

Newsletter of the Baton Rouge Astronomical Society



July, 2014

Next Meeting July 19th, 11:00AM at LIGO



The LIGO facility in Livingston Parish, LA

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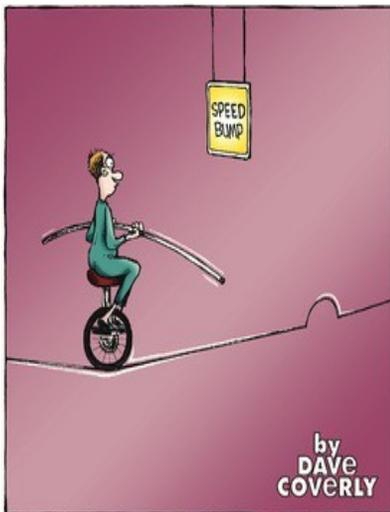
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President's Message

**WE WILL NOT MEET ON THE SECOND MONDAY NIGHT,
AS WE USUALLY DO.**

Our next meeting will be **Saturday, July 19, 2014, 11 AM – 4 PM at LIGO**, Livingston.

It will be a picnic/star-b-cue and enjoy each other's company. We will meet under the pavilion by the pond at 11 AM to begin the picnic. BRAS will provide the main course. You can bring a small dish if you wish.

At 1 PM, we can join the public for LIGO's regular Saturday Science day activities. That includes the museum, hands on experiments, a video about LIGO "Einstein's Messengers", and a tour of the facility.

One new thing we would like to do is set a table aside for anyone who has astronomical equipment they want to sell – telescopes, mounts, accessories, binoculars, cameras, books, etc. The idea is to have an impromptu garage sale (or swap meet). Bring what you have and let's see if we can move it.

LIGO is only open during the day, so the only stargazing we will be able to do will be solar. However, we will demonstrate the 35mm Lundt solar scope BRAS is raffling and sell tickets for the raffle. \$5 per ticket or 5 tickets for \$20. You don't need to be present to win. If you haven't bought tickets and can't make it to the LIGO event, call me at [225-342-7632](tel:225-342-7632), 7-4, M-F and I will make arrangements for you to get tickets.

William Katzman of LIGO expects a pretty big Scout group that day, so it may be more crowded than usual. It could also provide an opportunity for some outreach, letting the kids look at the Sun.

GOOD NEWS!!! THE BRIDGE AT THE BRAS DARK SKY SITE IN RAMAH HAS BEEN FIXED. THE SITE IS NOW OPEN AGAIN. YAAAAY!!

If you don't have a copy of the permission letter, let me know and I will get a copy to you. Remember, the site is open to BRAS members, not the public. It is on private property, so please be considerate and respectful.

Clear skies,
Merrill Hess
President

Secretary's Summary

- Merrill announced that the BRAS picnic lunch/meeting was on for July 19th from 11:00 a.m. to 1:00 p.m. at LIGO over in Livingston.
- BREC volunteers were reminded to fill out the volunteer log. It was mentioned that there is a \$500 tax credit on your taxes for 30 hours of volunteering per year (don't forget to include hours worked for International Astronomy Day). Official volunteers have been screened/background checked. Friday lectures count; ask to volunteer! Upcoming events include the Perseid meteor shower and the solar eclipse in October. Other volunteer work can be used for the outreach award from the Astronomical League.
- Chris Deselles was congratulated on getting one of his photos posted in the online edition of Astronomy magazine. This was a lunar shot showing lava flows and lunar maria. Chris D. mentioned that he already had the virtual 4th of July Star Party going on online through Astronomy.com.
- A newly discovered earth-sized planet that 17 times denser than we are and a quark nova in Cassiopeia A were mentioned as recent discoveries in the news for this past month.
- There is a raffle scheduled for this evening. The Lunt 35mm solar telescope is still being raffled as well as a 2013 Year in Space calendar, the book Astronomy for Dummies, and a red laser/ink pen combo.
- The lecture this month was on quasars; this was presented by Dr. Trevor McGuire. He will give a repeat of this lecture on Friday at 7:30 p.m. at the observatory.
- After the lecture someone asked about the status of the telescope that BRAS donated to the library. Evidently this is going along ok. Someone suggested that we might look into starting a "lend-an-astronomer" program as they do up north when someone needs to check with an expert.
- Chris mentioned about checking with Jennifer at Baton Rouge Gallery about a sketching class for those astronomers who might want to learn to sketch the night sky better. The class would be for 3 to 6 or 9 people and would run probably for one 4-hour session sometime around August to October.
- The meeting adjourned with a raffle.

Roslyn Readinger

BRAS Secretary

Not-So-Rare Earths

If the stars observed by NASA's *Kepler* spacecraft are statistically representative of those in our own solar neighborhood of the Milky Way galaxy, then "Earth-size planets are common around nearby Sun-like stars," conclude Erik A. Petigura and Geoffrey W. Marcy from the University of California, Berkeley and Andrew W. Howard from the University of Hawaii. They were led to that conclusion by a monumental statistical analysis of *Kepler* data completed with the help of the Carver supercomputer at the Department of Energy's (DOE's) National Energy Research Scientific Computing Center (NERSC).

