Skylights

Newsletter of the Astronomical Society of Northern New England

JUN 2015

Member of NASA's

Astronomical League

ASNNE MISSION

ASNNE is an incorporated, non-profit, scientific and educational organization with three primary goals:

1) To have fun sharing our knowledge and interest with others.

2) To provide basic education in astronomy and related sciences to all who are interested.

3) To promote the science of Astronomy.

What's Up In June

By Bernie Reim

The month of June is named after the Roman goddess Juno, who is also the goddess of marriage. June has the most hours of daylight for any month in the northern hemisphere and the fewest hours of daylight for the southern hemisphere.

This year the summer solstice is at 12:38 p.m. EDT on Sunday, June 21st. This is the highest point that the sun will reach on the ecliptic for the whole year. The days will be nearly 15 and a half hours long here in New England. They will stay that long for about a week.

The main highlight this month will be an incredible and even epic conjunction of Venus and Jupiter. This event is only the middle such occurrence in a series of three similar conjunctions that could have been the appearances of the Star of Bethlehem 2017 years ago.

These two are our brightest planets and they will be just one third of a degree apart on Tuesday evening June 30th. They start the month about 25 degrees apart. Then they will stay within just two degrees of each other for eight full days.

Watch Venus all month long as it goes on an interesting journey through Gemini and Cancer before it gets to Jupiter in Leo by the end of the month. On June first, the stars Castor and Pollux are evenly spaced in a nearly straight line with Venus in Gemini. Venus will also be exactly half lit by the sun. Watch as it gets less illuminated by the sun even as it gets brighter and larger and closer to Earth.

On the 13th another nearly straight line of equidistant objects occurs with Venus, Jupiter, and Regulus, the brightest star in Leo the lion and the 21st brightest star in the sky. On Flag Day, June 14th, our sister planet will pass right through the Beehive open star cluster in Cancer the Crab. It will be less than one degree from the center of this cluster which is visible without binoculars.

Then the waxing crescent moon chimes in and forms spectacular conjunctions with the pair in a true celestial waltz of great beauty and power. All of this happens before the real highlight of Venus being less than the width of the full moon below Jupiter.

Venus will be 15 times brighter than Jupiter by this time and it will also be very close in size to the King of the planets, 33 arc seconds across. Venus is actually 10 times smaller than Jupiter, like the earth. It will look the same size in the sky from our earthly vantage point in space. Then they will both set about 2 and a half hours after sunset, so the timing is perfect to witness this rare and memorable conjunction. Try to photograph this great event as it unfolds and culminates along with some of the other interesting stops that Venus will take on its way to its close encounter with the king of the planets.

Saturn is now just past opposition, but it will still be well placed for viewing and be brighter and closer to us than usual right through this summer. The ringed planet started its retrograde or westward motion in the sky back towards Libra on March 14th, which is also Einstein's birthday and pi day. A superior planet's opposition always occurs

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What's Up "*Continued from page 1*"

at the midpoint of its return to its normal eastward motion on August 2nd.

Saturn's globe covers 18 arc seconds of the sky and with its rings it covers 41 arc seconds, which is more than any other planet right now. Saturn's rings are tilted wide open at 24 degrees from edgewise. Look carefully through a telescope and you will notice that its famous rings are tilted so far open that they extend just beyond its poles, thereby hiding the South Pole from view. The nearly full moon will pass just above Saturn on June 28th.

Mercury will reach its greatest western elongation from the sun on June 24th. It will be 35% lit by the sun and getting more illuminated. Look for our first planet low in our east-northeastern sky 45 minutes before sunrise and just to the left of the orange giant star named Aldebaran, the fiery eye of Taurus the Bull. This star is 40 times the width of the sun, so if you could place it where the sun is in our sky, it would cover 20 degrees of our sky and its surface would extend almost to the orbit of Mercury, which appears to be right next to it now for a few days but is actually 65 light years away from this orange giant star whose name means "the follower". Our first man-made deep sky probe, Pioneer 10, will reach this star in about 2 million years.

