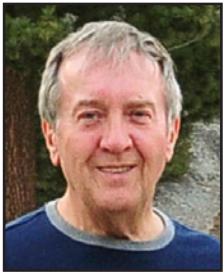


Sonoma Skies

Newsletter of the Sonoma County Astronomical Society
A nonprofit scientific and educational organization

October 2011 www.sonomaskies.org Volume XXXIV No. 10



President's Message

Hello SCAS Members,
We are three-quarters of the way through the year 2011 and the end is rushing quickly to confront us. It will be 2012 in three months, and the Mayan calendar may or may not portend the end of what we know to be real.

The Position of SCAS President is Open: After two years as SCAS president, I have determined that two is the magic number and a new president must emerge from our ranks to assume this good duty. Currently, no one board member has expressed an interest in his or her elevation to the great ranking.

However, with the full realization that the change is indeed imminent, minds may bend and change and see the opportunities and glory that lie in assuming the duties and obligations of being the SCAS president. We will discuss this at the next meeting.

2012 Calendars and Guides: In the meantime, the coming of 2012 also means that those of us who need guides and inspiration to see our way through the nebulousity of the New Year will surely need one or both of the following:

- The 2012 RASC astronomical calendar, est. price \$12.00
- The RASC Observer's Handbook, est. price \$18.00.

I am going to order these and will assume that we will have a demand for 20 of the former and 10 of the latter.

It will be a pure supply and demand situation and those who email to tell me that they most emphatically want one will go to the top of the list.

I might even be able to have them in time for the October 12 meeting, but I rather doubt it. So, make-my-day and let me know if you need to see what is in the stars for you in 2012.

Clear Skies!

—Len Nelson, SCAS President

Comets and Habitability

with Kamal S. Prasad, NASA Outreach, SSU
SCAS October 12 Meeting, 7:30 PM
at Proctor Terrace School

Occasionally people have looked up into the night sky and seen strange, glowing objects trailing luminous tails behind them as they move slowly among the stars. Sometimes they have terrified people with their mysterious comings and goings, but always brought some sense of awe and wonder. Ever thought that comets may have had something to do with life arising on earth? Our October 12 speaker has, and he is coming to share his thoughts and the subject with us. Come meet Kamal Prasad of Sonoma State University and hear what he has to say about comets!



You may have heard the expression, "follow the money" when trying to sleuth out influences on...well a lot of things that affect the outcome of all sorts of things. When we look for where life might exist, we might similarly say, "follow the water."

It seems that life as we can conceive of it depends on a planet having liquid water (the "Goldilocks zone"). Or as last month's speaker Chris McKay pointed out, at least some sort of fluid for alien life. Well what distinguishes our planet? Of course, it has a lot of water, and therefore a lot of life! So if life depends on water, where did it all come from? Some people believe that at least some water on our planet came from those "dirty snowballs" flying around our solar system, hitting our earth and releasing their water and maybe some other stuff that life depends upon to arise and survive.

Kamal S. Prasad got his undergraduate degree in Physics from University of California, Santa Cruz with minors in Astronomy and Education. He has taught high school physical science and written a science picture book about gravity. He works at the NASA Education and Public Outreach group at Sonoma State University. Outside of work, he is an environmental and animal rights activist.

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2012 Striking Sparks Sponsors Wanted

There is an opportunity for you or your organization to sponsor a telescope and participate in this worthwhile program. The cost to sponsor a “Striking Sparks” telescope is \$250. Contact Larry McCune, Striking Sparks Coordinator, at: [llmccune\(at\)comcast.net](mailto:llmccune(at)comcast.net)

This will be the 27th year of the program, and so far over 240 telescopes have been awarded to Sonoma County students. Our program’s goal is to focus science and astronomy interest in Sonoma County students.

For the 2011-2012 school year, we will be awarding the contest winners telescopes at the Wednesday, March 14, 2012 SCAS meeting at Proctor Terrace Elementary School.

Students who have been nominated by their teachers or by SCAS members, write essays about their interest in astronomy, and attend SCAS meetings or the Robert Ferguson Observatory between now and February 8, 2012, are eligible to enter the contest. All contest entries must be postmarked no later than Saturday, February 18, 2012. For more information on the program, see www.sonomaskies.org.

—Larry McCune, SCAS Striking Sparks Coordinator

SDO Discovers Solar Flare Aftershocks

NASA’s Solar Dynamics Observatory (SDO), the topic presented to SCAS by HMI Principal Investigator, Dr. Philip Scherrer in May 2011, discovered solar flare aftershocks this month.

According to NASA, about 1 in 7 flares experience an “aftershock.” About ninety minutes after the flare dies down, it springs to life again, producing an extra surge of extreme ultraviolet radiation. “We call it the ‘late phase flare,’” says Tom Woods, University of Colorado physicist. “The energy in the late phase can exceed the energy of the primary flare by as much as a factor of four.” The extra energy from the late phase can have a big effect on Earth. Extreme ultraviolet wavelengths are particularly good at heating and ionizing Earth’s upper atmosphere. When our planet’s atmosphere is heated by extreme UV radiation, it puffs up, accelerating the decay of low-orbiting satellites. Furthermore, the ionizing action of extreme UV can bend radio signals and disrupt the normal operation of GPS.

We have been watching solar flares since they were first observed in September 1859. SDO was able to make the discovery, 152 years later, because of its unique ability to monitor the sun’s extreme UV output in high resolution nearly 24 hours a day, 7 days a week. For more on this topic, be sure to see the NASA ScienceCast: http://www.youtube.com/watch?v=0_krMthM_rl or the original research paper: <http://iopscience.iop.org/0004-637X/739/2/59>.

And for more on SDO, please see the article in the September 2011 issue of Sonoma Skies.

—Adapted by R.K. Koslowsky, SCAS Member, from NASA’s “The Secret Lives of Solar Flares,” September 19, 2011

Comets and Habitability (from page 1)

So be sure and come to the next meeting while we discuss the wonder of comets, and meet Mr. Prasad, one of SSU’s most recent denizens of their very successful and worthwhile public outreach program. As usual, Proctor Terrace School, Wednesday October 12th at 7:30 p.m.