Computing Earth's twin

NASA's *Kepler* spacecraft, launched into an Earth-trailing orbit in 2009, stared at some 156,000 stars in the constellation Cygnus, monitoring their brightness photometrically every 30 minutes for four years. It was searching for any minute decreases in brightness that might indicate one or more planets transiting (passing in front of) their host star as seen from Earth. (For comparison, if Earth transited the Sun as viewed another star system exactly in the plane of Earth's orbit, the Sun's light would be dimmed by 100 parts per million—a hundredth of a percent—for about 12 hours once every 365 days.) Although *Kepler* identified some 3,000 planet candidates of all sizes orbiting stars of all colors and luminosities—some quite close to their parent star—the three authors wanted to find just those about the size of Earth that might be in the "habitable zone" where surface water could remain liquid. Thus, they wanted to search through the *Kepler* data to find evidence specifically for "Earth-size planets orbiting far enough from Sun-like stars to receive a similar intensity of light energy as Earth," the authors explained.

First, they narrowed their search in the *Kepler* data to 42,557 stars of spectral classes G (yellow) and K (orange), with surface temperatures of 4,100 K to 6,100 K bracketing the Sun's 5,770 K, and masses ranging from 0.6 to 1.1 times the Sun's. Then, with the aid of custom-built software called TERRA, they further looked for evidence of Earth-size planets with orbital periods longer than 50 days. They also quantified the fraction of planets that might have been missed by their census, either because the planes of their orbits were tilted so the planets could not transit the host star as seen from Earth, or those that the TERRA software itself could have missed.

Shedding (the right amount of) light

The intensity of light energy bathing a planet depends on both the star's luminosity and its distance from the planet. So the three astronomers then secured spectra for all 62 host stars that hosted planets with orbital periods longer than 100 days to precisely determine their luminosity. They ultimately found that some 11 percent (plus or minus 4 percent) of Sun-like stars have a planet 1 to 2 times the size of Earth that receives 1 to 4 times as much sunlight as Earth.

They did not identify any Earth-like planet with TERRA with an orbital period of 200 to 400 days, but they attribute that primarily to the shortness of the *Kepler* survey before the loss of the spacecraft's stabilizing reaction wheel in May 2013, and the difficulty of observing such long-period planets.

However, extrapolation from *Kepler* data of star systems with shorter-period orbits strongly suggests that nearly 6 percent of Sun-like stars have an Earth-size planet in an Earth-like orbit of 200 to 400 days. "Naturally, such an extrapolation carries less weight than a direct measurement," the authors note in their paper published in *Proceedings of the National Academy of Sciences*, but it "seems unlikely to be unrealistic by more than a factor of 2."

Even planets with shorter orbital periods could also be in the habitable zone, the authors note, for example, around stars of very different spectral types, such as early M dwarfs (small, cool red stars). "Thus, Earth-size planets appear to be common in the HZs [habitable zones] of a range of stellar types," the authors observe.

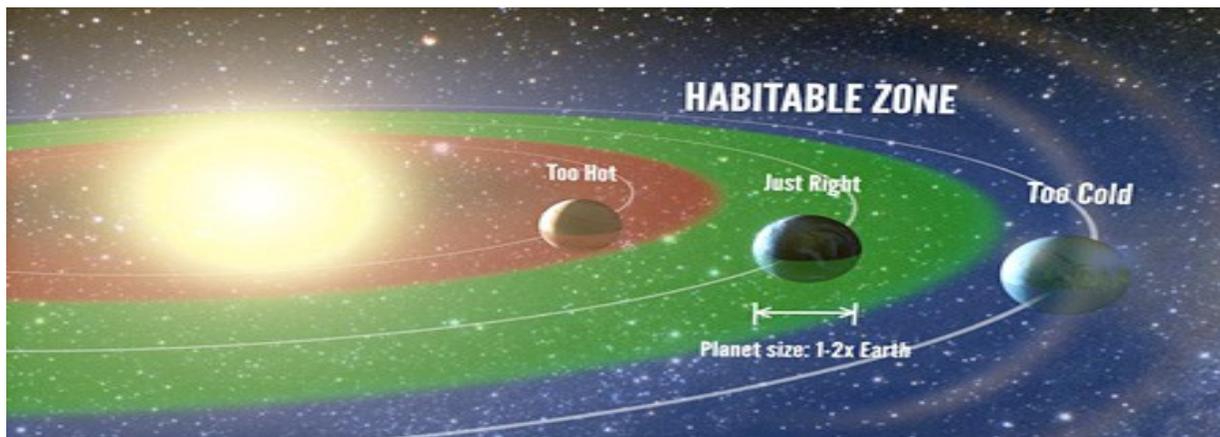
Upshot: The authors calculated that some 26 percent of more-or-less Sun-like stars have a planet 1 to 2 times the size of Earth, with an orbital period of 5 to 100 days. About 11 percent of Sun-like stars have

an Earth-size planet that receives 1 to 4 times Earth levels of stellar energy.

