

Sonoma Skies

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

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Scherrer, the Sun, and the SDO

Dr. Philip Scherrer, Principal Investigator [1] for the Helioseismic and Magnetic Imager (HMI) operating from the orbiting Solar Dynamics Observatory (SDO) presented the latest research results about our nearest star on May 11, 2011. His audience was the Sonoma County Astronomical Society.

Some Twentieth Century Background thanks to Author Kendrick Frazier

Oscillatory motions on the sun were first discovered in the early 1960s. During this time, solar scientists thought they were simply a local phenomenon of the sun's atmosphere. By the end of the 1970s, some of the solar oscillations were shown to be oscillations of the entire sun. Henry A. Hill, an astrophysicist at the University of Arizona, interpreted the long-period oscillations they were seeing on the sun as global. Hill designed a new kind of apparatus in the Santa Catalina mountains northeast of Tucson. The facility was called SCLERA, for Santa Catalina Laboratories for Experimental Relativity by Astrometry. The equipment measured the apparent solar diameter by detecting the edge of the sun simultaneously at opposites ends of the sun. Hill and his colleague found that oblateness was not present, but the data revealed that the sun was oscillating at regular intervals, as though the sun had been rung like a bell [2].

Many disputed these findings but Hill concluded that, "Global oscillations of the sun are being observed." Acoustic and gravity oscillations in the sun itself "are the only viable mechanisms capable of producing these phenomena." However, such pronouncements didn't settle the matter. At least two questions remained. Were the oscillations repeatable, and do the oscillating waves remain in phase over many days?

Hill's analysis showed that of twelve different oscillations observed, each was indeed staying in phase over the twenty-three-day span the measurements were taken. The chance that any one of the patterns seen could have been produced

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Welcome to Titan!

with Dr. Chris McKay
SCAS September 14 Meeting, 7:30 PM
at Proctor Terrace School

Imagine we're on a beach of sand dunes, with some little rivers and creeks draining into a big lake. A few rocks and boulders are around. We kick back on our beach towels to take in the sun and sky. Sounds nice? Now imagine we can barely see the sun because it's very cloudy, and in fact the sky is worse than any orange colored smoggy day in LA. It starts to drizzle and we decide to head home.

But home is a billion miles away! And that lake, the rivers and even the rain? They're liquid methane and other stuff, kind of like gasoline running through the creekbeds. Those rocks? They're mostly granite-hard chunks of water ice! Welcome to Titan, the biggest moon of Saturn! Where it's a balmy -300 degrees today! And you can't breathe that air, it's methane and stuff, too! Although it sounds like a weird science fiction world, some scientists think it has a lot in common with the early Earth, our home biosphere.

Come listen to Dr. Chris McKay as he takes us on a journey to this strange world of Titan. Chris is a leading planetary scientist working with NASA Ames with some stories to tell about other worlds right in our own solar system. Chris received his Ph.D. in AstroGeoPhysics from the University of Colorado in 1982, and has been with NASA ever since. He considers himself an "exobiologist", one who studies the possibilities of life on other planets, perhaps very different from our own, but perhaps similar to some extreme places on our home planet, as well.

Dr. McKay is a specialist in planetary atmospheres. He has found some interesting aspects about possible methane rain on Titan, suggesting ecosystems sometimes similar to Earth's, but

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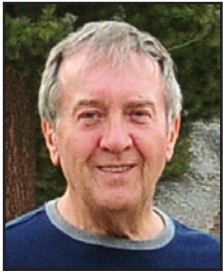


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President's Message

Hello Members of the SCAS, September beckons us and with it comes school star parties and throngs of young people who want to learn the thrill of astronomical discovery!

It's really fun for us too, and the more enthusiasm that we can muster in our explanations of what we see with our scopes, the more the students will be challenged to learn from the experience.

This year too, as Lynn Anderson no doubt explains in his write up further in this issue, we will generally be booking more than one school event each week. In reality, only about half of our school engagements actually materialize since the sky conditions have a nasty habit of canceling many events.

But how about August? If you come to the September general meeting, you will be entertained by Yosemite Star Party stories.

I will say that the early fire and smoke predictions were so worrisome that I was having difficulty mustering the enthusiasm to even go! Fortunately I did, and the sky conditions and temperature during the day in the valley and in the highlands were at or near perfect.

We'll also share stories about the SCAS Star-B-Que held on August 27.

So, there are many reasons to come to the September meeting in addition to our main presenter. Plan to be there. It's sure to be FUN!

