

ABOVE THE FOG

• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

Vol. 61, No. 7 - July 2013

GENERAL MEETING – JULY 17, 2013

Randall Museum . 199 Museum Way . San Francisco
7:00 pm Doors Open . 7:30 pm Announcements . 8:00 pm Speaker
SFAA's General Meetings occur on the 3rd Wednesday of each month (except January)

DAVID BLAKE, Ph.D., NASA Ames Research Center THE DEVELOPMENT OF THE CHEMIN MINERALOGY INSTRUMENT AND ITS DEPLOYMENT ON MARS (AND LATEST RESULTS FROM THE MARS SCIENCE LABORATORY ROVER CURIOSITY)



The CheMin instrument (short for “Chemistry and Mineralogy”) on the Mars Science Laboratory rover *Curiosity* is one of two “laboratory quality” instruments on board the *Curiosity* rover that is exploring Gale crater, Mars. CheMin is an X-ray diffractometer that has for the first time returned definitive and fully quantitative mineral identifications of Mars soil and drilled rock. I will describe CheMin’s 23-year development from an idea to a spacecraft qualified instrument, and report on some of the discoveries that *Curiosity* has made since its entry, descent and landing on Aug. 6, 2012, including the discovery and characterization of the first habitable environment on Mars.

David Blake received a B.S. in Biological Sciences from Stanford University in 1973. After a stint in the US Navy, he attended graduate school at the University of Michigan, where he received a Ph.D. in Geology & Mineralogy in 1983. He came to Ames Research Center as a NRC postdoctoral fellow and became a research scientist in the Exobiology Branch at Ames in 1989. He was the Exobiology Branch Chief from 2000-2004. In nearly 25 years of research at Ames, he has studied astrophysical ices, interplanetary dust, Mars meteorites, lunar soils, stratospheric soot and the geology and mineralogy of ancient habitable environments on Mars. He is the Principal Investigator of the CheMin XRD/XRF instrument on the Mars Science Laboratory rover *Curiosity*, and is a member of the Principal Science Group that directs the activities of *Curiosity* during its 2-year mission.

AUGUST MEETING – CHANGE OF DATE TO AUGUST 28

*Please note that due to a calendar conflict at the Randall,
San Francisco Amateur Astronomers August General Meeting
has been*

rescheduled to Wednesday, August 28

Doors open 7:00 p.m., 7:30 p.m. Announcements, 8:00 p.m. Speaker

PRESIDENT'S MESSAGE

Greetings Astronomy Fans!

Late June and early July mark the start of remote star party season for Bay Area amateur astronomers. Our season kicked off with our club's public viewing event at Glacier Point in Yosemite National Park on the weekend of June 29th. Husband Doug and I were first time attendees, and we enjoyed entertaining inquisitive park visitors. On our first night out I set up in an unfortunate location behind a tree that blocked my view of Saturn as the first object of the evening. An eager crowd gathered around me, but it was too bright for me to find faint fuzzes. Not knowing what else to show, I trained on Arcturus.

In my relatively rough repertoire of astronomy outreach skills, Arcturus is just a bright orangey star in Bootes. I wasn't expecting to impress anyone, but to my surprise Arcturus got me many WOW's, Whoa's, and Cools!. The crowd seemed to like how blazingly bright, sharp, and colorful it appeared in a 16" scope, and they appreciated some variety since many of our other volunteers were showing Saturn. An object that I expected to be a challenge to present without having done some research work ahead of time, sold itself. Crisis averted!

Many more stories about our viewing in Yosemite could be told, but instead I will move on to club administration. Last month a list of requests from Ranger Ryen relating to our observing or sharing views on Mt. Tamalpais, accidentally was omitted from the edition. Please refer to it in this month's edition.

Last month we said farewell to board member Dean Gustafson who moved away from the Bay temporarily to be with family. Dean's a master sidewalk astronomer and I hope he'll come back and join us. We welcome enthusiastic newcomer Suzie Huang as our new 2nd Alternate Board Member. Thanks for volunteering Suzie!

On another board related note, we are starting a four month trial period for holding board meetings virtually every other month, and will hold our July and September board meetings virtually. Like our in-person board meetings, virtual meetings during the trial are open for club members to attend. Let me know (sfaapresident@gmail.com) if you want to be invited to either of the two virtual meetings. In meeting virtually we hope to make it easier on board members who work Monday through Friday to attend, and, to free us up to join club members in socializing before the General Meeting and lecture. See you for the next General Meeting!

Wishing you clear, dark, and dry skies to view the Milky Way this summer.