By the middle of June the entire summer triangle will once again be visible, having cleared the eastern horizon by 11 pm. You know the earth has completed one more helical orbit around the sun and summer is once again poised on our doorstep, ready to burst forth in all of its glory when you see this configuration of stars at this time of night.

Through a telescope you can once again view some classic favorites in this part of our sky. These include the Ring Nebula, formed by the explosion of a star similar to our own about 7,000 years ago. This giant ring already spans 1 light year of space and will continue to expand for about another 10,000 years when it will fade out and blend into the interstellar medium. In a sense you are looking 5 billion years into the future when you view this remarkable phenomenon called a planetary nebula. You can also see Albireo, a beautiful blue and gold double star located about 400 light years away marking the head of Cygnus the Swan. Then you can see the North American nebula in Cygnus and the Veil nebula, a supernova remnant from a cataclysmic explosion that happened about 50,000 years ago.

Look just below this great triangle to see Delphinius the Dolphin. It is easy to picture a heavenly dolphin jumping for sheer joy out of the cosmic ocean when you view this faint but distinct little group of stars right below the famous summer triangle.

June 1. The nearly full moon is a few degrees above Saturn tonight.

June 2. Full moon is at 12:19 p.m. EDT. This is also called the Strawberry or Rose Moon.

June 3. A double shadow transit occurs on Jupiter tonight. The George Ellery Hale 200 inch Mt. Palomar telescope was dedicated on this day in 1948.

June 4. On this day in 2000 the Compton Gamma Ray telescope reentered our atmosphere.

June 5. On this day in 1989 Voyager 2 began observations of Neptune.

June 9. Last quarter moon is at 11:42 a.m.

June 13. The Beehive cluster glows just below Venus, which is within 10 degrees of Jupiter tonight.

June 16. New moon is at 10:05 a.m. On this day in 1963 Valentina Tereshkova became the first woman in space and still has the only solo space flight by a woman.

June 19. The waxing crescent moon passes near Venus and Jupiter this evening.

June 21. The summer solstice is today at 12:38 pm for the Northern Hemisphere.

June 24. First quarter moon is at 7:02 a.m.

June 26. Charles Messier was born on this day in 1730.

June 28. Saturn is about 2 degrees below the moon tonight.

June 29. George Ellery Hale was born on this day in 1868.

June 30. Venus and Jupiter are at their closest tonight, just 1/3 of a degree apart. On this day in 1908 a comet or asteroid exploded about 5 miles above Tunguska in Siberia with the force of 20 megatons, or about 1,000 times the force of the first atomic bomb we dropped over Hiroshima. The impact leveled 80 million trees over 1,000 square miles but did not leave a crater.

Moon Phases

Jun 2
Full

Jun 9
Last Quarter

Jun 16
New

Jun 24
First Quarter

Moon Data

Jun 1
Saturn 1.9° south of Moon

Jun 8
Neptune 3° south of Moon

Jun 10
Moon at perigee

Jun 11
Uranus 0.5° north of Moon

Jun 14
Mercury 0.04° North of Moon

Jun 20
Venus 6° north of Moon

Jupiter 5° north of Moon

Jun 23
Moon at apogee

Sky Object of the Month – June 2015
Messier 3 (NGC 5272) – Globular Cluster in Canes Venatici
by Glenn Chaple

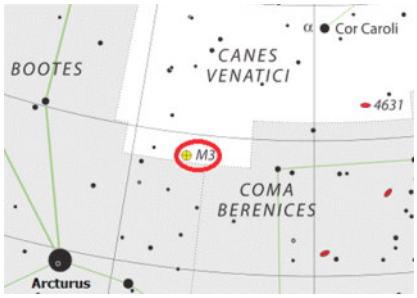
As May gives way to June, backyard astronomers begin to anticipate the arrival of summer's globular clusters, and with good reason. The globular-laden constellations Ophiuchus, Scorpius, and Sagittarius are beginning to show up in the early evening sky. We needn't wait for this globular onslaught. Already well-placed for after-sunset viewing is Messier 13 in Hercules - grandest of all the northern sky globulars. Also available is Messier 3 in Canes Venatici. Compared to M13, it's slightly fainter (magnitude 6.2 to M13's 5.8) and smaller (18 arcminutes to 20 arcminutes). Looks can be deceiving, as M3 is about half again as distant as M13 (33,000 LY to 26,000 LY) and is intrinsically the larger of the two.