Len Nelson, SCAS President



Len Nelson nailed this very bright Iridium flare on August 25 at RFO. It shot right through the constellation Cygnus, which you can see in the image. He used a Nikon D300 with a 10-24mm zoom at 13mm at f4.5 at ISO 400 for about 25 seconds.

NASA AMATEUR ASTRONOMERS FACEBOOK PAGE

Check it out at <http://www.facebook.com/pages/NASA-Amateur-Astronomers/117280451703083>

Astronomy Magazine

Larry McCune reports that Astronomy Magazine is offering subscription renewals for the discount price of \$34 for one year or \$60 for two years.

If you would like to renew your subscription or be included in the club program contact Larry McCune, SCAS Treasurer, and send a check payable to SCAS by October 1, 2011. Email: [llmccune\(at\)comcast.net](mailto:llmccune(at)comcast.net)

Welcome to Titan (from page 1)

of different chemicals, temperatures, etc. He is not one to rule out the chance that alien life forms might exist in systems we humans might not consider "habitable". Chris has developed his models on studying some pretty extreme areas here on Earth; after all it's a "little" easier to get to than other planets! As a result, he has spent a lot of time in the dry valleys of Antarctica, the Atacama extreme dry desert of Chile, Death Valley, and other exotic locales. He takes a moderate, some call it "biocentric" view of terraforming. That is, he has thought a lot about what it would take to take a certain planet, OK let's call it Mars for instance, and seeing if it can be made to support life like we know it, like us humans. But first he wants to make sure there aren't already some little bugs or more living there, we wouldn't want to destroy their ecosystem just for the sake of ours, necessarily.

So be sure to come to the next SCAS meeting, Wednesday September 14th, 7:30. Usual place Proctor Terrace School in Santa Rosa. Come listen to Chris McKay talk about the possibility of life on other worlds, and where life may have come from right here on Earth!

—John Whitehouse, SCAS VP

A MESSAGE FROM GUY OTTEWELL TO MEMBERS OF THE ASTRONOMICAL LEAGUE:

Astronomical Calendar 2012 (the upcoming issue of the large annual book which I've produced since 1974) may be the last—or the last in its present form. This is partly because of an eye condition that slows me down. It might continue, however, as more of a team effort.

Would you be interested in contributing an element of Astronomical Calendar **2013**, such as one of the illustrations or the text about one of the topics? If so, please write to [guy\(at\)universalworkshop.com](mailto:guy(at)universalworkshop.com).

At this stage all that is needed from you is an expression of interest, though if you were to mention something about your capability and particular interests, that might move things forward. When enough responses have been gathered, I will respond to all and will explain more.

(Ed. Note: Astronomical League membership is included in your SCAS membership).

A James Webb Space Telescope Cost Overrun Update

In the July 2011 issue of *Sonoma Skies*, an update on the James Webb Space Telescope, or JWST, was featured. It stated, "It's déjà vu. JWST, like its predecessor the HST, has gone way over budget, by \$1.5B. The previously revised \$5B lifecycle estimate is being revised upward again to \$6.5B. The JWST Independent Comprehensive Review Panel report, issued in October 2010, revealed that the problems causing cost growth and schedule delays on the JWST Project are associated with budgeting and program management, not technical performance. The technical performance on the Project has been commendable and often excellent. However, the budget baseline accepted at the Confirmation Review did not reflect the most probable cost with adequate reserves in each year of project execution. This resulted in a project that was simply not executable within the budgeted resources."

It was felt that in late 2010, an immediate quarter of a billion dollars was needed in 2011 to keep the project on track, an amount that was unlikely to be granted, considering the tough economic times. Indeed, this funding was not immediately granted. Instead, the program slipped beyond the planned launch date of 2015 and will reach an even higher cost plateau to complete, launch, and operate. This follow-on analysis was recently completed and is in the hands of the politicians looking to approve NASA's 2012 budget.

In mid-July, the House Appropriations Commerce, Justice, and Science Subcommittee, in the spirit of cutting programs recommended approval of "\$4.5 billion for NASA Science programs, which is \$431 million below last year's level. The bill also terminates funding for the James Webb Space Telescope, which is billions of dollars over budget and plagued by poor management."