Kepler observed a portion of sky 120 times larger than the full Moon—equivalent to 1/400 of the celestial sphere. The statistics from the *Kepler* region led the authors to make a bold and exciting prediction: “If one were to adopt a 22% occurrence rate of Earth-size planets in habitable zones of Sun-like stars, then the nearest such planet is expected to orbit a star that is less than 12 light-years from Earth and can be seen by the unaided eye.” —*Trudy E. Bell, M.A.*

Further reading: The *PNAS* paper “Prevalence of Earth-size planets orbiting Sun-like stars” is at <http://www.pnas.org/content/110/48/19273.full> . For more details about the role of the NERSC supercomputer in the computations, see also the NERSC press release “Are Earths Rare? Perhaps Not” at <http://cs.lbl.gov/news-media/news/2014/are-earths-rare-perhaps-not/>.

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 Department of Energy laboratories (Lawrence Berkeley Laboratory, Lawrence Livermore Laboratory, and Los Alamos National Laboratory). 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>.



Artist’s representation of the “habitable zone,” the range of orbits where water can remain liquid on the surface of a planet. Credit: Erik A. Petigura, Andrew W. Howard, and Geoffrey W. Marcy; artwork by Illumina Studios, LLC



Field of view of the Kepler space telescope , located in the constellation Cygnus, just above the plane of the Milky Way Galaxy. Credit: NASA

Message from the HRPO

HRPO

FRIDAY NIGHT LECTURE SERIES

all start at 7:30pm

4 July: {HRPO closed}

11 July: “Wonders of the Summer Sky” (Amy Brouillette)

18 July: “Apollo 11 45th Anniversary” (Tom Northrop)

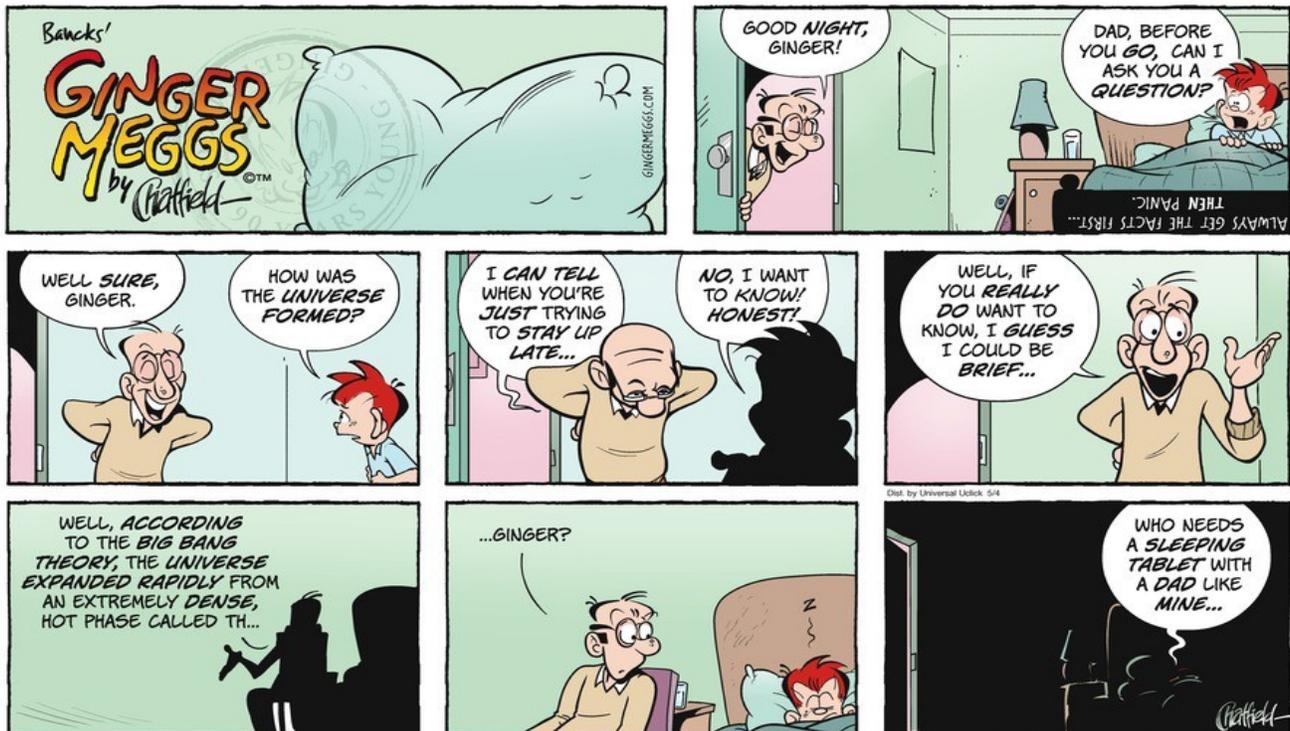
25 July: “Backyard Astronomy” (Trevor McGuire)

CALL FOR VOLUNTEERS

*Saturday, 12 July 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.

