The Ephemeris

August 2014

Volume 25 Number 08 - The Official Publication of the San Jose Astronomical Association

GUEST SPEAKER, July 12, 2014 - **Dr. Richard Elphic**

Barnstorming the Moon: Adventures of the Lunar Atmosphere and Dust Environment Explorer

From Tom Piller

SJAA's guest speaker, NASA Ames' Dr. Richard Elphic (pictured to the right) gave approximately 35 SJAA members an eye opening talk about the 2013-2014 Lunar Atmosphere and Dust Environment Explorer (LADEE) mission goals and findings. Please excuse my unscientific description of the talk, a more scientific explanation is listed further below with the NASA Ames credit.

The LADEE mission goals Dr. Elphic presented were:

1. Demonstrate a low cost lunar mission
2. Understand and characterize the moon's surface
3. Determine the composition of the lunar atmosphere
4. Demonstrate and test lunar laser communications

While all of the mission goals listed above were explained in some detail, I was most interested in the speaking points about the lunar atmosphere. For years we had heard that the moon has no atmosphere. More recently, as a result of Apollo mission observations of a phenomenon called 'horizon glow', there was speculation that there is some atmosphere consisting of electrostatically levitated dust. But through use of LADEE's on board mass & ultra violet spectrometers, measuring the exosphere and making gas observations, the LADEE mission found evidence of a dust ejecta cloud which engulfs the moon, apparently caused by constant bombardment. There was no evidence of electrostatically charged dust. This along with the discovery of noble gases, argon, helium and neon found in the lunar atmosphere, where findings indicate that these gas molecules actually hop around the surface. Small hops at night and larger hops during the day. Helium goes the highest; if I remember correctly, 50 miles high during the lunar day. The hopping phenomenon is apparently cased, in part, by sunlight where during the day the molecules become positively charged and at night, negatively charged.

Background (credit to NASA Ames): The Lunar Atmosphere and Dust Environment Explorer (LADEE) was launched from Wallops Flight Facility on 6 September, 2013 aboard the very first Minotaur V, a Peacekeeper ICBM converted to civilian use. The launch was perfect, and LADEE entered lunar orbit on 6 October, 2013. In the following weeks, the first laser communications from deep space achieved 622 Mbits/sec downlink, speeds sufficient for broadband video. Following instrument checkout and commissioning, LADEE commenced science operations on 21 November, 2013. Over the next 100 days, LADEE's Ultraviolet/Visible Spectrometer (UVS) systematically mapped sodium, potassium and other species in the tenuous lunar exosphere, while the Neutral Mass Spectrometer (NMS) systematically mapped argon, helium, and discovered neon in the lunar exosphere. At the same time, the Lunar Dust EXperiment (LDEX) discovered and characterized the dust exosphere, caused by continual bombardment of the Moon's surface by micrometeoroids. After the nominal science mission ended on March 1, 2014, LADEE continued to acquire more science data, culminating in a set of observations at very low altitudes (<10 km) above the sunrise terminator. Data from LADEE show how the Moon "breathes", with different species in its thin atmosphere varying with a variety of parameters. For example argon-40, a constituent arising from potassium-40 decay in the lunar interior "freezes out" on the very cold lunar nightside (~100K), but produces a dawn bulge of enhanced gas density as the cold lunar surface rotates around into sunlight and warms up.

August 2014 Events

Friday, August 01
In-Town Star party (Houge): 9:15 - 11:15pm

Sunday, August 03
Solar observing: 2-4PM
Fix-It Day: 2-4PM

Saturday, August 09
Board of Directors Meeting: 6 -7:30pm
Gen Meeting (Movie Night): 7:30-10pm

Friday, August 15
Beginner Astronomy Class: 8 - 9pm
In-Town Star party (Houge): 9 -11pm
Binocular Stargazing (RCDO): 9 -11pm

Saturday, August 16
Starry Nights Star Party: 9 -11pm
Ranch Cañada del Oro (RCDO)

Saturday, August 23
Henry Coe—Dark-Sky Weekend

Saturday, Sept 06
Board of Directors Meeting: 6-7:30pm
Gen Meeting (Show & Tell): 7:30-10pm

Sunday, Sept 07
Solar observing: 2-4PM
Fix-It Day: 2-4PM

SJAA events are subject to cancellation due to weather. Please visit website for up-to-date info.