ANGIE TRAEGER
President
San Francisco Amateur Astronomers
2013

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REQUESTS FROM RANGER RYEN FOR OUR MT. TAM OBSERVING NIGHTS

Greetings Mt. Tam observers! During a meeting with Ranger Ryen and Tinka Ross, Ranger Ryen passed along a few requests for our membership. One of them was completely news to me (Item #2 below), but after his explanation it makes perfect sense.

1. Display your parking placard BEFORE the rangers stop by to inspect our dashboards. The rangers are supposed to issue citations if we don't display a parking pass, and when they chase us down to ask for the passes they are only trying to be friendly and do us a favor. If you happen to forget to display your pass and the ranger asks you to display it, do so quickly. Stop your conversation, equipment setup, etc. and head to your car to get your parking pass.

To assist the rangers in speeding up their checks, you may find board members walking around during our members-only nights to remind folks to display passes. We'll also check for passes at the orange cone line during the Public Nights. (If you need to get your pass updated see the instructions on this page: <http://www.sfaa-astronomy.org/membership/>)

2. Please don't drive around the half closed Pantoll Gate, where the exit is open and the entrance is closed. (Yep, this is news to me -- Doug and I used to drive through the exit all of the time!) While the gate is half closed, the rangers are in the process of closing the park. Driving around the gate technically is a violation of some sort and the rangers protocol is to perform a "traffic stop" on anyone doing so. This takes up the rangers' time and is unnecessary.

If you encounter the gate half closed, wait at the bottom of the hill until the ranger comes back to close and fully lock up the gate. You can then show your parking pass and enter. Best practice is to arrive to Rock Springs before sunset.

3. For the Mt. Tam Public Nights, it is helpful to put small dim red led markers or glowy tape on the base of telescopes, especially on tripod legs. Both Ranger Ryen and Tinka report that the public is sometimes nervous about approaching a telescope because they can't see where the telescope is. When looking at the ground there is no sky to silhouette the equipment, like there is for navigating around people or an eyepiece at night time. Placing little markers on the legs or bottoms of the scope helps the public avoid having to use bright red lights in order to get around.

Some helpful advice can be found on this page from the SF Sidewalk Astronomers: <http://www.sfsidewalkastronomers.org/index.php?page=organizing-a-public-star-party>, particularly a link to the glow-in-the-dark-tape. http://www.scopestuff.com/ss_glot.htm.

Board members are currently researching glowing marker products that the club could potentially provide and/or sell in small quantities to club members.

4. For the Mt. Tam Public Nights, Ranger Ryen and Tinka thought it would be very nice if we could wear glowing name badges or a glowing club logo pin of some sort, so that the public knows who the "owner" of a scope is. Sometimes as the telescope owner we stand amongst members of the public, and it makes it easier for the public to ask us a question if we stand out from the crowd.

Board members are researching glowing badges -- we want to make something available that is not *too* bright. Stay tuned for an evening demo of badge samples in July or August.

Thanks all!

IMPORTANT DATES & UPCOMING SFAA VIEWING EVENTS

SFAA GENERAL MEETINGS & LECTURES

Randall Museum, 199 Museum Way (Near 14th Street and Roosevelt)

Third Wednesday of each month: 7:00 p.m. Doors open. 7:30 p.m. Announcements. 8:00 p.m. Speaker

SFAA BOARD MEETINGS IMMEDIATELY PRECEDE GENERAL MEETINGS AND BEGIN AT 6:00 P.M.

July 17, August 28, September 18, October 16, November 20, December 18

AUGUST MEETING – CHANGE OF DATE TO AUGUST 28

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RESCHEDULED to WEDNESDAY, AUGUST 28

Doors open 7:00 p.m., 7:30 p.m. Announcements, 8:00 p.m. Speaker

CITY STAR PARTY

http://www.sfaa-astronomy.org/star_parties/city/

2010 MT TAM SPECIAL USE PERMIT STAR PARTIES MEMBERS ONLY

SPECIAL USE PERMIT observing nights on Mount Tamalpais are private, open *only* to SFAA members. Please arrive by sunset. SFAA/Mt. Tam permit required for each car. We must vacate the mountain by 2:00 a.m. except on specially approved nights (such as Messier Marathon).

ALWAYS ON A SATURDAY

July 6, August 3, August 31, October 5, November 2, November 30

MT TAM PUBLIC STAR PARTIES (April through October)

Public nights on Mount Tamalpais start with a lecture in the Mountain Theatre followed by public viewing in the Rock Springs parking lot.

SFAA members may view privately after crowd departs from approx. 11 pm-2 am.