*Saturday, 19 July from 7:30pm to 10:30pm. *One volunteer. Apollo 11 Anniversary Party.* Demonstration tables; displays; small telescope. Easy.

*Saturday, 26 July from 12pm to 2pm. *One volunteer. Solar Viewing.* Small telescope. Easy; training provided.



GLOBE At Night

16 July to 25 July

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 July 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 eight 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 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](#).

[Innovative Athletic Shoe Direct Descendant of American Space Program](#)
[Time Magazine/Astronomical League Gallery Now Online](#)
[13 June Honey Moon Shot from Tom Northrop](#)
[Cassini Swoops Close to Titan for 102nd Time](#)
[Earthlings Saw Saturn-Moon-Spica-Mars Lineup on 9/10 June](#)
[Moon and Mars Fewer Than Two Degrees Apart on 5 July](#)
[Sunspot, Flare, Filament and Prominence](#)
[Ceres and Vesta Extremely Close from 29 June to 12 July](#)
[Concerning Protostar L1527](#)

[Baton Rouge Culmination Times Posted for U Scorpii, The Pleiades, the NGC 1333, the Elephant Trunk Nebula and M87](#)



HERACLES

Position: RA 17 Hours, Dec. +30

Named Stars:

Ras Algethi (Alpha Her), “The Head of the Kneeling One”, mag. 3.31, 17 14 38.86 +14 23 24.9, is a multi star system. Alpha Her 1 is a red supergiant irregular variable star whose magnitude can vary from 3 to 4 in a period of 100 days. Alpha Her 2, mag. 5.39, 17

14 31.20 +14 23 24.0, is a binary star system having a yellow giant and a yellow-white dwarf star, an orbital period of 51.59 days, and it’s common name means “the kneeler’s head”. Separation between Alpha Her 1 and 2 is 4.7 arc seconds.

Kornephoros (Beta Her), “The Club Bearer”, mag. 2.78, 16 30 13.26 +21 29 22.7, is a yellow giant star and a suspected variable star and binary star with an orbital period of 410 days.

Sarin (Delta Her), mag. 3.12, 17 15 01.92 +24 50 22.5, is a double star. The primary is a blue-white star of mag. 3.1, and the optical companion is mag. 8.2. Separation between the two stars is 25.8”.

Cujam (Epsilon Her), mag. 3.92, 17 00 17.41 +30 55 34.8, is a spectroscopic binary with a separation so small that they almost touch each other. Epsilon Her is the southeast corner of the “keystone” asterism.

Sophian (Eta Her), “Pure”, mag. 3.48, 16 42 53.74 +38 55 20.9, is a double star, and is about 1 billion years old. Eta Her is the northwestern corner of the “keystone” asterism. The companion to Eta Her, at mag. 12.5, is believed to be merely in the same line of sight. M 13 is about 2.5° toward the south.

Rukbalgethi Genubi (Theta Her), “The Left Knee of the Kneeling Man”, mag.3.86, 11 56 15.18 +37 15 01.9, is a bright giant star, and an irregular variable that varies from magnitude 3.7 to 4.1 over a period of 8 to 9 days.

Marfic (Kappa Her), “The Elbow”, mag. 5.00, 16 08 04.55 +17 02 49.2, is a double star. Kappa Her A is a yellow giant star at mag. 5.1, separated from Kappa Her B, an orange giant star at mag. 6.2, by 27 arc seconds. There is some doubt about it being a double star – it may just be a chance alignment.

Maasym (Lambda Her), mag. 4.41, 17 30 44.30 +26 06 38.2 by 286 AU.

Marfic al Jathih al Aisr (Mu Her), “The Left Elbow of the Kneeler”, mag. 3.42, 17 46 27.72 +27 43 21.0, is a double star. The secondary component is a binary star with a period of 43.2 years, separated from the primary star by 286 AU. The secondary stars, faint

red dwarfs, have magnitudes of 10.35 and 10.80 and are separated by 1.36”.

Fekhiz al Jathihal Asir (Omicron Her), also called “Atia”, mag. 3.84, 18 07 32.55 +28 45

44.9, is classified as an eruptive variable – a fast rotator resulting in an outflow of mass.

Fudail (Pi Her), “Excellent in Character”, mag. 3.16, 17 15 02.05 +36 48 33.0, is an orange giant star classified as a variable star with an unconfirmed sub-stellar companion. Pi Her is the northeast corner of the “keystone” asterism.

Rukbalgethi Shemali (Tau Her), “The Northern Knee”, mag. 3.91, 16 19 44.45 +46 18 47.8, is a blue sub-giant star. Tau Her was the north pole star around the year 7400 BC, and will be the closest bright star to the pole once again in 18,400 AD.

Kajam (Omega Her), “The Club”, mag. 4.57, 16 25 24.93 +14 02 00.3, this star has been previously designated as 51 Serpentis.

Deep Sky

M 13 (NGC 6205), “The Great Globular Cluster” or “The Hercules Cluster”, part of Abell 2151, mag. 5.9, 16 41.7 +36 28, 20’ in size, is an extremely bright, very large, round and rich cluster located 2.5° south of Eta Her.. Three dark rifts radiate outward from

near the center, like a dark “propeller”. This cluster contains 500,000 stars and extends 150 LY. NGC 6207 is 0.5° to the northeast.