INSIDE THIS ISSUE

The Invisible Shield of our Sun

By Dr. Ethan Siegel

Image credit: Hubble Heritage Team (AURA / STScI), C. R. O'Dell (Vanderbilt), and NASA, of the star LL Orionis and its heliosphere interacting with interstellar gas and plasma near the edge of the Orion Nebula (M42). Unlike our star, LL Orionis displays a bow shock, something our Sun will regain when the ISM next collides with us at a sufficiently large relative velocity.

Whether you look at the planets within our solar system, the stars within our galaxy or the galaxies spread throughout the universe, it's striking how empty outer space truly is. Even though the largest concentrations of mass are separated by huge distances, interstellar space isn't empty: it's filled with dilute amounts of gas, dust, radiation and ionized plasma. Although we've long been able to detect these components remotely, it's only since 2012 that a manmade spacecraft -- Voyager 1 -- successfully entered and gave our first direct measurements of the interstellar medium (ISM).

What we found was an amazing confirmation of the idea that our Sun creates a humongous "shield" around our solar system, the heliosphere, where the outward flux of the solar wind crashes against the ISM. Over 100 AU in radius, the heliosphere prevents the ionized plasma from the ISM from nearing the planets, asteroids and Kuiper belt objects contained within it. How? In addition to various wavelengths of light, the Sun is also a tremendous source of fast-moving, charged particles (mostly protons) that move between 300 and 800 km/s, or nearly 0.3% the speed of light. To achieve these speeds, these particles originate from the Sun's superheated corona, with temperatures in excess of 1,000,000 Kelvin!

When Voyager 1 finally left the heliosphere, it found a 40-fold increase in the density of ionized plasma particles. In addition, traveling beyond the heliopause showed a tremendous rise in the flux of intermediate-to-high energy cosmic ray protons, proving that our Sun shields our solar system quite effectively. Finally, it showed that the outer edges of the heliosheath consist of two zones, where the solar wind slows and then stagnates, and disappears altogether when you pass beyond the heliopause.

Unprotected passage through interstellar space would be life-threatening, as young stars, nebulae, and other intense energy sources pass perilously close to our solar system on ten-to-hundred-million-year timescales. Yet those objects pose no major danger to terrestrial life, as our Sun's invisible shield protects us from all but the rarer, highest energy cosmic particles. Even if we pass through a region like the Orion Nebula, our heliosphere keeps the vast majority of those dangerous ionized particles from impacting us, shielding even the solar system's outer worlds quite effectively. NASA spacecraft like the Voyagers, IBEX and SOHO continue to teach us more about our great cosmic shield and the ISM's irregularities. We're not helpless as we hurtle through it; the heliosphere gives us all the protection we need!

Want to learn more about Voyager 1's trip into interstellar space? Check this out: http://www.jpl.nasa.gov/news/news.php?release=2013-278.

Kids can test their knowledge about the Sun at NASA's Space place: http://spaceplace.nasa.gov/solar-tricktionary/.

NASA's Next Giant Leap

The first humans who will step foot on Mars are walking the Earth today.
It was 45 years ago that Neil Armstrong took the small step onto the surface of the moon that changed the course of history. The years that followed saw a Space Age of scientific, technological and human research, on which we have built the modern era. We stand on a new horizon, poised to take the next giant leap—deeper into the solar system. The Apollo missions blazed a path for human exploration to the moon and today we are extending that path to near-Earth asteroids, Mars and beyond. Technology drives exploration and we're building on the Apollo program's accomplishments to test and fly transformative, cutting-edge technologies today for tomorrow's missions. As we develop and test the new tools of 21st century spaceflight on the human Path to Mars, we once again will change the course of history.
The Path to Mars begins with research on Earth and extends beyond its bounds, aboard the orbiting laboratory of the International Space Station, with our international partners. Some 250 miles above our heads, astronauts are conducting hundreds of experiments not possible on Earth, teaching us how humans can live, work and thrive for longer periods in space.
To help this nation send humans to deep space and return them to Earth safely, engineers across the country are developing a new space transportation capability, destined to travel far beyond our home planet. The Orion spacecraft and Space Launch System (SLS) heavy-lift rocket will be the most advanced space vehicles ever built. Together, they will take us farther into the solar system than humans have ever traveled. They are our spaceship to Mars and beyond.

Caption:
On the left, a close-up view of an astronaut's bootprint in the lunar soil, photographed with a 70mm lunar surface camera during the Apollo 11 extravehicular activity (EVA) on the moon. On the right, artist's concept of an astronaut's bootprint on the surface of Mars.
Image Credit: NASA

Hubble Sees the Oldest Cluster in Milky Way Neighbor

This image shows NGC 121, a globular cluster in the constellation of Tucana (The Toucan). Globular clusters are big balls of old stars that orbit the centers of their galaxies like satellites — the Milky Way, for example, has around 150.

