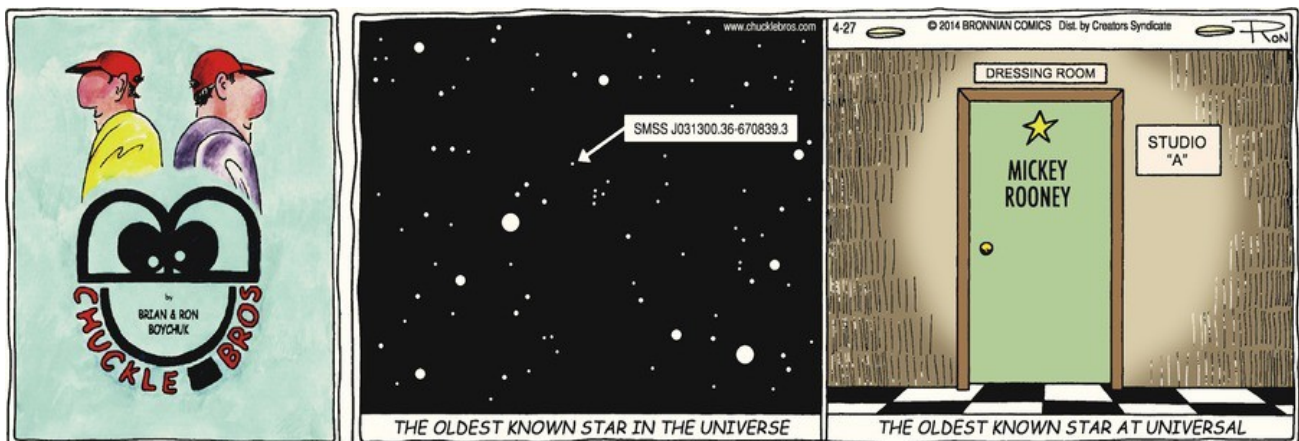
Recent Entries in the Forum

Below are selected recent additions to the BRAS Forum. There are also [nine active polls](#).

[Despite Rain, International Astronomy Day a Success](#)
[Innovative Light Bulb Direct Descendant of American Space Program](#)
[Inquiry Concerning Dean Lee Forest](#)
[Fun with the 10" Orion Skyquest](#)
[Another Jupiter Image from Ben Toman](#)
[Good 9 April Shot of Lunar Crater Copernicus](#)
[Nice Shot of Maria Frigoris and Imbrium](#)
[Time Magazine Collaborates with Astronomical League](#)
[31 May the Deadline for Imagine Your Parks 2 Input](#)
[About the Geggenschein](#)
[Cassini Swoops Close to Titan for 101st Time](#)
[First Earth-Sized Planet in Habitable Zone of Another Star](#)
[One More Week to See the \(Shrinking\) Great Red Spot](#)
[Ham Operator in India Hears ULL's CAPE Experiment Repeater](#)
[Though Dimming, Mars is Still a Nice Target](#)
[Total Lunar Eclipse Eclipsed in Baton Rouge](#)
[Camelopardalids Weak but Present](#)
[2007 VK184 No Longer Considered Risk to Earth](#)
[28 May Sees Close Pass of 2014 KF22](#)
[Comet 209/P LINEAR Visits Earth This Week](#)

Baton Rouge Culmination Times Posted for [Canopus](#), [Ptolemy's Cluster](#), the [Seagull Nebula](#), the [Elephant Trunk Nebula](#) and [M87](#)

****Note-** Clicking on any of the topics above will open a separate window and take you to the respective area of the BRAS Forum. We encourage you to log in and participate in the discussions!



Observing Report

URSA MINOR – THE LITTLE BEAR

Position: RA 15 Hours, Dec. +75

Named Stars:

Polaris (Alpha UMi), mag. 1.97, 02 31 47.08 +89 15 50.9, is less than 1° distant from true North Pole. This is a multiple star system- Alpha UMi A is a yellow supergiant Cepheid variable star. Alpha UMi B (or Polaris B) is a main sequence star and Alpha UMi Ab is a dwarf star in close orbit. There are two more distant stars, Alpha UMi C and Alpha UMi D.

Kochab (Beta UMi), “al-kawkab al-samaliyy”, “Heavenly Body”, “The North Star”, mag. 2.07, 14 50 42.40 +74 09 19.7, is an orange giant star. Kochab and Pherkad (Gamma UMi) are sometimes called “The Guardians of the Pole” because they appear to be rotating around Polaris. About 3,000 years ago, Kochab was the closest bright star to the true pole.