M 92 (NGC 6341), mag. 6.5, 17 17.1 +43 08, 14’ in size, has a high concentration of stars, large and very bright, and extends for 110 LY.

NGC 6210, PK 43+37.1, mag. 8.8, 16 44.5 +23 49, 20” x 16” in size, is a planetary nebula that is very bright, very small, and has a smooth disk. The nebula is involved in a larger, fainter disk, with traces of a ring structure – center star at mag. 12.2.

NGC 6229, mag. 9.4, 16 47.0 +47 32, 4.2’ in size with a high concentration of stars, and is very bright, very large, and roundish, and is located 1.5° north of 52 Her (mag. 4.8).

There are 22 more objects, all fainter than mag. 10.0 – see me if you want the info.

Other Stars:

Gamma Her., mag. 3.74, 16 21 55.04 +19 09 10.9, is a spectroscopic binary. Primary is a giant star with a dead helium core waiting to become a red giant and is a rapid rotator. Gamma Her is a semi-regular pulsating variable star with a period of 183.6 days.

Zeta Her., mag. 2.81, 16 41 17.48 +31 36 06.8, is a multiple star – the brightest of the “keystone” asterism. Primary is a yellow tinged sub-giant with an orange companion star (mag. 5.7) at a separation of 1.5 arc seconds (12 AU) and a period of 34.45 years.

Iota Her., mag. 3.82, 17 39 22.89 +46 00 22.8, is a sub-giant in a multiple star system. There is a spectroscopic binary with a period of 113.8 days, which has two companion stars, one with an orbital period of 60 years, the other lying further away with a period of about 1 million years.

14 Her., mag. 6.61, 16 10 24.21 +43 49 06.1, is an orange dwarf star with two planets confirmed in 2006. 14 Her. b has a 4.9 year period with an orbital separation of 2.8 AU.

68 Her., mag. 4.80, 17 17 19.57 +33 06 00.4, is a Beta Lyrae type eclipsing binary with a period of 2 days, and is also a rapid revolver. Separation between the two stars (both have diameters of 5 million miles), center-to-center, is 6 million miles.

95 Her., mag. 4.96, 18 01 30.40 +21 345 44.0, is a binary star. There is a separation of 6.3 arc seconds, and the secondary star has a magnitude of 5.8. Colors are yellow and blue, or gold and silver.

89 Her., mag. 5.47, 17 55 25.19 +26 02 59.9, is a rare yellow super-giant star.

DQ Her., or “Nova Herculis” 1934, mag. 15.2, 18 07 30 +45 51 33, was an extremely bright, slow nova that reached mag. 1.3 in Dec. of 1934 and remained at this magnitude for almost 2 months. It is the prototype for a category of cataclysmic variable stars known as intermediate polars.

HD 154345 (Gliese 651), mag. 7.5, 17 02 36.40 +47 04 54.8, is a dwarf star with one planet with a period of 9.095 years and an orbit of 4.18 AU.

HD 155358, mag. 7.5, 17 09 34.62 +33 21 21.1, is a yellow dwarf star. This star is one of the lowest metallicity stars known with a confirmed planet in its orbit. Two planets are orbiting and are gravitationally interacting.

HD 147506, mag. 8.71, 16 20 36.36 +41 02 53.1, is a dwarf star and it has the most massive transiting extra-solar planet known in its orbit – 9 times the size of Jupiter – the planet HAT-P-2b orbits the star every 5.6 days.

Gliese 623, mag. 10.27, 16 24 09.32 +48 21 10.05, is a binary star – two red dwarfs orbiting each other at 1.9 AU.

Gliese 649, mag. 9.62, 16 58 08.85 +25 44 39.0, is a red dwarf star. A planet with the mass of Saturn has been confirmed with a period of 598.3 days.

Gliese 661 is a double star – two red dwarfs with magnitudes of 10.029 and 10.25.

HD 164922, mag. 5.31, 18 02 30.86 +26 18 46.8, has one Saturn like planet at 2.11 AU.

HD 158038 has one planet in orbit around it.

HD 149026, mag. 8.15, 16 30 29.62 +38 20 50.3, has a transiting hot Jupiter planet.

HD 156668, mag. 8.42, 17 17 40.49 +29 13 38.0, has one planet – the second lightest planet discovered by radial velocity.

HD 146389, mag. 9.42, 16 15 50 +10 01 57, has one transiting planet.

HAT-P-14, mag. 9.98, 17 20 27.87 +38 14 31.9, has one transiting planet.

GSC 02620-00648, mag. 11.59, 17 53 13.06 +37 12 42.4, is a binary with one planet, TrES4, transiting.

WASP-103, mag. 12.0, 16 37 16.0 + 07 11 00, has one transiting planet.

GSC 03089-00929, mag. 12.40, 17 52 07.02 +37 32 46.2, has one transiting planet, TrES-3, with a 31 hour orbit that is decaying.