NGC 121 belongs to one of our neighboring galaxies, the Small Magellanic Cloud (SMC). It was discovered in 1835 by English astronomer John Herschel, and in recent years it has been studied in detail by astronomers wishing to learn more about how stars form and evolve.

Stars do not live forever — they develop differently depending on their original mass. In many clusters, all the stars seem to have formed at the same time, although in others we see distinct populations of stars that are different ages. By studying old stellar populations in globular clusters, astronomers can effectively use them as tracers for the stellar population of their host galaxies. With an object like NGC 121, which lies close to the Milky Way, Hubble is able to resolve individual stars and get a very detailed insight.

NGC 121 is around 10 billion years old, making it the oldest cluster in its galaxy; all of the SMC's other globular clusters are 8 billion years old or younger. However, NGC 121 is still several billions of years younger than its counterparts in the Milky Way and in other nearby galaxies like the Large Magellanic Cloud. The reason for this age gap is not completely clear, but it could indicate that cluster formation was initially delayed for some reason in the SMC, or that NGC 121 is the sole survivor of an older group of star clusters.

This image was taken using Hubble's Advanced Camera for Surveys (ACS).

European Space Agency

Credit: ESA/Hubble & NASA, Acknowledgment: Stefano Campani

Curiosity finds iron meteorite on Mars

Iron meteorites dominate the small number of space rocks found on the Red Planet.

NASA/JPL-Caltech/LANL/CNES/IRAP/LPGNantes/CNRS/IAS/MSSS

This rock encountered by NASA's Curiosity Mars rover is an iron meteorite called "Lebanon," similar in shape and luster to iron meteorites found on Mars by the previous generation of rovers, Spirit and Opportunity. Lebanon is about 2 yards (2 meters) wide (left to right, from this angle). The smaller piece in the foreground is called "Lebanon B."

This view combines a series of high-resolution circular images taken by the Remote Micro-Imager (RMI) of Curiosity's Chemistry and Camera (ChemCam) instrument with color and context from rover's Mast Camera (Mastcam). The component images were taken during the 640th martian day (sol) of Curiosity's work on Mars — May 25, 2014.

The imaging shows angular-shaped cavities on the surface of the rock. One possible explanation is that they resulted from preferential erosion along crystalline boundaries within the metal of the rock. Another possibility is that these cavities once contained olivine crystals, which can be found in a rare type of stony-iron meteorites called pallasites, thought to have been formed near the core-mantle boundary within an asteroid.

Iron meteorites are not rare among meteorites found on Earth, but they are less common than stony meteorites. On Mars, iron meteorites dominate the small number of meteorites that have been found. Part of the explanation could come from the resistance of iron meteorites to erosion processes on Mars.

Credit: NASA

Don't Forget the Perseid Meteor Shower!

The 2014 Perseid meteor shower will peak between August 10 and August 13. Observers are best to try their luck to catch some Perseids **just before dawn** on August 11, 12 and 13. For viewing, look between the radiant, which will be in the north-east part of the sky and the zenith (the point in sky directly above you).

The waning gibbous moon will be 95 to 85 percent illuminated during this time frame rising at approximately 10pm and not setting until the following morning. So not ideal viewing but still worth a try.

KID SPOT

Kid Spot Jokes:

- **Why is an astronaut like a football player?**
  (They both like touchdowns)
- **How did the astronaut serve drinks?**
  (In sunglasses)

Kid Spot Quiz:

1. **What is the largest moon in our solar system?**
2. **What is the most massive star known?**

Photo Credit: Wikipedia

Kid Spot Night Sky Challenge: July 2014

See if you can spot the following objects in the sky:

⇒ Saturn
⇒ Mars
⇒ Spica
⇒ Antares
⇒ The Great Square of Pegasus

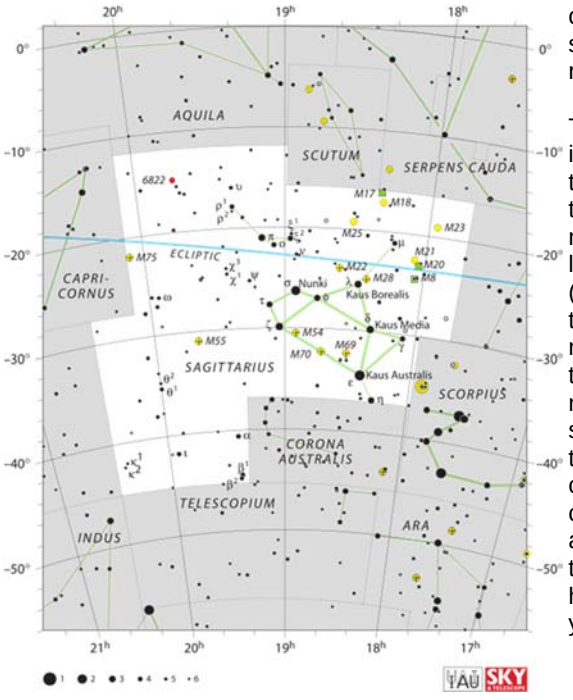
http://skyandtelescope.com/observing/ataglance