For more information: <http://www.sfaa-astronomy.org/starparties/>

July 13, Aug 10, Sept 7 and Oct 12

UPCOMING LECTURES

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August 28 - THE SECRET LIFE OF A METEORITE DEREK SEARS, SPACE SCIENCE AND ASTROBIOLOGY DIVISION, NASA AMES RESEARCH CENTER



It is clear that the chondritic meteorites - those having essentially solar composition - carry unique information about the origin and early history of the solar system and the materials from which the planets formed. Yet it is a highly complex record that centuries of work and highly sophisticated modern techniques have not been able to decipher. Even the most fundamental issues, the origin of the classes and the origin of their major component, the chondrules (that distinguish the meteorites from other materials), are still disputed. Here I argue that recent data from spacecraft on the nature of asteroid surfaces, advances in determining the chronology meteorites and their components, experiments flown on NASA's microgravity facility (the vomit comet), and the lunar samples returned from the Fra Mauro region of the Moon, make it clear that chondrules are impact melt spherules and the classes are caused by metal-silicate fractionation on asteroidal surfaces. In other words, the chondritic meteorites owe their major properties to asteroidal processes and that we must see through these to understand the information they carry about the early solar system and beyond.

Dr. Sears is a research scientist at NASA Ames Research Center. Until summer 2011, he was University Professor and W. M. Keck Professor at the University of Arkansas. His research interests involve laboratory studies of extraterrestrial materials, especially meteorites and lunar samples, mostly using thermoluminescence and cathodoluminescence. In the past he has performed instrumental neutron activation analysis and electron microprobe analysis. He has also worked on the surface processes occurring on Mars, asteroids and comets and has developed techniques to investigate these processes using microgravity and space simulation experiments. He has published three books and about 200 peer-reviewed research articles. Other interests include the history of meteoritics and planetary science and educational outreach, and he is the current editor of Meteorite magazine.

September 18 - BROWN DWARFS: THE SPECTROSCOPY OF SUBSTELLAR OBJECTS GIBOR BASRI



The most massive planet is nearly 6 times lighter than the least massive star. In between is the realm of brown dwarfs. In 1995 both the first brown dwarf and the first exoplanet were discovered. Since then we have found hundreds of each, and have learned quite a bit. Recent infrared surveys have now probed the whole sky to very faint levels. Recent discoveries include the coolest and closest brown dwarfs. This allows us to push to very cool objects - the spectral sequence has added 3 to the original 7: L, T, and Y dwarfs. We can actually see brown dwarfs, whereas exoplanets are almost all detected only indirectly. Brown dwarfs overlap in temperature with young massive exoplanets, so their spectra look much more like planets than stars. I will give a flavor of how spectroscopy can be used to study what the atmospheres and physical properties of such objects are like.

Gibor Basri has been a professor of Astronomy at UC Berkeley for more than 30 years. He is known as one of the discoverers of brown dwarfs, and an expert on low mass stars. In addition, he has contributed significantly to our understanding of star formation, and is now a member of the Kepler mission team which is searching for earth-sized exoplanets. Professor Basri has employed telescopes ranging from nearby Lick Observatory to the mighty Keck telescopes on Mauna Kea to space-borne telescopes like Hubble and Kepler. He has been awarded a Miller Research Professorship, and Sigma Xi Distinguished Lectureship. Basri has over 200 publications and 10,000 citations to his work, has given many public lectures and appeared on several television programs. He has long made promotion of science in underrepresented communities a mission, and is now the Vice Chancellor for Equity and Inclusion at Berkeley.

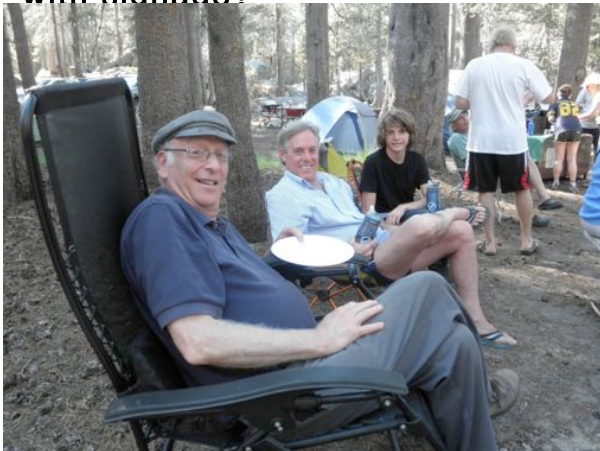
2013 YOSEMITE STAR PARTY AT GLACIER POINT – JUNE 28-29



The weather was good to us for our Yosemite trip this year, the potluck was over-the-top with too much food, the bears were unforgiving and disruptive at Glacier Point, and during Paul's evening talk, some of us got to hear and see a rockslide beneath us in the valley. The star party guests were inquisitive. I'll let the photos speak for themselves. Thanks to Anju, my buddy Josh, Elan, and especially Jorge for taking snapshots of the event. Angie



Can someone say, the club needs some help with signage?



