Skylights

Newsletter of the Astronomical Society of Northern New England

JULY 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 July

By Bernie Reim

The month of July is named for Julius Caesar. This is the first full month of summer for us in the northern hemisphere and the days will remain long and the nights will be warm and short. There will be many interesting highlights to pack into those short nights this month.

All five of the brightest planets will be visible, we are farthest from the sun, the dwarf planet Ceres will be at opposition, there will be a blue moon, a meteor shower, and the most exciting event of all will be the closest approach of the New Horizon's spacecraft to Pluto on July 14th.

The epic conjunction of Venus and Jupiter will still be unfolding throughout this month, but now Venus will be drifting noticeably farther away from Jupiter each evening. This pair of our brightest planets will start the month just half a degree apart, which is the width of the full moon in the sky. Then they will drift to about 7 degrees apart, but then you will notice an interesting effect as Venus starts its retrograde or western motion with respect to the fixed background of stars on July 23rd, so it will once again be getting closer to Jupiter from the other side.

Try to look at Venus through a telescope and you will see that it is rapidly getting thinner as it gets closer to the earth. It starts the month about one third illuminated by the sun, but it will end the month appearing as a tiny sliver only 8% lit by the sun and almost twice as large as it will start July. It will reach its brightest for the year at minus 4.7 magnitude by the middle of the month. On July 18th the slender waxing crescent moon will be directly below Venus, almost seeming to touch it in the sky. Jupiter will be just to the right and Regulus, the brightest star in Leo will be just above this illustrious pair of the second and third brightest objects in our sky after the sun itself.

Saturn is still very well placed in the eastern sky in the constellation of Scorpius as soon as it gets dark enough to spot its glowing orb at just fainter than zero magnitude, or fully 100 times fainter than Venus. The ringed planet is still moving in retrograde, or westward motion towards Libra all of this month. Its rings are still tilted well open at 24 degrees.

Mars is finally making its reappearance in our morning sky just after the middle of the month. The red planet will be very close to Mercury for a few days, but they will be hard to see because the sky will already be quite bright when they rise just 45 minutes before sunrise. Mars is about as small and far away as it can get now, on the other side of the sun from us, with over a year to go before its next opposition. Then Mercury will sink back down into the morning sky for its superior conjunction with the sun, also on the other side of the sun from us.

Pluto will not be the only dwarf planet to make the headlines this month. The largest and first discovered of all the asteroids, Ceres, will reach opposition on July 25 in the constellation of Sagittarius, only about 20 degrees east of where Pluto will be in the same constellation during its historic encounter with New Horizons this month. Ceres will reach 7.5 magnitude, which means that it will be visible in just a pair of binoculars,

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

unlike Pluto which will require a 12 inch or larger telescope since it will only reach 14.1 magnitude, or over 500 times fainter than Ceres. The ion drive powered Dawn spacecraft reached Ceres in March and is slowly descending closer to its icy surface to map it in good detail. It will reach its lowest orbit of just 232 miles in November, when many more well- hidden mysteries of this icy dwarf will begin to be revealed.

Tuesday, July 14 is the big day for Pluto, so mark your calendars. After an uneventful journey of 3 billion miles taking 9 and a half years, the highly efficient New Horizons spacecraft is in perfect health and more than ready for its epic encounter. This is the fastest spacecraft we have ever launched. Averaging 36,000 miles per hour, or about half the speed that the earth is always traveling all by itself around the sun, New Horizons travels the diameter of our sun every day, which is 865,000 miles.

We have four other spacecraft that are farther out than New Horizons, but none of them have studied any objects beyond Neptune. Since Pluto is tilted almost 90 degrees on its side, similar to the planet Uranus, all 5 of its known moons orbit perpendicular to the ecliptic plane of our solar system. So New Horizons will essentially act like an arrow shot from earth passing right through Pluto's perfect miniature solar system trying to discern the true nature of this distant, enigmatic, and complex target.