—John Whitehouse, SCAS VP

Ottewell Calendars

Lynn Anderson will be placing a group order for the popular Ottewell Astronomical calendars. See <http://www.universalworkshop.com/AC.htm> to view the 2012 edition.

Cost for the group order is anticipated to be \$18.95 each. Please get your order to Lynn at [astroman\(at\)sonic.net](mailto:astroman(at)sonic.net) by October 5.

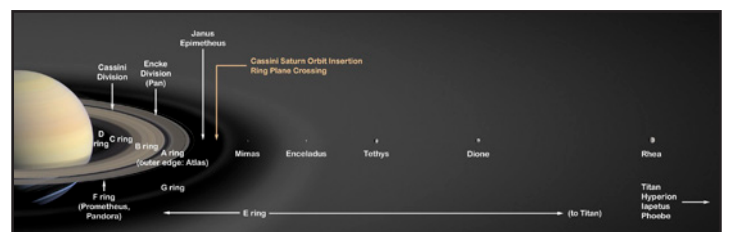
Why Can’t Mimas Be More Like Enceladus?

On May 25, 2011, Mountain View, California’s SETI hosted a very energetic talk by Bill McKinnon [1], a planetary scientist visiting from Washington University, St Louis, Missouri. McKinnon’s interest lies with the outer planets of our solar system and he infers planetary dynamics from the data gathered by Voyager, Galileo, and Cassini.

McKinnon began his lecture by suggesting his talk was a “tale of two satellites. Pity poor Mimas,” he implored. The ‘that’s no moon’ moon of Saturn ought to be as famous as its sibling, Enceladus. All other things being equal, Mimas should be more strongly tidally heated than Enceladus, but this is not the case. McKinnon started his review of the latest Cassini findings for both moons, including the astonishing heat flow radiating from Enceladus’s south pole. It turns out that Mimas’ lack of geologic activity is no surprise — the real question is how does Enceladus support its heat flow, active tectonics, and erupting plumes? Episodicity may be key, but even more radical notions have been proposed. These ideas, and new ones, were discussed as a result of a May 23-24 Enceladus Workshop, held at the SETI Institute.

Both Mimas and Enceladus are located in Saturn’s E ring [2]. Enceladus is Saturn’s sixth largest satellite with a 500-kilometer diameter and it’s the most reflective body in the solar system. It is quite smooth, especially on its south side, apparently lacking in craters. Mimas, on the other hand, is Saturn’s seventh largest satellite with a 400-kilometer diameter that is also bright in appearance, but not as bright as Enceladus. Impact craters pocket the planet everywhere. Most notable is the large, 140-kilometer-wide, Herschel crater.

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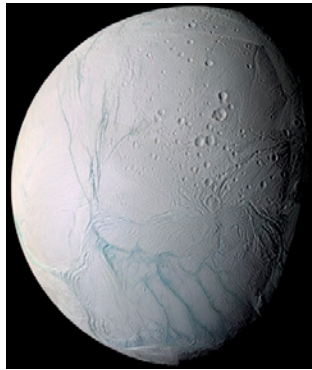


Saturn’s E ring expanse, courtesy of NASA

Enceladus and Mimas *(from page 2)*

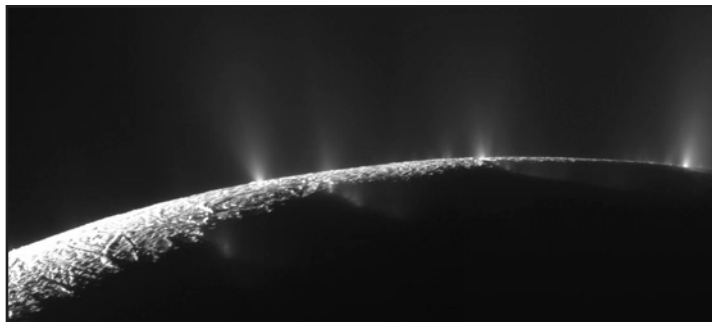
Enceladus

While Mimas has an older, cratered surface, Enceladus possesses a youthful, geologically active landscape. Enceladus's 'smooth' south pole features four fissures, called 'tiger stripes,' which are "warm," and the source of eruptions of water vapor and fine icy particles. The geyser-like eruptions create plumes near the south pole of Enceladus. The spray of vapor and icy particles are also the source of the material in Saturn's E ring, which encompasses the orbits of most of the icy satellites. These discoveries have been made by Voyager 2 and Cassini. Note the image below, courtesy of NASA's Cassini [3].



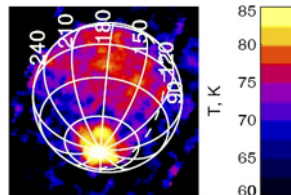
Enceladus; note the relatively smooth, bright surface and the tiger stripes near the south pole of this mosaic image.

All of the activity on the satellite occurs around the south pole. Micron-sized dust particles, like the consistency of toner cartridge particles, are found in the plumes and cover portions of the surface in something like 'snow.' Enceladus's hot spot is centered on the south pole. The four big tiger stripes are very active. They are like rifts and troughs and the region is intensely deformed. Note the image below, showing Enceladus's icy volcanism, courtesy of NASA's Cassini space probe [3].



Enceladus; note the geysers spewing water vapor and icy particles from the south pole (image inverted)

Cassini researchers sought to discover how much heat is emitted from Enceladus. They noted that the heat signature follows the tiger stripes along its features. Eight major point sources [4], in particular, are the cause for the icy volcanism. The data revealed that the total heat flow is on the order of 15.8 gigawatts, which is about 225 milliwatts per square meter, averaged over the whole south pole region, which is a huge number relative to Earth's smaller average outflow of 90 mw/m². Peak temperatures of 180 to 200 degrees Kelvin were noted, which allows eutectic melting of water-ammonia (H₂O-NH₃) ice, with a lower melting temperature of 176 degrees Kelvin, inside the moon.