M13 is my globular cluster of choice at public star parties. Conveniently placed between zeta (ζ) Herculis and eta (η) Herculis in the "Keystone" of Hercules, it's quick and easy to locate – something I consider when a line of people is waiting by my telescope.

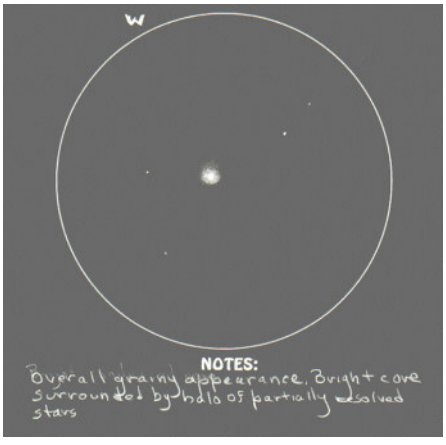
When time constraints aren't an issue, I like to place M3 on the observing menu. It isn't really all that hard to find, being bright enough to be easily spotted in binoculars and finderscopes (it's even been seen without optical aid by keen-eyed observers in dark-sky locations). To capture M3, point your telescope midway between alpha (α) Canum Venaticorum (Cor Caroli) and alpha (α) Bootis (Arcturus), but slightly closer to the latter (refer to the accompanying finder chart). A low-power sweep should pick up a roundish smudge of light. Switch to higher magnifications, and you're in business!

While most globular clusters require apertures of 6 inches and above to resolve their individual stars, M3 can be partially resolved in small-aperture scopes. The accompanying sketch shows its appearance as seen through a 4.5-inch reflector. Visible is the core and a smattering of stars near its outer edge. Large telescopes bring the outermost reaches of M3 into view – a spectacular sight, as an image taken by Amateur Telescope Makers of Boston President Neil Fleming shows. Rotate the Fleming photo about 30 degrees clockwise, and scale and orientation of both fields will be identical.

Think of this as you gaze at M3. You're looking at a half million stars packed into a sphere just 190 light years across!



www.messier-objects.com



4.5-inch f/8 reflector at 100X (Sketch by G. Chaple)

Photo by Neil Fleming

Principal Meteor Showers in 2015

January 4
Quadrantids

April 22
Lyrids

May 6
Eta Aquarids

July 30
Delta Aquarids

August 12
Perseids

October 9
Draconid

October 21
Orionids

November 9
Taurids

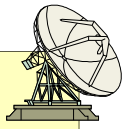
November 18
Leonids

November 26
Andromedids

December 14
Geminids

December 22
Ursids

Note: Dates are for maximum



Got any News?
Skylights welcomes your Input.

Here are some suggestions:

Book reviews -- Items for sale -- New equipment -- Ramblings -- Star parties -- Observing -- Photos.

The latest issue of the Space Place Newsletter: News and Notes for Formal and Informal Educators can be found at:

http://spaceplace.nasa.gov/educator-newsletter

Check out our great sites for kids:

The Space Place website (http://spaceplace.nasa.gov)

The *SciJinks Weather Laboratory* at http://**scijinks.gov**

NASA Climate Kids at http://**climate.nasa.gov/kids**

Our club has merchandise for sale at:

www.cafepress.com/asnne



All money raised goes to our operating fund.
Any design can be put on any item.