About the size of a baby grand piano, New Horizons is armed with 7 highly sophisticated scientific instruments that will measure many different features of this extremely interesting and unknown part of our solar system. These include two cameras in different wavelengths of light, a spectrometer, a radio science experiment, a plasma and solar wind spectrometer, and an interplanetary dust counter.

We already know that little Pluto has more moons than all four of our terrestrial planets combined. During the two days of hectic activity for this probe's very brief and close encounter with this ancient and alien primordial world, much data will be gathered and eventually many new discoveries will reveal themselves over the next two years as all this data slowly gets transmitted to us on Earth.

New Horizons will also pass right through the shadows that Pluto and Charon are always casting into deep space, which will give us new insights into their atmospheres and many other details about them that we could not otherwise see. New Horizons will get as close as 6200 miles above the surface of Pluto and be able to resolve features as small as a quarter of a mile across.

This is the first mission to pass close by a distant planetary body in 26 years. The last close encounter was Voyager 2 and Neptune in 1989. About half of all the people currently living in the world were not alive at that time. This will also be the last such mission planned for several more generations. New Horizons will also be able to visit at least one and maybe two more Kuiper belt objects after this great encounter. They are about one billion miles farther out, so it will take about another 3 years to get there.

July 1. Venus and Jupiter are still very close, about the width of the full moon apart. The moon is full at 10:20 p.m. EDT. This is also called the Hay or Thunder Moon.

July 4. The Crab nebula was first seen on this day in 1054. It is about 6500 light years away, which means that it actually exploded about 7500 years ago, but the light of this supernova just got to us about 1,000 years ago.

July 6. Isaac Newton published his Principia on this day in 1687. Earth is at aphelion, or farthest away from the sun for the year at 94,506,507 miles today.

July 8. Last quarter moon is at 4:24 p.m.

July 12. The moon will occult Aldebaran in Taurus for observers in Japan and part of Siberia.

July 15. New moon is at 9:24 p.m.

July 16. The first of 21 fragments of Comet Shoemaker-Levy 9 hit Jupiter today in the year 1994.

July 18. Venus and the waxing crescent moon are just two degrees apart this evening.

July 20. The first humans walked on the moon on this day in 1969.

July 24. First quarter moon is at 12:04 a.m.

July 25. The moon is near Saturn one hour after sunset tonight. Ceres is at opposition.

July 30. The Delta Aquarid meteor shower peaks this morning.

July 31. The second full moon of July is 6:43 a.m. This is known as a blue moon.