Enceladus; note the hot spot at the south pole as recorded by Cassini's CIRS in 2006 [3]

The best flyby to date for collecting Enceladus composition data was flyby E5 on October 9, 2008. Cassini flew through the plumes along the south pole and UVIS detected water while INMS data

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The SCAS Astronomer

by Herb Larsen



What could I do? She needed fresh wool of bat and owlets wings.

SCAS cartoonist Herb Larsen can be contacted at hlarseni@yahoo.com

WELCOME, NEW MEMBER

The SCAS wishes to welcome new member Jim Goodenough.

SOCIAL AMENITIES

Many thanks to Emilio Ricci for providing refreshments, and to Jim DeManche for acting as greeter at the September meeting.

Scope City

NEW MEMBER BONUS!

Scope City at 350 Bay Street, San Francisco, is offering a **\$25 merchandise discount to new members.**

Manager Sam Sweiss has supported SCAS and Striking Sparks and offers a huge selection of telescopes, accessories and more. Obtain a receipt from Dickson Yeager, Membership Director, showing you have paid the \$25 SCAS membership dues. To arrange for your merchandise discount, contact Sam at 415/421-8800 or at <http://www.scopecity.com>

Events

ROBERT FERGUSON OBSERVATORY

Public Observing Night

Saturday, October 29

Solar Viewing: Noon - 4:00 PM

Night Viewing begins 7:00 PM

(Please arrive before 10:00 PM)

The Observatory features four telescopes: A 14-inch SCT with CCD camera in the East wing, an 8-inch refractor under the dome, a radio telescope for observing Sun activity, and a 24-inch reflector in the West wing. SCAS members* may set up telescopes in the observatory parking lot to assist with public viewing. Auto access closes at dusk; late arrivals must carry equipment from the horse stable parking area.

Fees: No admission fee for solar viewing; donations are appreciated. Observatory night viewing fee: \$3 for adults 18 and over; children admitted free. The Park charges \$8 per vehicle for entry at all times. Info: www.rfo.org

***Note:** Unless you are a current RFO volunteer, you are expected to pay Park and RFO fees. SCAS and RFO are separate organizations and we pay fees and dues accordingly. Members who arrive before dark to set up a telescope with the intent of serving the public are considered temp-volunteers and need not pay the RFO fee.

Night Sky Classes—Fall Series

Upcoming Sessions

Oct. 18, Oct. 25, Nov. 22, Nov. 29

Classes begin at 7:00 PM. Series of six sessions. Each class includes a lecture on the constellations of the season, their history and mythology, and how to find stars and deep sky objects within them. Includes observing.

Fees: \$75 for the series. (Single session fee is \$23). 10% discount for VMOA members. Classes are held at the Observatory. For information or to register: (707) 833-6979, [nightsky\(at\)rfo.org](mailto:nightsky(at)rfo.org)

RENT THE FERGUSON OBSERVATORY!

Groups of up to 50 can be accommodated. Astronomer docents provide sky interpretation and operate telescopes, and you can stay up as late as you want! Make your reservation at least two weeks prior to your event. Best times for optimal sky gazing are around a week away from a Full Moon.

For information or to make a reservation, visit www.rfo.org or email George Loyer: [gloyer\(at\)rfo.org](mailto:gloyer(at)rfo.org).

SRJC PLANETARIUM

“And This is Our Moon” through October 6

“Nebulae, Clusters, the Winter Sky”
begins October 21

During winter months the Sun is below the horizon more than 12 hours in Sonoma County. On these longer cool clear nights we have ample opportunity to observe our beautiful winter nighttime sky. We'll tour our traditional winter sky and more definitively discover winter's beautiful deep space nebulae and clusters. We'll travel through interstellar space to see star forming regions, young and old stellar clusters, and other distant objects in our winter sky.

Show times: 7:00pm Fridays & Saturdays, 3:00pm Sundays. Admission is \$5 General & \$3 Students and Seniors (60+). Cash only, please.

“First Friday Night Sky”—Oct. 7 at 7:00 and 8:30 PM: Admission Free. Focus is on the stars, constellations, planets and other interesting facts about the current night sky.

No planetarium show that night.

Seating is on a first-come, first-served basis; so arrive early enough to pick up your free parking permit, return it to your vehicle, and arrive back in the planetarium by the scheduled start time. Info: 527-4372, <http://www.santarosa.edu/planetarium/>



MT. TAMALPAIS ASTRONOMY

Oct. 1, 7:30PM: “Milky Way Galaxies Across the Universe”—Dr. Anne Metevier, UC Santa Cruz/Sonoma State University

The universe contains many vast galaxies containing stars, gas, and dust. What do we know about the formation and evolution of galaxies most like our own Milky Way?

Free and open to the public. Families and students encouraged to come. Presentations held in the Mountain Theatre. Viewing afterwards in Rock Springs Parking Area, provided by San Francisco Amateur Astronomers. Dress warmly and car pool if possible. Bring a flashlight! Info: 415/455-5370; <http://www.mttam.net/>

SSU OBSERVATORY PUBLIC VIEWING

Oct. 21, 8:00-10:00 PM: “The Blue Snowball”

Observatory located inside the stadium area at the SE corner of campus (E. Cotati Ave. and Petaluma Hill Rd., two miles east of US 101). Follow signs to campus. Parking Lot F is most convenient. Call 707/664-2267 if it appears weather may force cancellation.

<http://www.phys-astro.sonoma.edu/observatory/pvn.html>

Events

Community Outreach Event Horizons

School Star Party Season is Upon Us

Two successful school star parties occurred on September 22nd & 23rd.