Anthony, Doug and Elan

Left: Al, Bill and Wills



Anju, Cliff & Rita



Peter & Al



Paul & Will



Jorge & Elise



Setup



Waiting for dark



John's musician setup



Visitors checking out Half Dome



Paul's talk



Just after a rockslide

From Kenneth Frank --
JOHN DOBSON WILL TURN 98! IN SEPTEMBER

It's ever too soon to plan --



JOHN DOBSON'S 98th BIRTHDAY CELEBRATION

We will be celebrating John's 98th birthday with a day-long event on
Wednesday, September 18
at
Griffith Observatory
Los Angeles

In true sidewalk fashion, we'll be building a 12" telescope to use for observing the Moon that evening as part of the International Observe the Moon celebration.

There will be hands-on grinding for the public and any amateurs who want to get a work out. We'll also be assembling the mount so that everyone can see the entire telescope building process for themselves.

More info to come as we do the details. Maybe we can caravan down to LA.
If you cannot go and would like to give him a card of good wishes, just mail it to me:

773 Tiburon Blvd.
Tiburon, CA
94920

or post on facebook:
<http://www.facebook.com/Sidewalkastro?fref=ts>

As John would say:

"Over & Out"

NIGHT SKY NETWORK

July 2013 - THE EVENING SKY

July Sky Map: <http://skymaps.com/skymaps/tesmn1307.pdf>

July Sky Calendar: <http://skymaps.com/articles/n1307.html>

BAY AREA ASTRONOMY EVENTS

Kenneth Lum

<http://tech.groups.yahoo.com/group/bayastro/?v=1&t=directory&ch=web&pub=groups&sec=dir&slk=94>

BAY AREA REGULARLY SCHEDULED EVENTS

**EVERY FRIDAY NIGHT
7:00 PM – 10:00 PM
excluding major holidays**

**The Telescope Makers'
Workshop**

**CHABOT SPACE AND
SCIENCE CENTER
10000 Skyline Boulevard
Oakland, CA 94619-2450**

THE TELESCOPE MAKERS' WORKSHOP is held every Friday night from 7pm - 10pm, excluding major holidays (e.g. Christmas Day and New Year's Day) that fall on Fridays. The Workshop is always closed on Memorial Day Weekend. Attendance every Friday night is not mandatory, and members work at their own pace. The Workshop meets at Chabot Space & Science Center, 10000 Skyline Blvd., Oakland. Contact us for more specific details:

Contact: E-mail Richard Ozer (rozer@pacbell.net) or (510) 406-1914

**EVERY FRIDAY & SATURDAY
EVENING, weather permitting
7:30 PM – 10:30 PM**

**CHABOT SPACE AND
SCIENCE CENTER
10000 Skyline Boulevard
Oakland, CA 94619-2450
(510) 336-7300**

EXPLORE THE NIGHT SKIES AT THE CHABOT OBSERVATORIES

For more information:

<http://www.chabotspace.org/>

Free Telescope Viewing

Regular hours are every Friday & Saturday evening, weather permitting: 7:30pm -10:30pm
Come for spectacular night sky viewing the best kept secret in the Bay Area and see the magnificence of our telescopes in action!

Daytime Telescope Viewing On Saturday and Sunday afternoons come view the sun, moon, or Venus through Chabot's telescopes. Free with General Admission. (weather permitting)

12pm - 5pm: Observatories Open

**Sunset – 5:11 PM
(TWICE MONTHLY)**

**Inclement weather (clouds,
excessive wind and showers) will
cause the event to be canceled
without notice.**

**SAN MATEO COUNTY
ASTRONOMICAL SOCIETY
STAR PARTY**

STAR PARTIES AT CRESTVIEW PARK, SAN CARLOS

Come out and bring the kids for a mind expanding look at the universe

The City of San Carlos Parks and Recreation Department and the San Mateo County Astronomical Society has open Star Parties twice a month. These events are held in Crestview Park, San Carlos California. Note that inclement weather (clouds, excessive wind and showers) will cause the event to be canceled without notice.

For more information call Bob Black, **(650)592-2166**, or send an email to SMCAS@live.com or call Ed Pieret at **(650)862-9602**.

Reasons to Attend

If you have kids interested in space or planets bring them here for a real life view of planets, nebula, star clusters and galaxies. If you are thinking of buying a telescope or want help using a telescope you own, come here to talk with experienced users. If you think you might have an interest in astronomy come and talk to experienced amateur astronomers.

Cautions

Dress warmly and wear a hat.

Visitors should park on the street and walk into the park so your headlights don't affect the observer's dark adaptation. Only park in the parking lot if you are arriving before dark and plan to stay until the end of the event. You shouldn't need lights but if you feel you do, only bring a small flashlight with the lens covered using red cellophane or red balloon.