HAT-P-18, mag.12.76, 17 05 24 +33 00 45, has a transiting planet.

Hercules A – Is an active galaxy in the Hercules constellation. It appears to be a regular elliptical galaxy, but when imaged in radio waves, there are plasma jets spanning over one million light years. The galaxy at the center, 3C348, has a black hole at its center that is almost 1000 times more massive than the one in our own Milky Way.

Asterism- The “Keystone” asterism is formed by four bright stars in Hercules – Pi, Eta, Zeta, and Epsilon Herculis – and it represents Hercules torso.

Meteor shower – There is only one shower associated – the Tau Herculids which peak on or near June 3rd. Radiant is near the Hercules/Corona Borealis border. Meteors are quite faint and at maximum, expect to see no more than 15 per hour average.

Sky Happenings during July

July 1st-Mercury is stationary at 9:00 AM CDT.

July 2nd- Venus passes 4° north of Alderbaran at 5:00 AM CDT.

July 3rd- Earth is at aphelion (94.5 million miles from the Sun) at 7:00 PM CDT – the farthest it will be for this year.

July 4th- Pluto reaches opposition and peak visibility this morning when it glows at mag. 14.1 among the background stars of northern Sagittarius.

July 4th/5th- Ceres and Vista appear just 10' apart in the sky. See Asteroids at the end of Sky Happenings for more on this.

July 5th- First Quarter Moon occurs at 6:59 AM CDT. The Moon passes 0.2° north of Mars at 8:00 PM CDT. The Moon will occult Mars during daylight in Hawaii, and at dusk or at night in parts of Latin America.

July 6th- Asteroid Vesta passes 0.2° south of asteroid Ceres at 4:00 AM CDT.

July 7th- A waxing gibbous Moon passes 0.4° south of Saturn at 9:00 PM CDT. The Moon occults Saturn for the southern part of South America.

July 12th-24th – At dawn, Mercury shines 6° to 8° to the lower left of Venus.

July 12th- A full Moon occurs at 6:25 AM CDT. Mercury is at its greatest western elongation (21°) at 1:00 PM CDT. Mars passes 1.4° north of Spica at 6:00 PM CDT.

July 13th- The Moon is at perigee (222,612 miles from Earth) at 3:26 AM CDT.

July 15th- The Moon passes 5° north of Neptune at 12:00 noon CDT.

July 18th- The Moon passes 1.4° north of Uranus at 5:00 AM CDT. The Last Quarter Moon occurs at 9:08 PM CDT.

July 21st- Saturn is stationary at 10:00 AM CDT.

July 22nd- Dawn – the waning crescent Moon appears very close to Alderbaran (for North America). Uranus is stationary at 4:00 AM CDT.

July 24th- Dawn – the crescent Moon floats about 5° to the right of Venus. Look for Mercury to the lower left. The Moon passes 4° south of Venus at 1:00 PM CDT. Jupiter is in conjunction with the Sun at 4:00 PM CDT.

July 25th- Dawn – A very thin crescent Moon may be visible almost directly below Venus and the lower right of Mercury starting 45 minutes before sunrise.

July 26th- New Moon occurs at 5:42 PM CDT.

July 27th- The Moon is at apogee (252,629 miles from Earth) at 10:28 PM CDT.

July 28th- Night – The modest, long lasting Delta Aquarid meteor shower peaks around this date. It's best at southerly latitudes.

July 29th- Mercury passes 6° south of Pollux at 12:00 midnight CDT.

Mercury – Mercury puts in a good appearance to Venus's lower left for much of July. Mercury is too faint to find early in the month, but it brightens rapidly and soon moves higher in the morning twilight. Mercury reaches its greatest western elongation on July 12th, when it lies 21° west of the Sun and stands 7° high in the east-northeast 45 minute before sunrise, but at a magnitude of +0.4 and less than half lit. On July 15th, Mercury will have a nearly half-lit disk that spans 7.5". On July 16th, Mercury will appear the closest in the sky to Venus – just over 6° away. Mercury appears noticeably lower late in the month, but continues to brighten up to magnitude -1.4 at month's end.

Venus – Venus rises in the east-northeast right around the start of astronomical twilight throughout July. From June 29th through July 3rd, Venus is less than 5° above or to the upper left of Alderbaran. During July, Venus will dim to mag. -3.8, with its diameter shrinking slightly from 12" to 11", and its phase grows from 85% to 92% lit. The planet resides in Taurus the Bull in early July, racing eastward all month, crossing the northern tip of Orion the Hunter on the 17th and 18th and traversing half of Gemini the Twins by the 31st. Even by sunrise, Venus is less than 20° high, with its altitude beginning to decline next month.