The evening of Thursday the 22nd, Lynn Anderson, Loren Cooper, Walt Bodley, John Whitehouse and SPARKS winner, Conner Nielson, provided telescope viewing for approximately 150 students and their family members on the playground of Guerneville Elementary School. Twilight lingered for what seemed to be too long, since there were no bright planets or a crescent moon to view while waiting for the brightest M-objects to be visible.

The following afternoon, there was only one star to view and Len Nelson and Eric Swanson set up an h-alpha and a neutral density telescope for the annual Strawberry School Walk-A-Thon, which was titled "Space Walk" this year. Sparks winner Andrew Wong and his mother Lynda (photo at right) were also on hand to show off the Sparks telescope and promote the Striking Sparks program. About 100 viewers took advantage of the opportunity to view our nearest star.



The Sept. 29 Star Party at Monte Rio Elementary was cancelled due to heavy fog that rolled in in the afternoon.

The Sept. 29 Meadow Elementary (Petaluma) event had about 70 people attending. Eric Swanson and Len Nelson were joined by Young Astronomers Blaine Eldred and Conrad Smith, with their telescopes. The 2-day Moon was visible through high clouds, along with one Iridium flare. The lack of clear sky gave us time to talk about types of scopes, and overall the event was well received.

Upcoming: In October, we are scheduled to be at Grant Elementary (Petaluma) on Tuesday the 18th, Rincon Valley Middle School on the 20th and at Whited Elementary School (Rincon Valley) on Wednesday the 26th. All three of these campuses have brought out a good crowd of interested viewers in past years. We also have another Rincon Valley school, Austin Creek, scheduled for Wednesday, November 2nd.

We have one "good" week without a single star party scheduled – well, a half week. The Monday, Tuesday and Wednesday before Thanksgiving has become available as the school that had previously booked that Tuesday has re-scheduled. If you know of a teacher who might be interested in scheduling a star party, have them get in contact with me at the email listed below. Since we are attempting to schedule more than one star party during any week, other weeks are available, but it would be too complex to describe those within this article.



If you have an interest in participating in public astronomy and are not already on the volunteer list, contact Lynn at [astroman\(at\)sonic.net](mailto:astroman@sonic.net) to receive email announcements about upcoming volunteer opportunities.

—Lynn Anderson, SCAS Director of Community Activities

SONOMA STATE UNIVERSITY SERIES "WHAT PHYSICISTS DO"

Mondays at 4:00 PM

Darwin Hall Room 103 (Coffee at 3:30 PM)

Oct. 3: "Planning for a Business Career with a Physics Degree: The basics to succeed that an MBA may not teach you"—Zeynep (Zee) Hakimoglu, CEO, ClearOne Communications

Oct. 10: "Cancer+Physics: Mice, Dice, and Faster Than Light Particles"—Nicole Ackerman, Stanford University

Oct. 17: "Astronomy Education"— Dr. Ed Prather
University of Arizona

Oct. 24: "Low Cost Manufacturing of High Quality Solar Grade Silicon for Photovoltaics"— Dr. Bill Imler, Squirrel Hill Associates

Oct. 31: "Dimensional Analysis"— Dr. Joe Tenn, Sonoma State University (Emeritus)

Information: <http://phys-astro.sonoma.edu/wpd/>

MORRISON PLANETARIUM DEAN LECTURE SERIES

Oct. 17, 7:30 PM: "Tiny But Powerful: The Smallest Supermassive Black Holes"—Dr. Jenny Greene, Department of Astrophysical Sciences, Princeton University

Supermassive black holes, with masses of millions to billions of times that of our own Sun, are found lurking at the centers of most nearby large galaxies. But which came first, the black hole or the galaxy? Dr. Greene will talk about the search for the smallest supermassive black holes today, and what they teach us about the first black holes.

Lectures sell out early, so reserve now. Call 800-794-7576 for reservations. Adults \$12, Seniors \$10, Members \$6. <http://www.calacademy.org/events/lectures/>

TAYLOR OBSERVATORY

Located in Kelseyville off Highway 29

Oct. 15, 8-11 PM: Public Event

Evening event includes lecture, planetarium show and telescope viewing. These events are held even in cloudy or rainy weather, although telescope viewing will not be possible. There is a suggested donation of \$3 per person. No reservation required. Info: 707/262-4121 or <http://www.taylorobservatory.org>

Events

SETI INSTITUTE COLLOQUIUM

Oct. 5, 7:00pm: “Detecting Circumbinary Planets”—Laurance Doyle, SETI Institute

We discuss several techniques for the detection of circumbinary planets (CBP, planets that circle two stars at once). This involves detection by transits (which in the case of CBP produce a quasi-periodic signal), eclipsing binary (EB) timing, dynamical timing of EBs, and a new detection technique called the “eclipse echo” EE method. With all these acronyms the detection of CBP around EBs with the EE method should make NASA happy. :)

Oct. 12, 12:00pm: “Earth science collaborative for ecological forecasting”—Ramakrishna Nemani, AMES

There is increasing pressure on the science community not only to understand how recent and projected changes in climate are likely to impact our global environment and the natural resources on which we depend, but also to design solutions to mitigate or cope with the likely impacts. Responding to this multi-dimensional challenge requires new tools and research frameworks that assist scientists in collaborating to rapidly investigate complex, interdisciplinary science questions of critical societal importance.

I will describe one such collaborative research framework, funded through the American Recovery and Reinvestment Act, within the National Aeronautics and Space Administration Earth sciences program called NASA Earth Exchange (NEX). NEX combines state-of-the-art supercomputing, Earth system modeling, remote sensing data from NASA and other agencies, and a scientific social networking platform to deliver a complete work environment in which users can explore and analyze large Earth science data sets, run modeling codes, collaborate on new or existing projects, and share results within and/or among communities. Through NEX we hope to lower the barrier of entry to data/compute intensive science and provide a mechanism for continuous engagement among members of the global change science community.