Pherkad (Gamma UMi), “ahfta al farka dayn”, “The Dim One of the Two Calves”, mag. 3.00, 15 20 43.75 +71 50 02.3, is an intermediate luminosity supergiant that rotates very fast, at an estimated speed of 180 km/sec., and it is also a shell star.

Yil dun (Delta UMi), “yildiz”- this is the Turkish word for star, mag. 4.35, 17 32 12.980 +86 35 10.8, is a white main sequence dwarf star.

Urodelus (Epsilon UMi), “The Conspicuous Tail”, mag. 4.21, 16 45 58.16 [+82 02 14.1](#), a triple star system, consisting of Epsilon UMi A- a yellow giant classified as an eclipsing spectroscopic binary star, and another component Epsilon UMi B – an eleventh magnitude star orbiting the primary binary system at a distance of 77 arc seconds.

Akhfa al Farkadain (Zeta UMi), “The Dimmer of Two Calves”, mag. 4.29, 15 44 03.46 +77 47 40.2, is a white main sequence dwarf star on its way to become a giant star, and is suspected to be a Delta Scuti variable star.

Anwar al Farkadain (Eta UMi), “The Brighter of the Two Calves”, mag. 4.95, 16 17 30.50 +75 45 16.9, is a yellow white main sequence dwarf star.

Pherkad Minor (11 UMi), mag. 5.02, 15 17 05.88 +71 49 26.0, this star has one planet in its system.

Deep Sky:

There are no Messier Objects in this constellation.

NGC 6217, mag. 11.2, 16 32.7 +78 12, 3.3'x3.2' in size, is a bright and quite large galaxy, with the inner arms curved more than the outer arms, and has a small, very bright nucleus.

NGC 6068, mag. 12.8, 15 55.4 +79 00, 1.2'x0.8' in size, is a very faint, very small, and slightly elongated galaxy.

NGC 3172, called Polaris Borealis, mag. 13.6, 0.5' in diameter, and is 0.9° from the

North Celestial Pole.

The **URSA MINOR DWARF Galaxy** is a dwarf elliptical galaxy composed mostly of older stars and is a satellite galaxy to our own Milky Way Galaxy. It has an apparent magnitude of 11.9, 15 09 25 +67 09 31, 11.56'x7.14' in size, located 4.7° south-southwest of Gamma UMi. Also known as PGC 54074, and UGC 9749.

Other Stars:

HD 120084, mag. 5.91, 13 42 39.38 +78 03 51.6, it has one planet in its system.

HD 150706, mag. 7.03, 16 31 17.59 +79 47 23.2, it has an unconfirmed planet in its system.

Calvera, 14 12 56.0 +79 22 04, it is a neutron star.

Asterism – The Little Dipper, formed by the seven brightest stars in Ursa Minor – Polaris (Alpha UMi), Yildun (Delta UMi), Urodelus (Epsilon UMi), Anwar al Farkadain (Eta UMi), Akhf al Farkadain (Zeta UMi), Pherkad (Gamma UMi), and Kochab (Beta UMi).

Polaris, the North Star, is at the end of the dipper's handle. The four stars constituting the "bowl" of the little dipper are unusual in that they are of second, third, fourth, and fifth magnitudes – Eta, Zeta, Gamma, and Beta UMi.

There is only one meteor shower associated with Ursa Minor – the Ursid Meteor Shower peaking between Dec. 18th and Dec. 25th. Its parent body is comet 8P/Tuttle.

The Legend

Ursa Minor – The Little Bear

The Little Bear was said by the Greeks to have been first named by the astronomer Thales of Miletus, who lived from about 625 BC to 545 BC. The earliest reference to it seems to have been made by the poet Callimachus of the third century BC, who reported that Thales 'measured out the little stars of the Wain, by which the Phoenicians sail'. Certainly Homer, two centuries before Thales, wrote only of the Great Bear, never mentioning its smaller counterpart.

However, it is not clear whether Thales actually invented the constellation or merely introduced it to the Greeks, for Thales was reputedly descended from a Phoenician family and, as Callimachus said, the Phoenicians navigated by reference to Ursa Minor rather than Ursa Major. Aratus points out that although the Little Bear is smaller and fainter than the Great Bear, it lies closer to the pole and hence provides a better guide to True North. We have the word of Eratosthenes that the Greeks also knew Ursa Minor as the "Phoenician".