Mars – Mars appears in the southwest as darkness falls all month. On July 1st, it stands 5.5° northwest of Spica (mag. 1.0), the brightest star in Virgo the Maiden. The planet

shines at mag. 0.0, a full magnitude brighter (equivalent to a factor of 2.5) than Spica. Mars orange glow contrasts nicely with Spica's blue-white hue. During early July, Mars and Spica continue to move closer to each other. On the 5th, a First Quarter Moon jumps between the pair. Across North and South America, the Moon appears within 1° of Mars. Observers in Central America and the northern half of South America will see the Moon occult Mars. On July 12th, Mars has its third and final conjunction of the year with Spica, with Mars passing just 1.3° to Spica's north-northeast. By month's end, Mars has pulled 9° east of Spica. Mars shrinks from 9.5" to 7.9" in angular equatorial diameter this month. Mars starts setting before midnight (daylight-savings time) around mid-month.

Jupiter – Jupiter hangs 5° above the west-northwestern horizon 30 minutes after sunset, and sets about an hour after the Sun, in the beginning of July, appearing 1/2° lower each evening, becoming lost to view early in the month. Jupiter reaches conjunction with the Sun on July 24th.

Saturn – Saturn lingers in western Libra near the wide double star Alpha Librae (Zubenelgenubi) this month, dimming from +0.4 to +0.55. The rings are at this year's minimum tilt of 21°, and the planet's disk measures 18" across the equator. You can find Saturn about 30° high in the southwest as twilight fades this month. On July 21st, Saturn halts retrograde motion and resumes direct (eastward) motion. But much faster Mars, though still in Virgo the Maiden, continues to close the gap between itself and Saturn: from 28° to 14° separation in July. Mars will catch up to Saturn on August 25th.

Uranus – Uranus is in Pisces the Fish, and transits the sky's meridian around sunrise or later. The best time to view Uranus is at dawn's first gleaming, with Uranus appearing roughly halfway from the southeastern horizon to the zenith. Look for it some 2° south of 4th magnitude Epsilon Piscium. Uranus shines at mag. 5.8, with a disk of 3.5" across, and has a distinct blue-green color.

Neptune – As midnight approaches, Neptune pokes above the eastern horizon. At mag. 7.8, Neptune lies in central Aquarius the Water Bearer. It climbs 40° high in the south by 4:00 AM LDT. To find Neptune, draw an imaginary line between the 4th magnitude stars Tau and Theta Aquarii, Neptune lies to the left of this line's midpoint. As July begins, Neptune stands 1.9° northeast of 5th magnitude Sigma Aquarii, with the gap dwindling to 1.4° at month's end. The ice giant has a 2.3" diameter disk and a blue-grey hue.

Pluto – Pluto glows at mag. 14.1 among the background stars of northern Sagittarius, reaching opposition on July 4th, thereby being highest in the south in the middle of the night. To find Pluto, first find 2nd magnitude Sigma Sagittarii (Nunki), the star marking the northeast corner of the handle in Sagittarius's Teapot Asterism. Next locate 29 Sgr, a 5.2 magnitude star that lies 6° north and a bit west of Nunki. Pluto remains

within 0.5° ($30''$) of this orange sun throughout July. A fainter star, the 7th magnitude variable star BB Sgr., resides $19''$ east of 29 Sgr.- Pluto's westward motion in July carries it $1.2''$ south of BB Sgr. on July 8th and $2.5'$ south of 29 Sgr. on the 21st.

Moon – The Moon is a waxing crescent to the lower left of Regulus on July 1st. On July 5th, the First Quarter Moon hangs close to Spica and Mars (0.2°) for North American observers. On July 7th, the Moon occults Saturn for observers in the southernmost area of South America, and appears close to Saturn (0.4° away) for North American observers. The waxing crescent Moon is very near Alderbaran on July 22nd, and it is rather close to the right of Venus and Mercury 94° to 5° on July 24th and 25th, respectively.

Meteor Showers – The best meteor shower this month is the Southern Delta Aquarids. You can expect to see 15 to 20 meteors/hour at maximum, with its peak intensity maintained for a few days. The greatest numbers occur in the hour or two before morning twilight begins on July 29th and 30th. Other meteor showers in July include the Alpha Capricornids and the Piscis Austrinids.

Asteroids – Ceres and Vesta – On the evenings of July 4th and 5th, these asteroids will appear closest at 10 arc minutes separation, while cruising $1\ 1/2^\circ$ southwest of 3rd magnitude Zeta Virginis. Ceres is mag. 8.5 and Vesta is mag. 7.2, and they are moderately high (30°) in the southwest at nightfall.

611 Valeria- on the morning of July 19th, 611 Valeria will occult an 8.7 magnitude star in Pisces the Fish for up to 4 seconds as seen from a track predicted to cross northern Mexico, Texas, the deep South, and the Carolinas. The occultation will happen within a couple of minutes of 9:10 UT in Texas and 9:12 UT in the Carolinas.

Viewing Times

Evening	Midnight	Morning
Mars (SW)	Mars (W)	Mercury (NE)
Jupiter (NW)	Saturn (SW)	Venus (E)
Saturn (S)	Neptune (SE)	Uranus (SE)
		Neptune (S)

Due to cycles of the Moon, best dates for Dark Site Viewing are June 28th, and July 26th.