Moon Phases

Jul 1 & 31
Full

Jul 8
Last Quarter

Jul 15
New

Jul 24
First Quarter

Moon Data

Jul 5
Moon at perigee

Jul 6
Neptune 3° south of Moon

Jul 8
Uranus 0.8° north of Moon

Jul 12
Aldebaran 0.9° south of Moon

Jul 18
Venus 0.4° north of Moon

Jupiter 4° north of Moon

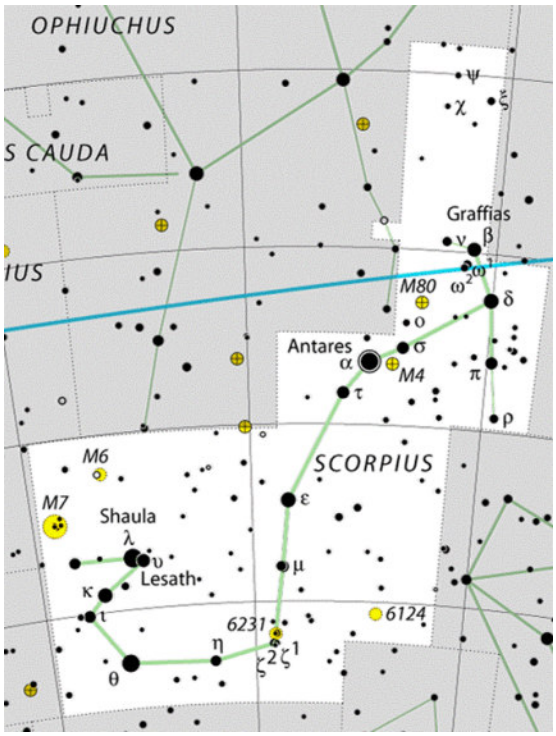
Jul 21
Moon at apogee

Jul 26
Saturn 2° south of Moon

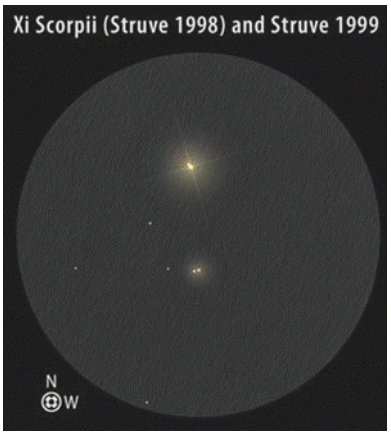
Sky Object of the Month – July 2015
Xi (ξ) Scorpii (Σ1998) – Double Star in Scorpius
by Glenn Chaple

Our cosmic wanderings take us 93 light years away to the triple star xi (ξ) Scorpii (Σ1998), located in the Scorpion's northwest corner. A 60mm refractor magnifying 60X will reveal two stars (xi Scorpii A and C), of magnitudes 4.9 and 7.3 and separated by 7.0". If the seeing is extremely steady, check out the brighter star with a larger scope (minimum aperture of 4 inches) and magnification of 150X or more. You should capture a magnitude 5.2 companion (xi Scorpii B) just 1.1" away. Xi Scorpii A and B are a binary pair with an orbital period of 46 years. As the diagram shows, they are currently near greatest separation.

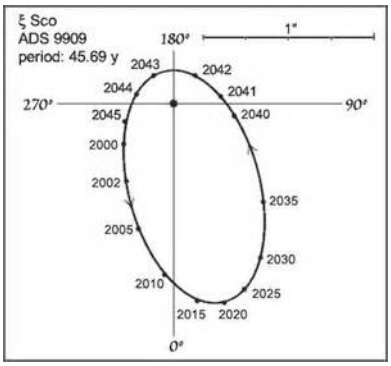
When I first viewed xi Scorpii with a 3-inch reflecting telescope in the summer of 1971, I was surprised to see a faint double star in the same field. I had "discovered" Σ1999 (magnitudes 7.5 and 8.1; separation 11.8". Although nearly 5 minutes of arc separate Σ1999 from xi Scorpii, the two have the same common proper motion and are likely gravitationally bound. When viewing xi Scorpii and Σ1999, pay close attention to the colors of their component stars. Xi Scorpii A and B are F-type stars, while C is a cooler G8 dwarf. Both Σ1999 stars have K spectral classes. What colors do you see?



www.constellation-guide.com



Sketch by Jeremy Perez (www.perezmedia.net)



www.dibonsmith.com

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

Systems Engineer for Environmental Satellite

Sarah Sherman is a systems engineer for the Soil Moisture Active Passive (SMAP) mission. She helped develop and launch a spacecraft that orbits Earth and looks at how much water is in the soil.

http://climatekids.nasa.gov/career-satellites

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.

No Surprise! Earth's Strongest Gravity Lies Atop The Highest Mountains

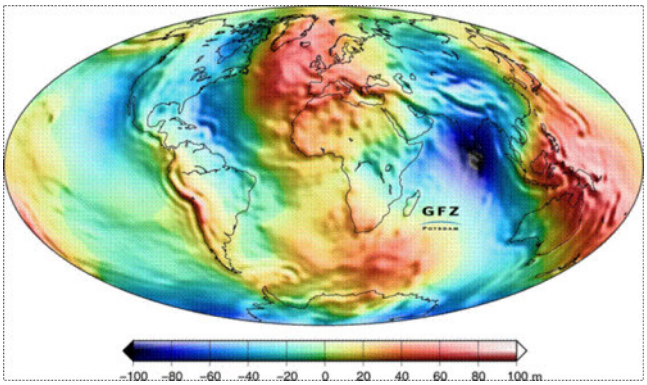
By Dr. Ethan Siegel

Put more mass beneath your feet and feel the downward acceleration due to gravity increase. Newton's law of universal gravitation may have been superseded by Einstein's, but it still describes the gravitational force and acceleration here on Earth to remarkable precision. The acceleration you experience is directly proportional to the amount of mass you "see," but inversely proportional to the distance from you to that mass squared.