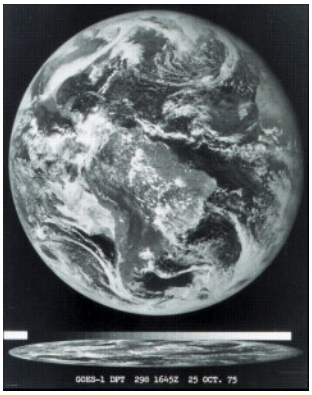
The "G" in GOES Is What Makes It Go

By Dr. Ethan Siegel

Going up into space is the best way to view the universe, eliminating all the distortionary effects of weather, clouds, temperature variations and the atmosphere's airflow all in one swoop. It's also the best way, so long as you're up at high enough altitudes, to view an entire 50 percent of Earth all at once. And if you place your observatory at just the right location, you can observe the *same* hemisphere of Earth continuously, tracking the changes and behavior of our atmosphere for many years.

The trick, believe it or not, was worked out by Kepler some 400 years ago! The same scientist who discovered that planets orbit the sun in ellipses also figured out the relationship between how distant an object needs to be from a much more massive one in order to have a certain orbital period. All you need to know is the period and distance of one satellite for any given body, and you can figure out the necessary distance to have any desired period. Luckily for us, planet Earth has a natural satellite—the moon—and just from that information, we can figure out how distant an artificial satellite would need to be to have an orbital period that exactly matches the length of a day and the rotational speed of Earth. For our world, that means an orbital distance of 42,164 km (26,199 miles) from Earth's center, or 35,786 km (22,236 miles) above mean sea level.

We call that orbit *geosynchronous* or *geostationary*, meaning that a satellite at that distance always remains above the exact same location on our world. Other effects—like solar wind, radiation pressure and the moon—require onboard thrusters to maintain the satellite's precisely desired position above any given point on Earth's surface. While geostationary satellites have been in use since 1963, it was only in 1974 that the Synchronous Meteorological Satellite (SMS) program began to monitor Earth's weather with them, growing into the Geostationary Operational Environmental Satellite (GOES) program the next year. For 40 years now, GOES satellites have monitored the Earth's weather continuously, with a total of 16 satellites having been launched as part of the program. To the delight of NASA (and Ghostbusters) fans everywhere, GOES-R series will launch in 2016, with thrice the spectral information, four times the spatial resolution and five times the coverage speed of its predecessors, with many other improved capabilities. Yet it's the simplicity of gravity and the geostationary "G" in *GOES* that gives us the power to observe our hemisphere all at once, continuously, and for as long as we like!



Caption:

Image credit: National Oceanic and Atmospheric Administration, of the first image ever obtained from a GOES satellite. This image was taken from over 22,000 miles (35,000 km) above the Earth's surface on October 25, 1975.

The University of California High-Performance AstroComputing Center

Measuring Olbers's Paradox

Why is the sky dark at night? That question puzzled centuries of astronomers, including Thomas Digges, Johannes Kepler, and Edmond Halley. After all, if the universe were infinite in all directions, it would be filled with an infinite number of stars, whose collective glow would make the night sky bright. So did a dark sky at night imply that the universe was not infinite? The conundrum was given the name of Olbers's paradox, after the German astronomer Wilhelm Olbers who discussed it in the 1820s.

Well, it turns out that those historical astronomers, working just from first principles, were onto something truly profound—but for reasons they could not anticipate.

Even from deep space far away from the lights of Earth and the stars of the Milky Way, the sky of intergalactic space is *not* absolutely black. It *does* faintly glow with photons from galaxies, both bright galaxies and those too distant to resolve with current instruments. That ever-so-faint glow is called the extragalactic background light (EBL).

Extragalactic background light

Streaming through deep space today in some form is almost all the light that all galaxies have radiated throughout the history of the Universe. Some of these photons are extraordinarily ancient, emitted billions of years ago and red-shifted (expanded in wavelength) with the expansion of the universe. Other photons are comparatively recent from local galaxies nearby. Together, these photons crisscrossing space suffuse the Universe with a faint background glow in the ultraviolet, visible, and infrared regions of the spectrum, rendering the deep night-black void between galaxies not totally dark.