Oct. 19, 12:00pm: “The oxygen isotopic composition of the Sun: implications for solar nebula chemistry”—Kevin McKeegan, UCLA

We have measured the oxygen isotopic composition of the solar wind, captured and returned to Earth by NASA’s Genesis mission. The data demonstrate that the Earth, Moon, Mars, and bulk meteorites are depleted in ^{16}O by $\sim 7\%$ relative to the bulk solar system in a non-mass-dependent manner. Gas phase photochemistry, occurring either in the solar nebula or in its progenitor molecular cloud, is most likely responsible for changing the isotopic composition of planetary materials in the inner solar system prior to planetesimal accretion. Understanding how, when, and where the rocky planets acquired an isotopic composition distinct from the average composition of the dust and gas from which the solar system formed is a major challenge for the science of planetary origins.

Oct. 26, 12:00pm: “Living with a Star - dangerously”—Friedemann Freund, SETI Institute

The sun “talks” to the Earth. One channel, still poorly understood, involves the ionosphere. The ionosphere interacts magnetically with the solid Earth, reaching deep into the crust, generating forces that can trigger earthquakes. Before major earthquakes, the crust “talks” back to the ionosphere, causing perturbations.

Colloquiums run from Noon to 1 PM on Wednesdays and at 7:00 PM one evening per month. Location: SETI Headquarters at 189 N. Bernardo Ave., Mountain View ([map](#)). Free. Lectures are available on YouTube at: <http://www.youtube.com/setiinstitute>

Enceladus and Mimas (from page 3)

analysis revealed water, carbon dioxide, ammonia (NH_3), CH_4 , C_2H_2 , and C_3H_8 . Argon-40 (^{40}Ar) was also detected, suggesting the presence of radioactive decay of potassium (^{40}K). Scientists infer that the depletion time of this source to be on the order of 10 to 100 million years from now.

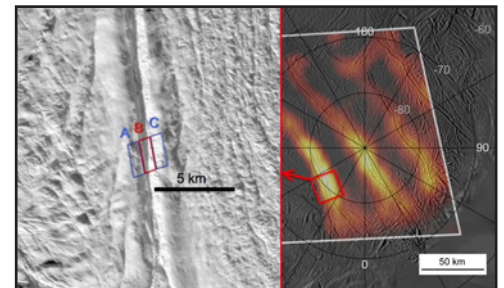
The energy source for Enceladus’s geological activity is almost certainly tidal heating.

Enceladus is heated from its 2:1 gravitational resonance with its sister moon, Dione. The continual distortion of their orbital shape is due to Saturn’s gravity as the moons orbit the ringed planet. Enceladus possesses a slightly eccentric orbit.

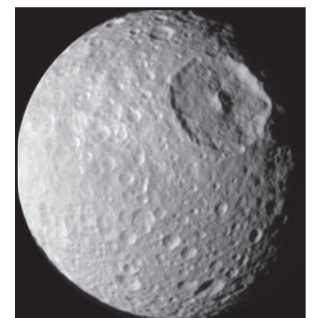
Although the moon has an icy mantle and a rocky core, it is believed it possesses a regional ocean about 80 to 100 kilometers below its surface. Cassini’s CDA found salt (NaCl), Na_2CO_3 , NaHCO_3 , and KCl in the icy grains of Enceladus’s plumes. Further analysis revealed that the particles were only slightly salty, about one-third the salinity of Earth’s oceans.

Mimas

The initial view of Mimas’s orbit about Saturn would suggest that the moon should also be tidally heated at a rate at least twice that of Enceladus, or much more. However, Mimas is not in the same situation as Enceladus, which has a resonant eccentricity, a source of energy that is ultimately supplied by the rotation of Saturn. Consequently, Enceladus dissipates the added energy in the form of heating beneath its south pole area – an endothermic heat source. McKinnon aptly notes that this heating is a renewable energy resource.



Right: Map of thermal emission along most of the tiger stripe system, taken by the CIRS detector in March 2008, with $\sim 6\text{ km}$ spatial resolution. The location of the left-hand panel is shown by the red rectangle. **Left:** An enlargement of the brightest region of the left-most tiger stripe, known as Damascus Sulcus, centered near the source of plume. Source, Spencer et al: <http://www.lpi.usra.edu/meetings/lpsc2011/pdf/2553.pdf>



Mimas; note the extensive cratering and the large Herschel crater, image courtesy of NASA

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Young Astronomers

Star Parties Earn Eyepieces!

Hello Young Astronomers,

You do recall that for volunteering for five school or RFO public star parties helps you earn an eyepiece to complement the one or two that you have now, right?

I will expect you to keep track of each event you have gone to so that when you have earned one you can send me an email detailing the events at which you participated, and I'll then arrange for you to get your well-deserved eyepiece. So, not only do you get great experience, but you are rewarded for the effort too. :-)

Jupiter is now beginning to rise at an hour that is very easy to work into your evening schedule. It is my intention to alert you to any upcoming Galilean satellite shadow transits of the planet. Then, I want you to get your scope outside on one of those nights to see if you can witness it. We will see how this goes.

If you'd like company, let me know. Maybe we can get a small star party organized somewhere close to where you live. I'd really like to have one of you report what you saw in the next issue of Sonoma Skies.

Clear Skies!

—Len Nelson, SCAS President



This Hubble Space Telescope image of Galaxy NGC 4414 was used to help calculate the expansion rate of the universe. The galaxy is about 60 million light-years away. Credit: NASA and The Hubble Heritage Team (STScI/AURA)

Dark Clues to the Universe

by Dr. Marc Rayman

Urban astronomers are always wishing for darker skies. But that complaint is due to light from Earth. What about the light coming from the night sky itself? When you think about it, why is the sky dark at all?

Of course, space appears dark at night because that is when our side of Earth faces away from the Sun. But what about all those other suns? Our own Milky Way galaxy contains over 200 billion stars, and the entire universe probably contains over 100 billion galaxies. You might suppose that that many stars would light up the night like daytime!



Until the 20th century, astronomers didn't think it was even possible to count all the stars in the universe. They thought the universe was infinite and unchanging.