Please respect the telescopes and ask permission from the owner if you wish to touch.

Parents, please watch your children.

The park is residential, and adjacent to homes and backyards, please keep noise to a minimum.

Schedule Time

Astronomers arrive to set up at around sunset. Observing starts at about one hour after sunset and continues for two to three hours.

<p>EVERY CLEAR FRIDAY EVENING 9:00 PM – 11:00 PM</p> <p>FOOTHILL COMMUNITY COLLEGE OBSERVATORY 12345 Moody Road Los Altos Hills</p> <p>Cost: Free</p>	<p>Foothill Observatory is open for public viewing every clear Friday evening from 9:00 p.m. until 11:00 p.m. Visitors can view the wonders of the universe through the observatory's computer-controlled 16- inch Schmidt-Cassegrain telescope. Views of objects in our solar system may include craters and mountains on the moon, the moons and cloud-bands of Jupiter, the rings of Saturn, etc. Deep space objects including star clusters, nebulae, and distant galaxies also provide dramatic demonstrations of the vastness of the cosmos. The choice of targets for Any evening's viewing depends on the season and what objects are currently in the sky.</p> <p>The public viewing programs at Foothill are free of charge and are open to guests of all ages. Please note that the observatory is closed when the weather is cloudy. Also note that visitor parking permits are available from the machines in the parking lots for \$3.00.</p> <p>Come to Foothill Observatory and join us in the exploration of our Universe!</p> <p>Foothill Observatory is located on the campus of Foothill College in Los Altos Hills, CA. Take Highway 280 to the El Monte Rd exit. The observatory is next to parking lot 4. Parking at the college requires visitor parking permits that are available from the machines in the parking lots for \$3.00.</p>
<p>EVERY CLEAR SATURDAY MORNING OBSERVATORY 10:00 AM – 12:00 PM</p> <p>FOOTHILL COMMUNITY COLLEGE 12345 Moody Road Los Altos Hills</p> <p>Cost: Free</p>	<p>Solar observing with a Hydrogen alpha solar telescope every clear Saturday morning. This allows spectacular views of solar prominences and unusual surface features on the Sun not otherwise visible with regular white light telescopes. Admission is free.</p> <p>Foothill Observatory is located on the campus of Foothill College in Los Altos Hills, CA. Take Highway 280 to the El Monte Rd. exit. The observatory is next to parking lot 4. Parking at the college requires visitor parking permits that are available from the machines in the parking lots for \$ 3.00.</p>

BAY AREA EVENTS – JULY 2013

<p>Monday, July 15 7:30 PM – 9:00 PM</p> <p>CALIFORNIA ACADEMY OF SCIENCES 55 Music Concourse Drive San Francisco 94118</p> <p>Cost: \$12 General, \$8 Members</p>	<p>SPEAKER: DR JON JENKINS, SETI THE ONCE AND FUTURE KEPLER MISSION: HOT ON THE TRAIL OF HABITABLE EARTH-SIZE PLANETS</p> <p>Kepler vaulted into the heavens on March 7, 2009, initiating NASA's search for Earth-size planets orbiting Sun-like stars in the habitable zone, where liquid water could exist on the planetary surface and support alien biology. In the 4 years since, a flood of photometric data on upwards of 190,000 stars of unprecedented precision and continuity has provoked a watershed of 132+ confirmed or validated planets, 2700+ planetary candidates and a resounding revolution in our understanding of the behavior of stars. Recent discoveries include Kepler-62 with 5 planets total of which 2 are in the habitable zone, and are 1.4 and 1.7 times the radius of the Earth. Dr. Jenkins will highlight key science results from Kepler, and will also discuss the daunting challenges that faced the technical and scientific team as they designed, built and are now operating this amazing observatory. He will also give a brief overview of TESS, NASA's next mission to detect Earth's closest cousins.</p>
<p>Tuesday, July 16 12:00 NOON</p> <p>SETI INSTITUTE 189 Bernardo Ave Mountain View, CA 94043</p>	<p>SPEAKER: TAMARA MCDUNN, JET PROPULSION LABORATORY SETI INSTITUTE COLLOQUIUM SERIES: ATMOSPHERIC POLAR WARMING AT MARS</p> <p>This talk will cover two active areas of research in the field of martian atmospheric dynamics. The first is polar warming, a temperature enhancement over mid-to-high latitudes that results in a reversed (poleward) meridional temperature gradient.</p> <p>Dr. McDunn will show observations of polar warming over the ~30-90 km altitude range from the Mars Climate Sounder (MCS) instrument aboard the Mars Reconnaissance Orbiter. She will also present results of ongoing efforts to understand the drivers of this phenomenon (including topography, dust loading, and gravity wave breaking) using the Mars Weather Research and Forecasting global circulation model. The second topic of this talk will be semi-stationary waves masquerading as stationary waves. Stationary waves play a crucial role in the redistribution of heat from the equator to the high latitudes, significantly impact the atmosphere's stability, and impart acceleration on the mean flow of the middle-to-upper atmosphere.</p> <p>Using MCS observations, Dr. McDunn will show how the traditional technique used to identify stationary waves from orbital data limited to two local times does not discriminate against a type of wave that displays near-steady behavior on seasonal timescales yet undergoes significant variability on diurnal timescales (here referred to as "semi-stationary").</p> <p>https://plus.google.com/events/c9qa6oa1gispnc5iprg42m3fcg</p>