Capturing those precious ancient photons, carefully measuring and counting them, and learning to read the abundance and patterns of the EBL allows astronomers to deduce details both about the early formation of galaxies like our own Milky Way as well as about the grand story of cosmic origin.

Measuring the EBL directly is difficult, however, because our solar system and our Milky Way galaxy are themselves awash in light. Only in the past year or so have astronomers succeeded in obtaining actual measurements of the elusive EBL using a clever indirect work-around: observations of gamma rays from blazars—galaxies with supermassive black holes producing jets of gamma rays that happen to be pointed at Earth. The latest results were published in *The Astrophysical Journal* in May 2013 by Alberto Domínguez of the University of California, Riverside, and coauthors.

These pioneering measurements are possible because gamma rays from distant sources collide with lower-energy visible and infrared EBL photons, annihilating both; those collisions with EBL photons thus remove some of the gamma rays. Different energies of the highest-energy gamma rays are waylaid by different energies of EBL photons. Thus, measuring how much gamma rays of different energies are attenuated from blazars at different

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Measuring Olbers's Paradox

"Continued from page 6"

distances from Earth indirectly gives a measurement of how many EBL photons of different wavelengths exist along the line of sight from blazar to Earth over those different distances.

The new measurements required combining data on X-ray and gamma-ray blazar emissions from space observatories with observations of the highest-energy gamma rays detected by Atmospheric Cherenkov Telescopes on the ground.

What the measurements reveal

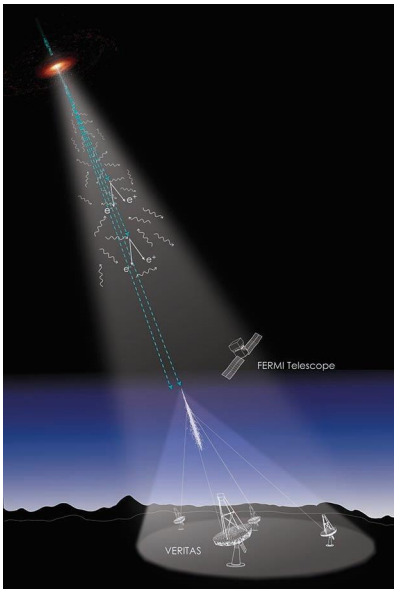
The result? The EBL both nearby and from earlier (more distant) epochs is consistent with expectations from the number of galaxies observed, with little room for additional light from exotic hypothetical sources. This important measurement constrains when and how the universe was reionized during the first billion years.

The EBL measurements also show that the galaxies that were shining at "cosmic high noon"—the period from about eight to twelve billion years ago when stars were forming most rapidly—were unlike most nearby galaxies. Nearby galaxies emit most of their light near visible wavelengths. But at cosmic high noon, exploding stars produced dust (made of heavier elements such as carbon, oxygen, and iron) that enveloped star-forming regions and absorbed much of the ultraviolet and visible light, which was reradiated at much longer infrared. As this dust built up in galaxies over cosmic time, it allowed later generations of stars to form along with rocky planets, including Earth.

Future measurements of the EBL using gamma rays from farther away can help reveal the nature of the first stars and galaxies. *–Trudy E. Bell, M.A.*

***Further reading*:** A press release summarizing this work is at http://hipacc.ucsc.edu/PressRelease/CGRH.html. The paper "Detection of the Cosmic γ-Ray Horizon from Multiwavelength Observations of Blazars," by Alberto Domínguez and six coauthors in *The Astrophysical Journal* is at http://arxiv.org/pdf/1305.2162v1.pdf. A definitive book on the history of Olbers's paradox is *Darkness at Night: A Riddle of the Universe* by Edward Harrison (Harvard University Press, 1989).

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 .