Constellations

Sagittarius ♐ is one of the constellations of the zodiac as well as one of the 48 constellations listed by the 2nd-century astronomer Ptolemy. It remains one of the 88 modern constellations.

Its name is Latin for the archer, and its symbol is a stylized arrow. Sagittarius is commonly represented as a centaur drawing a bow. It lies between Scorpius and Ophiuchus to the west and Capricornus to the east. In Greek mythology, Sagittarius is usually identified as a centaur: half human, half horse. The arrow of this constellation points towards the star Antares, the "heart of the scorpion," and Sagittarius stands poised to attack should Scorpius ever attack the nearby Hercules, or to avenge Scorpius's slaying of Orion.

As seen from the northern hemisphere, the constellation's brighter stars form an easily recognizable asterism known as 'the Teapot'. Under good viewing conditions, a particularly dense area of the Milky Way can be seen rising in a north-westerly arc above the spout, like a puff of steam rising from a boiling kettle.
The constellation as a whole is often depicted as having the rough appearance of a stick-figure archer drawing its bow, with the fainter stars providing the outline of the horse's body. Sagittarius famously points its arrow at the heart of Scorpius, represented by the reddish star Antares, as the two constellations race around the sky.



Source: Wikipedia

The Milky Way is at its densest near Sagittarius, as this is where the galactic center lies. Consequently, Sagittarius contains many star clusters and well-known nebulae including the Lagoon Nebula (Messier 8), the Omega Nebula (Messier 17) also known as the Horseshoe Nebula or Swan Nebula, near the border with Scutum; and the Trifid Nebula (Messier 20), a large nebula containing some very young, hot stars. The grouping of the Lagoon Nebula, the Trifid Nebula, and NGC 6559 is often called the *Sagittarius triplet*. M24, also called the Small Sagittarius Star Cloud, is a star cluster with an approximate magnitude of 3. About 9400 light-years away, it has a diameter of approximately 330 light-years.

Kid Spot Quiz Answers:

1) Ganymede
2) Eta Carinae

School Star Parties

The San Jose Astronomical Association conducts evening observing sessions (commonly called "star parties") for schools in mid-Santa Clara County, generally from Sunnyvale to Fremont to Morgan Hill. For those who are outside of that area, please see our suggestions on the SJAA webpage under 'Classes-Programs / School Star Party'
The co-coordinator for SJAA is Jim Van Nuland.
Please see the SJAA webpage for a step-by-step procedure for setting up a school star party.

SJAA Library

From Sukhada Palav

Stop by the book cabinet to check the SJAA library out next time you are Houge Park for one of our events! I hope our budding astronomers group will enjoy reading these books!!! For more information on SJAA Library, please check out - http://www.sjaa.net/sjaa-library/
If you have any questions or comments, I can be reached at: librarian.sjaa@gmail.com.

Advanced Loaner Telescope & QuickSTARt Programs

From Dave Ittner

http://www.sjaa.net/advanced-loaner-telescope-program/

The purpose of this program is for SJAA members to evaluate equipment they are considering purchasing or are just curious about. Check out the growing list of equipment below. Please note that certain items have restrictions or special conditions that must be met.
If you are an SJAA member and an experienced observer or have been through the SJAA Quick STARt program please contact Dave Ittner to request a particular item.
Please consider donating unused equipment – learn more about this on the SJAA website.

Fix-It Program

From Ed Wong

The FixIt session provides a place for people to come with their telescope or other astronomy gear problems and have them looked at. The session is held every first Sunday of the month, from 2 to 4 PM (coinciding with the Solar Observing sessions) at Houge Park.

The program has drawn so much traffic that requests now exceed resources. As a result, those who make a reservation will get priority. Appointments are needed for service in order for us to prepare what we need to bring in order to provide you with the best service possible. Appointment sign up cutoff time is Sat noon before the Sunday Fix It session.
Please Note: Fix it sessions are dedicated to fixing telescopes issues. We will no longer be able to disassemble telescopes to fix electrical issues or disassemble telescopes to clean mirrors or corrector plates (Time permitting, we may be able to give you instruction on how to do this on your own). Please fill out the form on the SJAA webpage under 'Classes-Programs / FixIt' to schedule an appointment to help us be better prepared to assist you.