<p>Thursday, July 18</p> <p>7:00 PM – 9:00 PM</p> <p>LAWRENCE HALL OF SCIENCE 1 Centennial Drive Berkeley CA 94720</p> <p>Cost: Free</p>	<p>THE SEARCH FOR OTHER EARTHS</p> <p>With almost 3000 planet candidates discovered by Kepler since its launch in 2009, at no other time in history has the possibility of finding an Earth-like planet been so within our reach. Learn about the groundbreaking hunt for exoplanets and its implications for the search for life elsewhere.</p> <p>Speakers:</p> <ul style="list-style-type: none"> • Gibor Basri, Co-Investigator, NASA Kepler Mission; UC Berkeley Department of Astronomy • Natalie Batalha, Co-Investigator, NASA Kepler Mission; Professor of Physics and Astronomy at San Jose State University • Tori Hoehler, Research Scientist, Space Sciences & Astrobiology Division, NASA Ames • Andrew Fraknoi, moderator, Chair of Astronomy Department at Foothill College <p>Hosted by the Full Option Science System.</p> <p>Contact: Jessica Penchos Phone: 510-643-5145 Website: http://lawrencehallofscience.org/content/search_other_earths</p>
<p>Tuesday, July 23</p> <p>7:30 PM</p> <p>PANOFSKY AUDITORIUM SLAC NATIONAL ACCELERATOR LABORATORY 2575 Sand Hill Road Menlo Park 94025-7015</p> <p>Cost: Free</p>	<p>DEBBIE BARD, SLAC/KIPAC</p> <p>THE DARK ENERGY THROUGH EINSTEIN'S LENS</p>

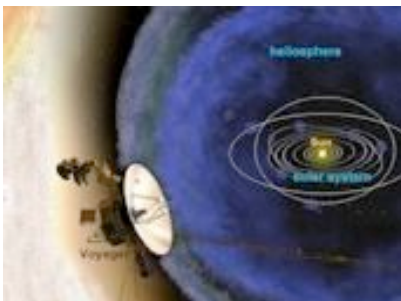
NASA SCIENCE CAST

The Science@NASA team is pleased to announce a new product: the ScienceCast. Every week, we produce a short video highlighting a topic in NASA science news. A complete list of ScienceCast episodes may be found on Science@NASA's Youtube channel: <http://www.youtube.com/user/ScienceAtNASA> . Enjoy!

NASA SCIENCE NEWS

<http://science.nasa.gov/science-news/>

VOYAGER I APPROACHES INTERSTELLAR SPACE



June 27, 2013: Three new papers published in today's issue of Science suggest that Voyager I, now more than 18 billion kilometers from the sun, is closer to becoming the first human-made object to reach interstellar space.

Data published in today's issue of Science suggest that Voyager I is nearing the edge of the heliosphere. [More](#)

"This strange, last region before interstellar space is coming into focus, thanks to Voyager I, humankind's most distant scout," said Ed Stone, Voyager project scientist at the California Institute of Technology in Pasadena.

Voyager I is near the edge of the heliosphere, a vast bubble made of the sun's own magnetic field. When Voyager punches through the bubble, it will exit the solar system and enter interstellar space--the realm of the stars.

The papers describe how Voyager I's recent entry into a region called "[the magnetic highway](#)" revealed two of three telltale signs of a breakthrough: charged particles disappearing as they zoom out along the solar magnetic field, and cosmic rays from far outside zooming in. Scientists have not yet seen the third sign, an abrupt change in the direction of the magnetic field, which would indicate the presence of the interstellar magnetic field.

"If you looked at the cosmic ray and energetic particle data in isolation, you might think Voyager had reached interstellar space," says Stone, "but the team feels Voyager 1 has not yet gotten there because we are still within the domain of the sun's magnetic field."

Voyager 1 and its twin spacecraft, Voyager 2, were launched in 1977. They toured Jupiter, Saturn, Uranus and Neptune before embarking on their interstellar mission in 1990. They now aim to leave the heliosphere. Measuring the size of the heliosphere is part of the Voyagers' mission.