Energetic gamma rays (dashed lines) from a distant blazar strike photons of extragalactic background light (wavy lines) in intergalactic space, annihilating both gamma ray and photon. Different energies of EBL photons waylay different energies of gamma rays, so comparing the attenuation of gamma rays at different energies from different spacecraft and ground-based instruments indirectly measures the spectrum of EBL photons. Credit: Nina McCurdy and Joel R. Primack/UC-HiPACC; Blazar: Frame from a conceptual animation of 3C 120 created by Wolfgang Steffen/UNAM

Club Meeting & Star Party Dates

Date	Subject	Location
June 5	**ASNNE Club Meeting:** **6:45-7:30PM:** Beginner Astronomy Class (Public walk-ins welcome). **7:30-9:30PM:** Club Meeting **Meeting Agenda** **Guest Speaker/Topic: TBD** **Bernie Reim** - What's UP **Astro Shorts:** (news, stories, jokes, reports, questions, observations etc.) **Where's Pluto** - Update on the New Horizons Mission and "Planet" status. Mission 5 phases 1, Pre-encounter (now through October 2014), Immediate approach (April-May 2015), Encounter (June-August 2015), Immediate post-encounter (September-October 2015) and later post-encounter (April-December 2016).	The New School, Kennebunk, Me.
June 12	Club/Public Star Party (*Visit website for updates and or cancellations*)	Starfield Observatory, West Kennebunk, Me.

Directions to ASNNE event locations

Directions to The New School in Kennebunck [38 York Street (Rt1) Kennebunk, ME]

For directions to The New School you can use this link to the ASNNE NSN page and then click on "get directions" from the meeting location. Enter your starting location to generate a road map with complete directions. It works great. http://nightsky.jpl.nasa.gov/club-view.cfm?Club_ID=137

Directions to Starfield Observatory [Alewive Road, Kennebunk, ME]

From North:
Get off turnpike at exit 32, (Biddeford) turn right on Rt 111. Go 5 miles and turn left on Rt 35. Go 2 miles on Rt 35 over Kennebunk River to very sharp 90 degree left turn. The entrance to the Starfield Observatory site is at the telephone pole at the beginning of the large field on the left. Look for the ASNNE sign on the pole.

From South:
Get off the turnpike at exit 25 in Kennebunk. After toll both turn right on Rt 35. Go up over the turnpike and immediately turn right on Rt 35. About 4 miles along you will crest a hill and see a large field on your right. Continue until you reach the end of the field. Turn right into the Starfield Observatory site at the last telephone pole along the field. Look for the ASNNE sign on the pole. If you come to a very sharp 90 degree right turn you have just passed the field.

To join **ASNNE**, please fill out the below membership form. *Checks should be made payable to: Astronomical Society of Northern New England (A.S.N.N.E).* For more details, please visit our website: **http://www.asnne.org**

Astronomical Society of Northern New England
P.O. Box 1338
Kennebunk, ME 04043-1338

2015 Membership Registration Form

(Print, fill out and mail to address above)

Name(s for family): _____

Address: _____
City/State: _____ Zip code: _____

Telephone # _____

E-mail: _____

Membership (check one):
Individual $35 _____ Family $ 40 _____ Student under 21 years of age $10 _____ Donation_____

Total Enclosed_____

Tell us about yourself:
1. Experience level: Beginner____ Some Experience ____ Advanced_____

2. Do you own any equipment? (Y/N) And if so, what types?

_____
3. Do you have any special interests in Astronomy?

_____
4. What do you hope to gain by joining ASNNE?

_____
5. How could ASNNE best help you pursue your interest in Astronomy?

_____
6. ASNNE's principal mission is public education. We hold many star parties for schools and the general public for which we need volunteers for a variety of tasks, from operating telescopes to registering guests to parking cars. Would you be interested in helping?
Yes_____ No_____

7. ASNNE maintains a members-only section of its web site for names, addresses and interests of members as a way for members to contact each other. Your information will not be used for any other purpose. Can we add your information to that portion of our web site?

Yes_____ No_____