The news [1] was shocking to the astronomy community. JWST was, according to the journal *Science*, "conceived as a successor to the Hubble Space Telescope." Its "price tag rose from an estimated \$1.0 billion in 2001 to \$5.1B in 2008 when NASA confirmed the project and set a launch date of 2014. Last year, an external review...determined that the telescope would cost [\$6.5] billion" and "the earliest viable launch date was September 2015, but only if NASA added \$200 million to Webb's projected annual budget in each of the fiscal years 2011 and 2012. NASA officials said it would be impossible to find the additional money and this year floated 2018 as a possible launch date."

This new launch date could spell the end of JWST even though "more than 75% of the telescope's hardware either is in fabrication or has already been delivered...The mirror technology was one of the most significant challenges, and all 18 of the segments have now been fabricated, retiring an enormous part of the overall risk."

Then on July 20, 2011, Dr. William Bottke, a prominent planetary scientist based in Boulder, Colorado suggested that the "James

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

WELCOME, NEW MEMBER

The SCAS wishes to welcome new member Leo Bleier of Ukiah. He found us via the SCAS website and is interested in learning more about astronomy.

PRO RC 400 DEMO AT SCOPE CITY

Sept. 1, 2PM: Gino, Product manager and head of Research and Development for Officina Stellare will be on hand to answer all your questions on their entire product line for the professional and advanced amateur astronomers.

Free event plus 10% off on any purchase that day.

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, September 24

Solar Viewing: Noon - 4:00 PM

Night Viewing begins 8:00 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

Sept. 20, Sept. 27, 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)

Observing Lab

“Star Death: The End of Stellar Fusion”

Friday, Sept. 23, 7:00 PM

Stars are massive balls of gas, so massive that they have pressures and temperatures in their interiors sufficient to cause nuclear fusion, a process that generates the tremendous amounts of energy that we associate with stars. In this Lab, we look at the remnants, residuals, remains and traces of stars that exhausted their nuclear fuel and have progressed to a different mode of existence. Rain check: Wed 9/28

To register or for more information email [nightsky\(at\)rfo.org](mailto:nightsky(at)rfo.org)

SRJC PLANETARIUM

“And This is Our Moon” begins September 16

Possibly the most noticed object in our night sky is our satellite the Moon. The lure and mystery of the Moon has fascinated humans for thousands of years. In this show we'll discover the nature of the Moon. You'll learn about its phases, why we see only one side of the Moon, and how and why it affects the way we live. And, if we imagine a time of communicating with intelligent life beyond our solar system, why would we find it an important consideration to say “and this is our Moon”?

Show times: 7:00pm Fridays & Saturdays, 3:00pm Sundays

Admission is \$5 General & \$3 Students and Seniors (60+). Cash only, please. 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

Sept. 3, 8:00PM: “Extreme Astronomy: Eyeing the Cosmos through a Cubic Kilometer of Ice”—Dr. Kirill Filimonov, UC Berkeley

Come and learn why physicists are fishing for elusive cosmic neutrinos using Ice Cube, the world's largest telescope located on the harshest continent on Earth.

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/>

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).

Events

Community Outreach Event Horizons

School Star Party Pre-Sale Going Well

There are twenty-two weeks during the school year where there is either a young moon or no moon to view during the early evenings. These are the times we recommend for school star parties to avoid having the sky washed out by a too-bright moon. As of this writing, fifteen of those weeks have already been booked by schools on our email list from the last couple of years.

A letter announcing the remaining potential star party dates has been forwarded to the Sonoma County Office of Education to soon be sent to all Sonoma County teachers. A similar letter sent last year resulted in making contact with several schools with whom we had not had a previous relationship. With luck, we could soon be booked for the entire school year.

The only two crescent moon or moonless weeks that have not yet been claimed are March 19-23, which is Spring Break for many schools, and May 21-25, which will either be after schools are dismissed or the last week of the school year. Multiple dates indicate that a star party will occur, but that the particular day has not yet been selected.

Here is the schedule, so far:

September 22	Guerneville School
September 23	Solar Viewing, Strawberry School, Santa Rosa
September 29	Monte Rio School
September 29	Meadow School, Petaluma
October 20	Rincon Valley Middle School
October 24 – 28	Whited Elementary, Rincon Valley
November 2	Austin Creek Elementary, Rincon Valley
November 21 – 25	Bodega Bay School
November 30	Old Adobe Elementary, Petaluma
December 12 – 16	Valley Vista Elementary, Petaluma
January 25	Dunham Elementary, Petaluma
January 20	Mary Collins Charter, Petaluma
February 16	Windsor Creek Elementary
February 24	Willowside Middle School, Santa Rosa
February 27, 28, 29	Oak Grove, Sebastopol
March 27	Alexander Valley School
April 17	Brook Haven Elementary, Sebastopol
April 23-27	El Verano, Sonoma
April 23-27	Cazdero (pending)
May 18	Geyserville

If you know of a teacher or school that might be interested in having a telescope star party, please share this information with them. While we have typically been scheduling only one star party in any given week, if a star party is listed for Petaluma, or some other community, it might be possible to have another star party in a different part of the county, depending on volunteer interest and willingness to travel.