Besides being very hard to imagine, the trouble with an infinite universe is that no matter where you look in the night sky, you should see a star. Stars should overlap each other in the sky like tree trunks in the middle of a very thick forest. But, if this were the case, the sky would be blazing with light. This problem greatly troubled astronomers and became known as "Olbers' Paradox" after the 19th century astronomer Heinrich Olbers who wrote about it, although he was not the first to raise this astronomical mystery.

To try to explain the paradox, some 19th century scientists thought that dust clouds between the stars must be absorbing a lot of the starlight so it wouldn't shine through to us. But later scientists realized that the dust itself would absorb so much energy from the starlight that eventually it would glow as hot and bright as the stars themselves. Astronomers now realize that the universe is not infinite. A finite universe—that is, a universe of limited size—even one with trillions of stars, just wouldn't have enough stars to light up all of space.

Although the idea of a finite universe explains why Earth's sky is dark at night, other factors work to make it even darker.

The universe is expanding. As a result, the light that leaves a distant galaxy today will have much farther to travel to our eyes than the light that left it a million years ago or even one year ago. That means the amount of light energy reaching us from distant stars dwindles all the time. And the farther away the star, the less bright it will look to us.

Also, because space is expanding, the wavelengths of the light passing through it are expanding. Thus, the farther the light has traveled, the more red-shifted (and lower in energy) it becomes, perhaps red-shifting right out of the visible range. So, even darker skies prevail.

The universe, both finite in size and finite in age, is full of wonderful sights. See some bright, beautiful images of faraway galaxies against the blackness of space at the Space Place image galleries. Visit <http://spaceplace.nasa.gov/search/?q=gallery>.

—Article provided by JPL/NASA

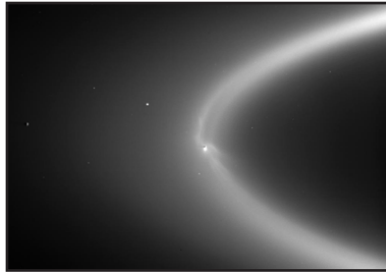
“What’s Up” Podcast

Using a combination of NASA images, beautifully clear graphics and her own narration, Jane does an outstanding job of explaining what you can expect to see in the night sky each month. Find Jane's podcasts here: <http://solarsystem.nasa.gov/news/whatsup.cfm>

Enceladus and Mimas *(from page 6)*

However, Mimas follows an eccentric orbit that isn't excited by an inherent resonance. Its two percent eccentricity is free, not forced. However, at some time in the past, it appears likely that its current orbital path was shaped by the resonant interaction with another satellite. Mimas's orbit has evolved outward, perhaps from a synchronous path over 4.5 billion years and going forward, with its eccentricity decaying over time. Even so, then why are there especially cold regions on Mimas?

McKinnon's colleagues have attributed the daytime cooling of Mimas to an exothermic process, one that results in the accumulation of E ring dust and high-energy (MeV) electron bombardment. As Mimas orbits Saturn, its path results in the deposition of E-ring dust on the trailing hemisphere and alteration of the surface structure and thermal inertia by MeV electrons along the equator on the leading hemisphere. Validation of this theory was obtained during a flyby of Mimas on February 13, 2010. Cassini's CIRS [3] detected a thermal anomaly of 15 degrees Kelvin on the trailing side of Mimas; this anomaly was attributed to differences in the thermal inertia rather than to geophysical activity within Mimas's frozen, icy surface.



Enceladus spewing particles into the E ring, image courtesy of NASA

2011 Flybys of Mimas and Enceladus

No flybys of Mimas are planned for the balance of 2011. However, three flybys of Enceladus are scheduled as follows:

October 1st: Enceladus flyby E-14 will come within 62 miles of the moon's surface. This close flyby of the south pole will feature fields and particles instruments learning more about the nature and number of the particles in the plumes. Remote sensing instruments will also be seeking changes in the moon's level of activity.

October 19th: Enceladus flyby E-15 will be taken from an altitude of 765 miles. This flyby will feature an ultraviolet stellar occultation, in which a hot bright star goes behind the plumes of the moon. Scientists hope to understand the density, composition, and variability of the plume from these observations. Infrared instruments and cameras will also be monitoring activity on the moon.

November 6th: Enceladus flyby E-16 takes place from a distance of 308 miles. The primary goal is to obtain the first detailed radar observation of this moon. This will be the first close radar pass of an icy moon besides Titan; the results will enable a comparison of the radar properties of a moon with a known composition (Enceladus) with that of Titan. The segment also includes plume observations, CIRS monitoring of hotspot activity, UVIS observations of Dione and its environment, and searches for Lagrangian companions of Enceladus and Rhea.

Stay tuned for more results as these flybys are completed and analyzed by year-end 2011. This is an exciting time for planetary science.

—Submitted by **R.K. Koslowsky**, SCAS Member
<http://worldperspective.bravehost.com/astronomy.html>

Notes:

[1] William McKinnon and his group focus their research on the outer solar system, particularly the major icy satellites of the giant planets, such as volcanic Io, oceanic Europa, and magnetic Ganymede, and dwarf planets in the Kuiper Belt such as Pluto. It is an extraordinarily rich arena in which to recapitulate all of geology and geophysics, but from a fresh perspective. Their research addresses internal structure, origin and evolution, tectonism and volcanism, impact mechanics and cratering history, and the potential for life. The evolution of the midsized satellites of Saturn has been a recent focus.

McKinnon quotes from 2005: "Enceladus is a geologist's paradise. It has endless sets of closely-spaced fractures and faults." "[Enceladus] has been pulled, stretched and compressed in multiple episodes of deformation and relaxation." "I'm betting that liquid ammonia-water is involved." <http://www.newscientist.com/article/dn7029>

A 2008 blog report: "One hot spot detected [on Enceladus] by Cassini is ejecting plumes of ice and vapor above the arid world in a cloud so fine that, according to William McKinnon, the result is like a smoke made of ice, its particles about one-thousandth of a millimeter across." Enceladus is clearly a geologically active world, far from the inert desolation once expected.