According to Aratus, the Little Bear represents one of the two Nymphs who nursed the infant Zeus in the cave Dicte on Crete. Apollodorus tells us that the nurse's names were

Adrasteia and Ida. Ursa Minor commemorates Ida while Adrasteia, the senior of the two, is Ursa Major (see April's constellation – Ursa Major – for more of this tale). Ursa Minor, the Little Bear, also represents Arcas, the son of the Great Mother Bear. Arcas was the son of Zeus and Callisto (Ursa Major) in some tales – see April's constellation.

Sky Happenings

June 1st – Asteroid Vesta is stationary at 2:00 AM CDT. The Moon passes 6° south of Jupiter at 3:00 AM CDT.

June 2nd – The Moon is at apogee (251,627 miles from Earth) at 11:25 PM CDT.

June 3rd – There will be a triple shadow transit on Jupiter in daylight – 1:08 PM CDT to 2:44 PM CDT.

June 5th – First Quarter Moon occurs at 3:39 PM CDT.

June 7th – Mercury is stationary at 5:00 AM CDT. Asteroid Ceres is stationary at 5:00 PM CDT. The Moon passes 1.6° south of Mars at 8:00 PM CDT with Spica on their left.

June 8th – A waxing gibbous Moon is 2° below Mars in the evening and 2° from Spica.

June 9th – The Moon shines to the right of Saturn.

June 10th – Neptune is stationary at 1:00 AM CDT. The Moon passes 0.6° south of Saturn at 2:00 PM CDT.

June 13th – Full Moon occurs at 11:11 AM CDT.

June 14th – The Moon is at perigee (224,997 miles from Earth) at 10:29 PM CDT.

June 18th – The Moon passes 5° north of Neptune at 5:00 AM CDT.

June 19th – The Last Quarter Moon occurs at 1:39 PM CDT. Mercury is in inferior conjunction at 6:00 PM CDT.

June 20th – The Moon passes 1.6° north of Uranus at 10:00 PM CDT.

June 21st – Jupiter passes 6° south of Pollux at 7:00 AM CDT. Summer Solstice occurs at 5:57 AM CDT – summer begins.

June 24th – Asteroid Amphinrite is at opposition at 4:00 AM CDT. Dawn – The waning crescent Moon forms a spectacular close pair with Venus, with the Pleiades to their upper left. The Moon will pass 1.3° south of Venus at 8:00 AM CDT.

June 25th – A very thin crescent Moon shines to the left of Alderbaran very low in the east-northeast shortly before sunrise, with Venus and the Pleiades above them.

June 27th – A New Moon occurs at 3:08 PM CDT.

June 28th – The Moon passes 5° south of Jupiter at 10:00 PM CDT.

June 29th – Dusk – Jupiter shines well to the right of the waxing crescent Moon very low in the west-northwest shortly after sunset.

June 30th – The Moon is at apogee (252,233 miles from Earth) at 2:10 PM CDT.

Best Time to View Planets:

Evening

Mercury (Northwest)
Mars (Southwest)
Jupiter (West)
Saturn (South)

Midnight

Mars (Southwest)
Saturn (Southwest)

Morning

Venus (East)
Uranus (East)
Neptune (Southeast)

Mercury – At the start of June, Mercury (mag. 1.2) is visible low in the west-northwest about 45 minutes after sunset, and sets about 90 minutes after the Sun. Mercury will pass through an inferior conjunction with the Sun on June 19th.

Venus – Look east as dawn brightens – a relatively faint Venus, magnitude of -3.9, and a disk of less than 14" wide, will be very low on the horizon.

Mars – As twilight deepens at the beginning of June, Mars glows with a magnitude of -0.5 due to the due south. By June 30th, Mars fades to 0.0 magnitude, matching Arcturus and Vega. During June, Mars moves increasingly rapidly eastward through Virgo, heading almost directly toward Spica, which it will pass on July 4th. Mars apparent size shrinks from 11.8" to 9.5" during the month, and the disk shows a distinct phase. As darkness falls in North America on June 1st, Sinus Sabaeus appears as a dark linear feature near the center of the Martian disk while the broader Sinus Meridiani lies to its east. Syrtis Major – the planet's most prominent dark feature – sits on the western limb and quickly rotates out of view. Each evening, Syrtis Major slides closer and closer to the disk's center, reaching it on June 7th. As darkness falls on June 14th, the dusky Mare Cimmerium appears south of the disk's heart with the bright Elysium Plains to the north. At the end of June, the massive volcano Olympus Mons is about to rise at the eastern terminator - you probably won't be able to see it – it will take an exceptionally clear and steady sky and a 16 inch instrument or larger to see it.