Voyager 2 is about 9 billion miles (15 billion kilometers) from the sun and still inside the heliosphere. Voyager 1 was about 11 billion miles (18 billion kilometers) from the sun Aug. 25 when it reached the magnetic highway, which appears to connect the spacecraft to interstellar space. This region allows charged particles to travel into and out of the heliosphere along a smooth magnetic field line, instead of bouncing around in all directions as if trapped on local roads. Voyager 1 can therefore sample interstellar space before it actually enters the new realm.

Scientists do not know exactly how far Voyager 1 has to go to reach interstellar space. They estimate it could take several more months, or even years, to get there. The arrival could come at any time, so stay tuned.

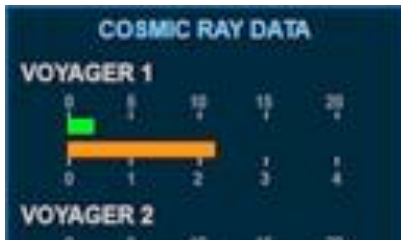
For more information about the Voyager spacecraft mission, visit: <http://www.nasa.gov/voyager> and <http://voyager.jpl.nasa.gov> .

Credits:

Production editor: [Dr. Tony Phillips](#) | Credit: [Science@NASA](#)

More information:

The Science papers focus on observations made from May to September 2012 by Voyager 1's cosmic ray, low-energy charged particle and magnetometer instruments, with some additional charged particle data obtained through April of this year.



A gauge on the Voyager home page tracks levels of two of the three key signs scientists believe will appear when the spacecraft leave our solar neighborhood and enter interstellar space. [Check it out](#)

Upon entering the magnetic highway, "we saw a dramatic and rapid disappearance of the solar-originating particles. They decreased in intensity by more than 1,000 times, as if there was a huge vacuum pump at the entrance ramp onto the magnetic highway," said Stamatios Krimigis, the low-energy charged particle instrument's principal investigator at the Johns Hopkins University Applied Physics Laboratory in Laurel, Md. "We have never witnessed such a decrease before, except when Voyager 1 exited the giant magnetosphere of Jupiter, some 34 years ago."

Other charged particle behavior observed by Voyager 1 also indicates the spacecraft still is in a region of transition to the interstellar medium. While crossing into the new region, the charged particles originating from the heliosphere that decreased most quickly were those shooting straightest along solar magnetic field lines. Particles moving perpendicular to the magnetic field did not decrease as quickly. However, cosmic rays moving along the field lines in the magnetic highway region were somewhat more populous than those moving perpendicular to the field. In interstellar space, the direction of the moving charged particles

is not expected to matter.

In the span of about 24 hours, the magnetic field originating from the sun also began piling up, like cars backed up on a freeway exit ramp. But scientists were able to quantify that the magnetic field barely changed direction -- by no more than 2 degrees.

"A day made such a difference in this region with the magnetic field suddenly doubling and becoming extraordinarily smooth," said Leonard Burlaga, the lead author of one of the papers, and based at NASA's Goddard Space Flight Center in Greenbelt, Md. "But since there was no significant change in the magnetic field direction, we're still observing the field lines originating at the sun."

NASA's Jet Propulsion Laboratory, in Pasadena, Calif., built and operates the Voyager spacecraft. California Institute of Technology in Pasadena manages JPL for NASA. The Voyager missions are a part of NASA's Heliophysics System Observatory, sponsored by the Heliophysics Division of the Science Mission Directorate at NASA Headquarters in Washington.

OPPORTUNITY'S IMPROBABLE ANNIVERSARY

July 1, 2013: When NASA's Mars rover Opportunity blasted off from Cape Canaveral in 2003, many onlookers expected a relatively short mission. Landing on Mars is risky business. The Red Planet has a long history of destroying spacecraft that attempt to visit it. Even if Opportunity did land safely, it was only designed for a 3-month mission on the hostile Martian surface.

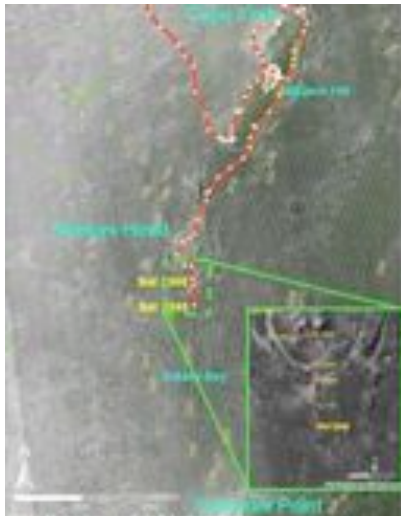
Few, if any, imagined that Opportunity would still be roving the red sands of Mars--and still making discoveries--ten years later. On July 7, 2013, Opportunity celebrates the 10th anniversary of its launch and more than 9 years on Mars.