"The tidal motion here is interesting. Enceladus is in dynamic resonance with Dione, so that every time the more distant Dione orbits Saturn, Enceladus makes two revolutions. The continuous squeeze from Saturn does interesting things to the surface, with the temperature at the hot spot at least 100 degrees warmer than the temperature at the actual poles." <http://www.centauri-dreams.org/?p=1661>

[2] The E ring was first discovered telescopically in 1967, and its presence was confirmed by the Pioneer 11 flyby in 1979. It is a thick disk of very fine icy or dusty material, with the individual particles only one micron (a millionth of a meter) across. Five of Saturn's seven largest moons are embedded within it: Mimas, Enceladus, Tethys, Dione, and Rhea. Cassini has discovered that active vents on Enceladus' south pole are the source of the material in the E ring. The vents produce tiny particles of water ice, and the motions of the moons and magnetic field of Saturn spread the material out from Enceladus into a broad doughnut around Saturn.

[3] As NASA tells us, Cassini's science instruments "survey and sniff, analyze and scrutinize, and, of course, they take stunning images in various visible spectra." The orbiter's twelve science instruments are designed to carry out detailed scientific studies of Saturn, from collecting data in multiple regions of the electromagnetic spectrum to studying dust particles, and characterizing Saturn's plasma environment and magnetosphere. The onboard instruments gather data for 27 diverse science investigations, providing planetary scientists with an enormous amount of information. These twelve instruments, grouped into three categories are as follows:

1. **Optical Remote Sensing:** Mounted on the remote sensing pallet, these four instruments study Saturn, its rings, and its moons in the electromagnetic spectrum.
 - Composite Infrared Spectrometer (CIRS)
 - Imaging Science Subsystem (ISS)
 - Ultraviolet Imaging Spectrograph (UVIS)
 - Visible and Infrared Mapping Spectrometer (VIMS)
2. **Fields, Particles and Waves:** These instruments study the dust, plasma and magnetic fields around Saturn and its moons.
 - Cassini Plasma Spectrometer (CAPS)
 - Cosmic Dust Analyzer (CDA)
 - Ion and Neutral Mass Spectrometer (INMS)
 - Magnetometer (MAG)
 - Magnetospheric Imaging Instrument (MIMI)
 - Radio and Plasma Wave Science (RPWS)
3. **Microwave Remote Sensing:** Using radio waves, these instruments map atmospheres, determine the mass of moons, collect data on ring particle size, and unveil the surface of Titan.
 - Radar
 - Radio Science (RSS)

McKinnon was particularly keen on the results provided by the high-resolution visible imager (ISS), the near infrared spectra (CIRS), the ultraviolet detection of the water vapor plumes near the south pole of Enceladus (UVIS), ongoing thermal mappings of the southern heat flows and the mass spectrometer analysis of the plume's composition (VIMS).

[4] Recent triangulation work has revealed that although there are eight major plume jets producing the geyser-driven ejecta, 65 individual plume jets have been detected along the tiger stripes.

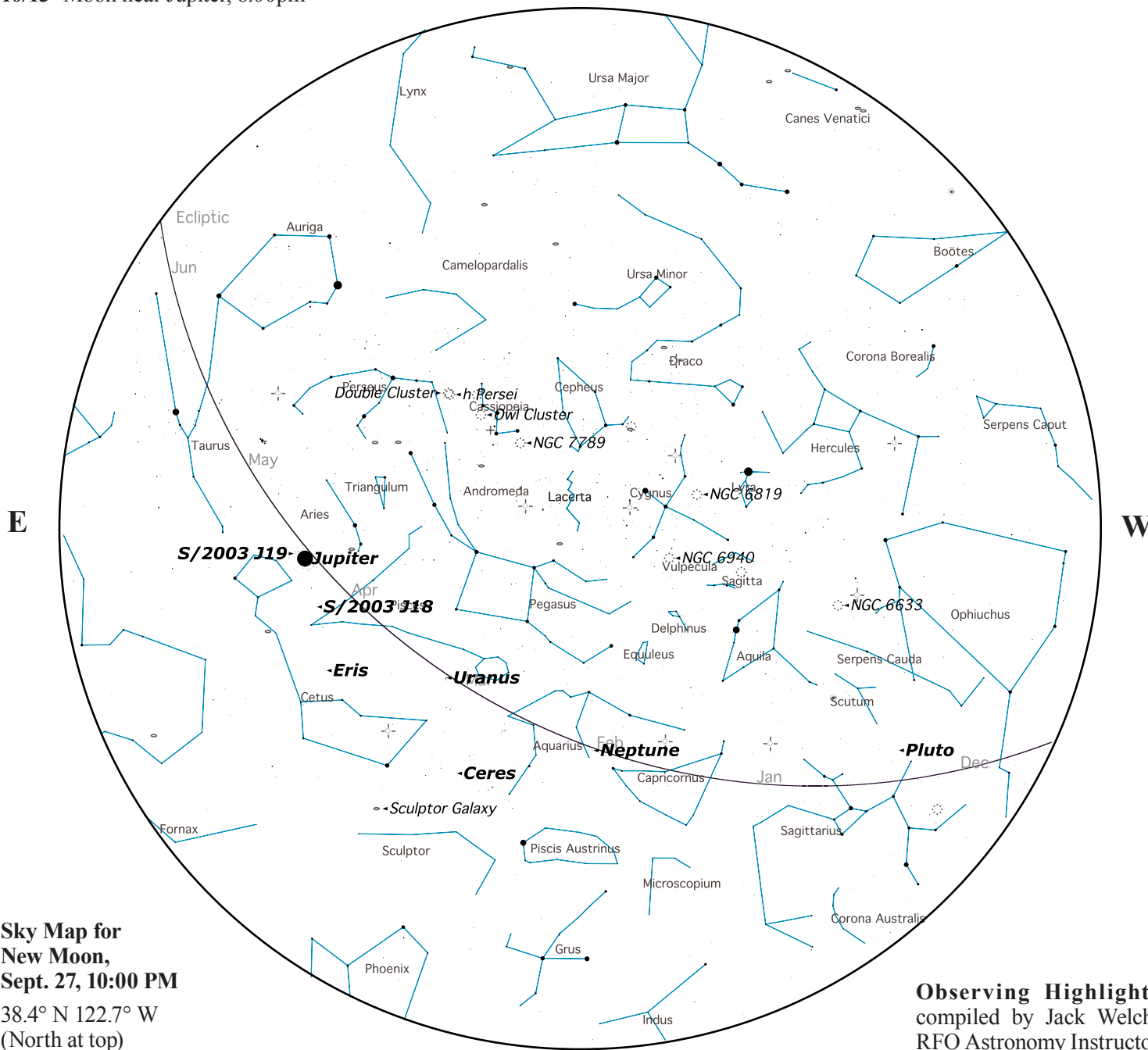
Reference:

[1] For more on Enceladus and the 2005 Cassini flybys, please see Ralph Lorenz & Jacqueline Mitton's *Titan Unveiled: Saturn's Mysterious Moon Explored* (2008), pp. 196-200.

October 2011 Observing Highlights

- 10/1** Mars near M44, 4:00am. Best viewed with binoculars.
- 10/2** Algol minimum at 10:08pm
- 10/9** Occultation of 16 Piscium. At about 1958, mag 5.7 16 Piscium will disappear behind the dark limb of a 96% moon 80° from the north cusp. This will be challenging for scopes under about 4" of aperture. Later this same night the moon will occult 19 Psc.
- 10/10** Occultation of 19 Piscium. At about 0401 the mag 5.0 garnet-colored carbon star 19 Piscium will disappear behind the dark limb of the 97% moon 68° from the south cusp.
- 10/11** Full moon occurs 10 hours before apogee making it the smallest full moon of 2011.
- 10/13** Moon near Jupiter, 8:00pm

- 10/20** Algol minimum at 3:01am.
- 10/22** Algol minimum at 11:49pm
- 10/24** Zodiacal Light in E through 11/6, 5:30am. The Zodiacal Light is a faint glow along the line of the ecliptic caused by sunlight reflecting off particles in the plane of our solar system.
- 10/25** Algol minimum at 8:38pm
- 10/26** New Moon, 1:00pm. Large Tides through 10/29. The new moon occurs just 8 hours after perigee.
- 10/28** Jupiter at Opposition, 7:00pm. In Aries, this is a close opposition with Jupiter's disk reaching the large size of 49.6" and a magnitude of -2.9.



**Sky Map for
New Moon,
Sept. 27, 10:00 PM**
38.4° N 122.7° W
(North at top)

Observing Highlights
compiled by Jack Welch,
RFO Astronomy Instructor

SCAS Membership Application/Renewal

Annual Membership dues are \$25 due June 1.
(New members joining after Nov. 30 pay \$12.50)

Please complete this form and give to the Membership Director or a Board member with your check, payable to "SCAS," at the next meeting, or mail your dues to: SCAS, P.O. Box 183, Santa Rosa, CA 95402-0183.

New Renewal Family (no extra charge)

Name(s): _____

Email: _____
(Required for *Sonoma Skies*)

Address: _____

City/State/Zip: _____

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I am interested in serving in one or more of these areas:

- School Star Parties SCAS Board
 Newsletter Striking Sparks
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New Members please note interests and hobbies you would like us to know about:

New Members please share your reason(s) for joining SCAS, and how you heard about the club:

Your dues include our monthly newsletter *Sonoma Skies*, membership in the Astronomical League and its *Reflector* magazine, discounted subscriptions for *Sky and Telescope* and *Astronomy* magazines, great guest speakers at our monthly meetings, the annual Star-B-Que, and opportunities to meet new and interesting people who share your passion for the night sky and many aspects of astronomy and science.

Welcome to the SCAS!

Sonoma County Astronomical Society (SCAS)

Membership Information

Meetings: 7:30 PM on the second Wednesday of each month, in the Multipurpose Room of Proctor Terrace Elementary School, 1711 Bryden Lane at Fourth Street, Santa Rosa, unless otherwise announced in this publication. The public is invited.

Dues: \$25, renewable June 1 of each year. New members joining between December 1 and May 31 pay partial-year dues of \$12.50.

Star Parties: See the Events section for dates and times.

Rental Telescope: Members are eligible to borrow the club's 80mm refractor with tripod. Contact any Board member listed below.

Egroup URL: Connect with other members about going observing, observing reports and chat about astronomy and news items from AANC and *Sky & Telescope*. Hosted by Keith Payea at kpayea@bryantlabs.net. Any SCAS member is welcome to join. Visit <http://groups.yahoo.com/group/scas> and click the "Join" button, or send an email to scas-subscribe@yahoo.com

Discount Subscriptions: For *Sky & Telescope*, new subscribers may send a check for \$32.95 payable to "SCAS", with your complete mailing address, directly to: Larry McCune, 544 Thyme Place, San Rafael, CA 94903. Once you have received the discount rate, you may renew your subscription by sending your personal check with the renewal notice directly to Sky Publishing. Discount subscriptions to *Astronomy* Magazine occur annually in October. Check *Sonoma Skies* for details.

Library: SCAS Librarian David Simons hosts a library of astronomy books that may be checked out by members at SCAS meetings, to be returned at the next meeting. Videotaped lectures on astronomy may be rented for \$3 per month.

Sonoma Skies is the monthly newsletter of the Sonoma County Astronomical Society (SCAS). Subscription is included as part of membership. Articles and member announcements are welcome and are published on a first come, first served basis, space permitting, and may be edited. **The deadline for submissions is 7 days prior to the end of each month.** Mail to: Editor, SCAS, P.O. Box 183, Santa Rosa, CA 95402, or email publications@sonomaskies.org

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