Comet PANSTAARS (C/2012 K1) should reach 7th or 8th magnitude in July, disappearing in the evening twilight by mid July as it approaches the Sun. Best viewing is during the first week of July, about 2 hours after sunset. PANSTAARS sits about 10°

high in the west-northwest. To find the comet, find the Sickle asterism that forms the head of Leo the Lion. Identify Mu Leo (4th magnitude) and Epsilon Leo (3rd magnitude), the two stars at the end of the Sickle's curved blade. During early July, the comet tracks to the south-southwest along a path that runs parallel to the imaginary line that joins these two stars.

The origin of this constellation is so ancient that its true identity was lost even to the Greeks, who know the figure simply as Engoriasin, literally meaning 'The Kneeling One'. The Greek poet Aratus described him as being worn out with toil, his hands upraised, with one knee bent and a foot on the head of Draco, the Dragon. 'No one knows his name, nor what he labors at', said Aratus. But Eratosthenes, a century after Aratus, identified the figure as Heracles (the Greek name for Hercules) triumphing over the dragon that guarded the Golden Apples of the Hesperids. The Greek playwright Aeschylus, quoted by Hyginus, offered a different explanation. He said that Heracles was kneeling, wounded and exhausted during his battle with the Ligurians.

Heracles was the son of Zeus and Alcmene, a mortal woman. When he was an infant, Zeus laid him at Hera's breast while she was slept. Having suckled her milk, Heracles became immortal. Hera was enraged, both at this and at her husband's infidelity, and while she could not kill Heracles, she made his life difficult at every turn. She cast a spell that made him insane and kill his wife and children. Once he regained his senses and realized what he had done, he visited the Oracle at Delphi to see how he could atone for his deed. The Oracle sent him to serve Eurystheus, King of Mycenae, for a period of 12 years. It was then that he got the name of Heracles, which means "The Glory of Hera". His given name at birth was Alcides, Alcacus, or Palae3mon according to different sources.

King Eurystheus gave Heracles a series of tasks, known as the Labors of Heracles. The first was to kill the Nemean Lion, a beast whose hide was impervious to any weapon. After Heracles had strangled the lion to death, he used its claws to cut off the skin and later used the pelt as a cloak and the gaping mouth as a helmet, which both protected him and made him look even more frightening. The Nemean Lion is represented by the constellation Leo the Lion.

The second task was to destroy the Hydra, represented by the constellation Hydra, a monster with multiple heads. As he fought with the beast, Hera sent a crab to distract him. Heracles killed the crab, and Hera placed it in the sky as the constellation Cancer, the Crab.

Heracles was then sent to catch a deer with golden horns and, after that, a ferocious boar. The fifth task was to clean the stables of King Augeias of Elis. The sixth was to kill a flock of marauding birds, and the eighth labor was to bring the horse of King Diomedes of Thrace, which ate flesh, to King Eurystheus. The ninth was to bring the belt of Hippolyte, the Queen of the Amazons. The tenth labor was to steal the cattle of Geryon,

a monster that lived on the island of Erytheia. On his way back, he was attacked by local forces, which outnumbered and nearly overcame him. He sank to his knees and prayed to Zeus. The god helped him by sending rocks, which Heracles threw at his attackers. This is the event that, according to Aeschylus, was commemorated by the constellation Engonasin (The Kneeler).

Even though Eurystheus and Heracles had originally agreed on ten tasks, when Heracles came back the king refused to release him from his service and set two additional tasks. The first was to steal the Golden Apples from Hera's garden on Mount Atlas. The garden was guarded by the Hesperides, daughters of the Titan Atlas, and the Hesperides were guarded by the dragon Ladon, whose task was to make sure that they did not steal any of the apples. The dragon is represented by the constellation Draco, the Dragon. Hera herself placed the dragon in the sky after Heracles had killed it.

The final labor was the most difficult one. Heracles was sent to the gates of the Underworld to fetch Cerberus, the dog that had three heads and was tasked with guarding the entrance and making sure that those who had crossed the river Styx did not try to escape. Heracles used his pelt to protect himself and dragged the dog to Eurystheus. The king, who had not expected to see Heracles again, had no choice but to release him from his service.

After completing the twelve labors, Heracles married Deianeira, daughter of King Oeneus. While the two were traveling together, they came to the river Evenus, where the centaur Nessus ferried people across. Heracles swam across the river, but Deianeira needed to be carried and Nessus, who offered to do it, fell in lust with her and tried to ravish her. Heracles shot the centaur with an arrow that was tipped in the Hydra's poison. As he lay dying, Nessus offered Deianeira some of his blood, saying it can act as a love charm. Deianeira kept the blood, poisoned by Heracles arrow. Much later, she became worried that Heracles attention was wandering to another woman and she gave him a shirt on which she had smeared Nessus's blood. When Heracles put the shirt on, hydra's poison started burning his flesh and, once he realized what was going on, he built himself a funeral pyre on Mount Oeta and lay on his pelt ready to die. The fire burned the part of him that was mortal, and the immortal part joined Zeus and the other gods on Mount Olympus. Zeus placed Heracles in the sky as the constellation now known by his Roman name, Hercules.