The denser the mass beneath your feet, the stronger the gravitational force, and when you are closer to such a mass, the force is even greater. At higher elevations or even higher altitudes, you'd expect your gravitational force to drop as you move farther from Earth's center. You'd probably also expect that downward acceleration to be greater if you stood atop a large mountain than if you flew tens of thousands of feet above a flat ocean, with nothing but ultra-light air and liquid water beneath you for all those miles. In fact this is true, but not just due to the mountain's extra mass!

Earth is built like a layer-cake, with the less dense atmosphere, ocean, and crust floating atop the denser mantle, which in turn floats atop the outer and inner cores of our planet. An iceberg's buoyancy is enough to lift only about one tenth of it above the sea, with the other nine tenths below the surface. Similarly, each and every mountain range has a corresponding "invisible mountain" that dips deep into the mantle. Beneath the ocean floor, Earth's crust might be only three to six miles thick, but it can exceed 40 miles in thickness around major mountain ranges like the Himalayas and the Andes. It's where one of Earth's tectonic plates subducts beneath another that we see the largest gravitational anomalies: another confirmation of the theory of continental drift.

A combination of instruments aboard NASA's Gravity Recovery and Climate Experiment (GRACE) satellites, including the SuperSTAR accelerometer, the K-band ranging system and the onboard GPS receiver, have enabled the construction of the most accurate map of Earth's gravitational field ever: to accelerations of nanometers per second squared. While the mountaintops may be farther from Earth's center than any other point, the extra mass of the mountains and their roots – minus the mass of the displaced mantle – accounts for the true gravitational accelerations we actually see. It's only by the grace of these satellites that we can measure this to such accuracy and confirm what was first conjectured in the 1800s: that the full layer-cake structure of Earth must be accounted for to explain the gravity we experience on our world!



Caption:

Image credit: NASA / GRACE mission / Christoph Reigber, et al. (2005): An Earth gravity field model complete to degree and order 150 from GRACE: EIGEN-GRACE02S, Journal of Geodynamics 39(1),1–10. Reds indicate greater gravitational anomalies; blues are smaller ones.

The University of California High-Performance AstroComputing Center

Planck: Revising the Universe

The Universe is about 100 million years older than previously estimated and is expanding slightly more slowly; it also has slightly more dark matter and a bit less dark energy than previously suspected. There is no evidence for an additional neutrino-like relativistic particle beyond the three families of neutrinos that have already been discovered; their total mass is not more than 0.23 electron volts, about half the upper limit from the earlier results from NASAs Wilkinson Microwave Anisotropy Probe (WMAP).

Those are the key findings revealed by the most accurate and detailed map of the cosmic microwave background (CMB)—the oldest light in the Universe, dating back to 370,000 years after the Big Bang—produced from the first 15.5 months of data from the Planck satellite and analyzed using one of the world's most powerful supercomputers.

The researchers included, among others, University of California faculty from Berkeley (George Smoot and Martin White), Berkeley Space Sciences Laboratory (R. Keskitalo), Davis (Lloyd Knox), the U.S. Department of Energy National Energy Research Scientific Computing Center (NERSC) at the Lawrence Berkeley National Laboratory (Julian Borrill and T.S. Kisner), and Santa Barbara (Philip Lubin, P. R. Meinhold, and Andrea Zonca).

A trillion data points

The Planck satellite, designed and built by the European Space Agency (ESA) with significant contributions from the U.S. National Aeronautics and Space Administration (NASA), was launched in May 2009 and began scientific observations in mid-August.

Like its NASA predecessors the Cosmic Background Explorer (COBE) and WMAP, Planck's mission is to map tiny temperature fluctuations in the microwave background radiation bathing the heavens, left from the Big Bang. But both Planck's sensitivity and its resolution are unprecedented.