From the Board of Directors

General Notices

One Board seat remains open. Contact Lee Hoglan [or any Board member] if interested.

Announcements

SJAA 60 Years Old

SJAA will be 60 years later this year. Keep an eye out for future announcements regarding commemorating the occasion.

Movie Night
Saturday, August 9th

The next General Meeting is the SJAA second annual Movie Night. The two movies are "Robinson Crusoe on Mars" and "Star Wars, Episode V: Empire Strikes Back". The event will be a drink/snack/dessert potluck and a popcorn machine is in the works.

Annual Show & Tell
Saturday, September 6th

Bring your pictures, any piece of equipment you put together, maybe an astronomy related trip you have taken; just about anything goes. This is your chance to show your stuff.

Board Meeting Excerpts July 12, 2014

In attendance

Rob Jaworski, Lee Hoglan, Dave Ittner, Rich Neuschaefer, Teruo Utsumi
Absent: (excused) Ed Wong, Greg Claytor, Michael Packer

Ephemeris Frequency / Mailing

The monthly Ephemeris publication is labor intensive. Ways to spread the work load and possibly changing the frequency to quarterly were discussed. SJAA by-laws related to the Ephemeris for frequency and hard copy versus web page will need to be reviewed. Mailing will be delegated to the printer to cut several hours off of the monthly work load.

Sixtieth (60th) Anniversary

The club will mark its 60th anniversary end of the year. Rob asked everyone to consider ways to commemorate the occasion. Currently, the month of December is open.

FixIt Program Changes

The program has drawn so much traffic that requests now exceed resources. Those who make a reservation will get priority. The focus will be on fixing equipment and not tutoring on equipment operation. How to accommodate members who require assistance on operating their equipment is open for discussion.

Astronomical League

Rob talked to Bob Jardine (TAC-AL chair) about the SJAA joining the AL. Bob said a coordinator is required but the effort is minimal. It was decided to move forward with the AL membership.

SJAA Contacts

President:	Rob Jaworski
Vice President:	Lee Hoglan
Treasurer:	Michael Packer
Secretary:	Teruo Utsumi
Director:	Greg Claytor
Director:	Dave Ittner
Director:	Ed Wong
Director:	Rich Neuschaefer
Director:	pending
Beginner Class:	pending
Fix-it Program:	Ed Wong
Imaging SIG:	pending
Library:	Sukhada Palav
Loaner Program:	Dave Ittner
Ephemeris Newsletter -	
Editor	Sandy Mohan
Production	Tom Piller
Publicity:	Rob Jaworski
Questions:	Lee Hoglan
Quick STARt	Dave Ittner
Solar:	Michael Packer
School Events:	Jim Van Nuland
Speakers:	Teruo Utsumi

E-mails: http://www.sjaa.net/contact.shtml

SJAA Ephemeris newsletter of the San Jose Astronomical Association, is published monthly

Articles for publication should be submitted by the 20th of the previous month.

San Jose Astronomical Association
P.O. Box 28243
San Jose, CA 95159-8243
http://www.sjaa.net/contact

Place
postage
here

San Jose Astronomical Association
P.O. Box 28243
San Jose, CA 95159-8243

Fold here

San Jose Astronomical Association Membership Form

P.O. Box 28243 San Jose, CA 95159-8243

☐ **New** ☐ **Renewal** (Name only if no corrections)

Membership Type:

☐ Regular — $20

☐ Regular with Sky & Telescope — $53

☐ Junior (under 18) — $10

☐ Junior with Sky & Telescope — $43

Subscribing to Sky & Telescope magazine through the SJAA saves you $5 off the regular rate. (S&T will not accept multi-year subscriptions through the club program. Allow 2 months lead time.)

☐ **I prefer to get the Ephemeris newsletter in print form (Add $10 to the dues listed on the left). The newsletter is always available online at:**

http://www.sjaa.net/sjaa-newsletter-ephemeris/

Questions? Send e-mail to
sjaamemberships@gmail.com

Bring this form to any SJAA Meeting or send to the address (above). Make checks payable to "SJAA", or join/renew at **http://www.sjaa.net/join-the-sjaa/**

Name: ______________________________

Address: ______________________________

City/ST/Zip: ______________________________

Phone: ______________________________

E-mail address: ______________________________