A new ScienceCast video celebrates the improbable 10th anniversary of Mars rover Opportunity. [Play it](#)

Opportunity is celebrating by driving. The rover is currently en route to "Solander Point," a place on the rim of Endurance Crater where a treasure-trove of geological layers is exposed for investigation.

After nine-plus years of traveling, Opportunity recently set the US space program's all-time record for mileage on another planet. The milestone occurred on May 15, 2013, when the rover drove 80 meters, bringing its total odometry 35.760 kilometers or 22.220 miles.



A map of Opportunity's planned traverse from Cape York to Solander Point. [Larger image](#)

The previous mark had been held by the Apollo 17 moon rover, which astronauts Gene Cernan and Harrison Schmitt drove for 35.74 km (22.21 miles) across the lunar surface in December 1972.

Over the years, Opportunity's travels have been punctuated by hundreds of stops to photograph and sample the Martian landscape. The surface of Mars of today is bone dry and hostile to life as we know it. Opportunity's mission is to hunt for places where it wasn't always so, places where ancient water might have nourished life forms native to Mars.

So far so good; the rover has found abundant evidence that liquid water was once present. For the past 20 months, Opportunity has been "working" the rim of Endeavour Crater. There, Opportunity found deposits of gypsum probably formed from groundwater seeping up through cracks in Martian soil. Also, Opportunity has also found signs of clay minerals in a rock named "Esperance".

"A lot of water moved through this rock," says Steve Squyres of Cornell University, principal investigator for the mission. "These results are some of the most important findings of our entire mission."

Solander Point, where Opportunity is heading now, has two key attractions:

For one thing, while Opportunity's most recent stop, Cape York, exposed just a few meters of geological layering, Solander Point exposes roughly 10 times as much. A visit to Solander Point will be like reading a Martian history book.

Second, and perhaps more importantly, there are north-facing slopes at Solander Point where the rover can tilt its solar panels toward the sun and ride out the coming winter. The minimum-sunshine days of this sixth Martian winter for Opportunity will come in February 2014.

If Opportunity survives another year--and who now would bet against it?--the rover might yet break the all-time extraterrestrial driving record set by Lunokhod 2, a Soviet robotic vehicle that traveled an estimated 26 miles (42 km) across the Moon in 1973.

After that lies the 26.2 mile mark. In other words, stay tuned for the first Martian Marathon.

To follow Opportunity and other rovers on Mars, please visit <http://marsrovers.jpl.nasa.gov/>

Credits: Author:[Dr. Tony Phillips](#) | Production editor: [Dr. Tony Phillips](#) | Credit: [Science@NASA](#)

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The SFAA owns eight very fine, easy to use, loaner telescopes well-suited for deep sky, planets, and star parties. All scopes are available to any SFAA member. The loaner custodians for the majority of our fleet are Pete & Sarah Goldie. Please contact them at telescopes@sfaa-astronomy.org for details if you are interested in borrowing a scope or if you have items you can donate for the loaner program (eyepieces, star maps/books, red flashlights, collimator, etc.). Please contact the appropriate member indicated below if you are interested in borrowing one of the telescopes.

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- 2) 8" f/7 Dobsonian/Pete Goldie
- 3) 8.5" f/6 Dobsonian/Pete Goldie
- 4) 10" f/8 Dobsonian/Pete Goldie
- 5) 114mm f/4 Newtonian StarBlast/Pete Goldie
- 6) 8" f/10 Celestron SCT/Annette Gabrielli/ annette@sfaa-astronomy.org
- 7) 8" f/10 Meade SCT/Stefanie Ulrey/treasurer@sfaa-astronomy.org
- 8) 9.5" f/5.6 Celestron Newtonian/Ken Frank/ ken@sfaa-astronomy.org

CLUB ASTRONOMY VIDEOS

The SFAA owns a series of astronomy videotapes featuring Alex Filippenko, a world-renowned professor of astronomy at UC Berkeley. The videotapes provide an introduction to astronomy and cover topics such as the Solar System, the lifecycles of stars, the nature of galaxies, and the birth of the Universe. The SFAA loans the tapes free to all members. If you are interested in viewing these tapes, you may check them out at any of the SFAA General Meetings. These tapes were kindly donated to the SFAA by Bert Katzung. For information on the course tapes themselves:

<http://www.teach12.com/tc/assets/coursedescriptions/180.asp>

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Membership is billed for each upcoming year on June 30. Members may receive no more than one bulletin after the expiration of membership.

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