Jupiter – Jupiter sets almost 3 hours after the Sun on June 1st, but only about 1 hour after the Sun on June 30th. Jupiter shines at magnitude -1.8, and has an equatorial diameter of 32" – near their minimum for the year as Jupiter heads toward its conjunction with the Sun on July 24th. On June 1st, Jupiter appears about 10° northwest (to the right) of the waxing Moon, standing out in the twilight within a half-hour of sunset, with first magnitude Pollux significantly harder to see at about one binocular field to the planet's upper right. On June 3rd, Europa, Ganymede, and Callisto simultaneously cast their shadows on the Jovian cloud tops in a rare triple transit (last one in Oct. 2013, next in Jan. 2015 – the next after that won't happen until 2032). Callisto's shadow starts the show when it touches Jupiter's disk at 15:22 UT (10:22 AM CDT). The shadow of Europa follows at 17:08 UT (12:08 PM CDT), and Ganymede's touches the Jovian disk at 18:08 UT (1:08 PM CDT). The three shadows move in

tandem across Jupiter's disk for 95 minutes until Callisto's lifts back into space at 19:43 UT (2:43 PM CDT). On June 21st, Jupiter passes 6 ½° south (lower left) of Pollux. By month's end, low in the twilight, Jupiter moves into an almost straight line with Castor and Pollux to its right.

Saturn – Saturn begins the night at or near it's highest in the south, glowing about midway in the huge gap between Spica and Antares, and continues to retrograde a little closer to the wide double star Alpha Librae (Zubenelgenubi). Saturn dims slightly during June, from magnitude +0.2 to +0.4, and its globe shrinks from 18.5" to 18.0", with the rings remaining at a tilt of 21°. Saturn's eighth magnitude moon Titan orbits the planet every 16 days – passing due north of Saturn on June 1st and 17th, and due south on June 9th and 25th. Three 10th magnitude moons, Tethys, Dione, and Rhea are within range of a 4 inch instrument, while a 6 inch instrument should capture 12th magnitude Enceladus. Distant Iapetus glows at 10th magnitude when it is far west of Saturn, but dims to 12th magnitude as it reaches greatest eastern elongation.

Uranus – Uranus rises at about 3:00 AM CDT and stands about 10° above the eastern horizon shortly before morning twilight begins, glowing at magnitude 5.9 with a distinctive blue-green color and a disk that span 3.5". Uranus appears against the background stars of Pisces the Fish, between 2° and 3° south-southwest of 4th magnitude Epsilon Piscium. Do not confuse Uranus with a pair of similarly bright stars (73 and 80 Psc) to its east.

Neptune – Neptune rises around 1:30 AM LDT in early June and 2 hours earlier by month's end. Neptune is at magnitude 7.9 in the starry backdrop of Aquarius the Water Bearer., about 2° northeast of 5th magnitude Sigma Aquarii, between two 7th magnitude stars. Neptune is blue-gray in color and has a 2.3" diameter disk.

Pluto – Pluto glows feebly at around magnitude 14.1 in Sagittarius. Pluto will be at opposition to the Sun on July 4th.

Moon – On June 1st, the Moon is a waxing crescent far to the left of Jupiter at dusk. The gibbous Moon is just to the lower left of Mars on the evening of June 7th and just to the left of Spica the next evening. A thicker Moon is well to the lower left of Saturn on the 10th. On June 24th, the waning crescent Moon is spectacularly close to Venus low in the eastern sky at dawn. On June 25th, the Moon is very thin and low at dawn, at the lower left of Alderbaran.

Asteroids 1Ceres and 4Vesta were at opposition less than two days apart back in April, when they shone at magnitudes 7.0 and 5.8. Since then, they have remained very close in the sky pursuing their retrograde loops near 3rd magnitude Zeta Virginis, well north of Spica (about 10° north). From June 29th through July 12th, Ceres and Vesta will be separated by less than 1/2° (23').

Comet PANSTARS (C/2012 K1), at 8th magnitude, is high in the evening sky among the background stars of Ursa Major. The comet appears 4' east of 3rd magnitude Mu

Ursa Majoris on June 1st, and closes the gap to 2° a few days later. C/2012 K1 appears out of round because it is building two tails. In mid June, the comet is crossing Leo Minor.

One meteor shower this month, the Bootid Shower, from June 22nd to July 2nd, and the peak is on June 23rd. Radiant is between Bootes and Ursa Minor, above the end of the Big Dipper's handle.