Planck is 930,000 miles away, on the opposite side of Earth from the sun, in the gravitationally semi-stable L2 libration point where it keeps up with Earth in its orbit. That orbit plus Plank's spinning on its axis allows the spacecraft's 72 detectors to scan successive narrow (2 arcminutes wide) strips or rings around the heavens, building up a map of rings covering the complete sky twice a year. As Planck measures some 10,000 samples per second, in its first 15.5 months of observing, it has gathered a trillion data points.

Analyzing such a massive data set is a monumental computational challenge. So in 2007, before the spacecraft was launched, NASA and the DOE negotiated a formal interagency agreement that provided the Planck mission multiyear access to NERSC.

Especially challenging is the task not only of separating the CMB from the unavoidable instrumental noise and foreground signals from our Milky Way galaxy, but also of then understanding precisely how well this separation has been done. Using a technique called Monte Carlo simulations, the data were crunched on NERSC's 150,000-core Cray XE6 supercomputer Hopper.

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Planck: Revising the Universe

"Continued from page 6"

Refining our understanding

Although future data releases in 2014 and 2015 will add in results from polarization and other measurements, this first release of data reveals results that are already surprising.

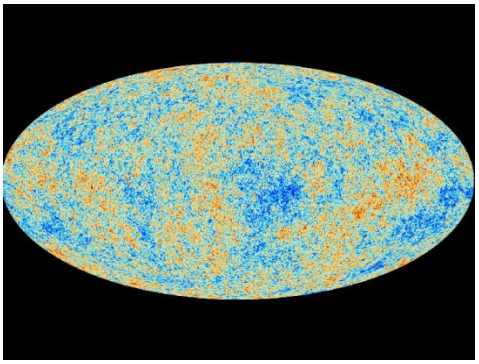
The Planck data reveal that the Universe is 13.8 billion years old, more precise than the previously accepted age of 13.7 billion years. The Hubble constant—the rate at which the Universe is expanding—is revised downward to only 67.80 plus or minus 0.77 kilometers per second per megaparsec (a megaparsec is about 3 million light-years).

Planck's results also indicate that dark energy makes up "only" 69.1 percent (plus or minus 1.0 percent) of the density of the Universe (instead of 71.4 percent as measured by WMAP). Thus, dark matter and ordinary matter make up a heftier 30.9 percent. *–Trudy E. Bell, M.A.*

***Further reading*:** The LBNL press release appears at http://newscenter.lbl.gov/news-releases/2013/03/14/massive-planck-simulations/, the NERSC release at http://www.nersc.gov/news-publications/news/science-news/2013/planck-results/, the Davis release at http://blogs.ucdavis.edu/egghead/2013/03/21/plancks-new-map-brings-universe-into-focus/, and the Santa Barbara release at http://www.ia.ucsb.edu/pa/display.aspx?pkey=2967.

Papers have been submitted to *Astronomy and Astrophysics;* preprints appear at http://www.sciops.esa.int/index.php?project=PLANCK&page=Planck_Published_Papers .

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 .



Planck map of the cosmic microwave background shows tiny fluctuations in temperature, which correspond to regions of different densities: denser regions eventually coalesced into today's galaxies and stars.

Credit: ESA and the Planck collaboration

Cray XE6 supercomputer Hopper, named for 20th-century computer scientist Grace Hopper, performed most of the Planck calculations. Hopper is at the DOE National Energy Scientific Computing Center at Lawrence Berkeley National Laboratory,

Credit: Roy Kaltschmidt

Club Meeting & Star Party Dates

Date	Subject	Location
July 3	**ASNNE Club Meeting:** **Meeting Agenda** Picnic and observing session (weather permitting) at Starfield Observatory. Bring your own food and beverage. Gas grills will be HOT. All dessert donations will be appreciatively eaten! If rained out, just a regular July meeting at The New School (TNS). Guest speaker/topic - TBD. Regular agenda: Bernie Reim - What's Up. Members Astro shorts - ie, news, events, questions. Where's Pluto - Update on the New Horizons Mission and "Planet" status. Days to close approach.	Starfield Observatory, West Kennebunk, Me.
TBD	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_____