Looking ahead, Saturday, October 8th is *Observe the Moon Night*. There will be a fairly bright eleven-day-old moon to view. This will be another opportunity to drag out your telescope and amaze your neighbors, or to take it to a public area and do some sidewalk astronomy.

For those of you not yet on the list of volunteers who want to get involved in sharing your passion for astronomy, contact Lynn at [astroman\(at\)sonic.net](mailto:astroman(at)sonic.net) to receive email announcements about upcoming volunteer opportunities.

—Lynn Anderson, SCAS Director of Community Activities

MORRISON PLANETARIUM DEAN LECTURE SERIES

Sept. 12, 7:30 PM: “WISE Astronomy: The Wide-field Infrared Survey Explorer”—Bryan J. Mendez, Ph.D., Space Sciences Laboratory, UC Berkeley

NASA’s Wide-field Infrared Survey Explorer (WISE) mapped the sky in infrared light, searching for asteroids, the nearest and coolest stars, the origins of stellar and planetary systems, and the most luminous galaxies in the Universe. WISE was an unmanned satellite carrying an infrared-sensitive telescope that imaged the entire sky, providing a vast storehouse of knowledge about the Solar System, the Milky Way, and the Universe. During this lecture, Dr. Mendez will describe the mission, its history, current status, and some of the discoveries it has made.

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

Sept. 17, 8-11 PM: Public Event “Dark Matter-Dark Energy”

Presenter Dr. Gerald deBane is back at Taylor. He will be exciting visitors explaining that there is something out there that we cannot see—dark matter and energy. 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

Sept. 7: “Gravity Probe B: The Relativity Gyroscope Experiment”—Barry Muhlfelder, High Energy Physics Laboratory, Stanford University

Gravity Probe B, launched 20 April 2004, is a space experiment testing two predictions of Einstein’s theory of General Relativity, the geodetic and frame-dragging effects by means of cryogenic gyroscopes in Earth orbit. On-orbit data collection started August 2004 and ended September 2005. Analysis of the data from all four gyroscope results in a geodetic drift rate of $-6,602 \pm 18$ mas/yr and a frame-dragging rate of -37 ± 7 mas/yr, to be compared with the GR predictions of $-6,606$ mas/yr and -39 mas/yr, respectively.

Dr. Muhlfelder has worked for 25 years, most recently as the project manager, on the Gravity Probe-B experiment. He will describe the final results of the latest experiment to test Einstein’s gravitational theory.

Sept. 7: “Gravitational wave astronomy: a peek through the window”—Paul Groot, Radboud University, Nijmegen, Netherlands

The direct detection of gravitational waves will offer a completely new window onto our Universe: one that is dominated by degenerate objects, black holes, explosions and mergers. Although this window is so far still obscured a glimpse of its richness can be seen from electromagnetic observations of gravitational wave sources. Dr. Groot will overview the progress in the fields of ultracompact binaries and the promise and results of synoptic surveys such the Kepler observations and the Palomar Transient Surveys. As an aside, and to connect to the SETI mission, Dr. Groot will briefly discuss the possibility of life on planets around white dwarfs as well.

Sept. 21: “SpaceX and the Dragon Spacecraft”—Abhishek Tripathi SpaceX Inc.

With the retirement of the Space Shuttle this past summer the United States entered a new era, one in which U.S. astronauts will be flying only aboard the Russian Soyuz vehicle in order to access Low Earth Orbit and the International Space Station. California headquartered Space Exploration Technologies (SpaceX) has developed and twice launched a brand new launch vehicle (Falcon9), as well as launched and recovered a space capsule designed for humans (Dragon). SpaceX will soon begin delivering cargo, and ultimately plans on launching crew, to the International Space Station from U.S. soil. And all that is just the beginning of what SpaceX has in mind to revolutionize human access into Space.

Colloquiums run from Noon to 1 PM on Wednesdays and at 7:30 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>

SDO (from page 1)

randomly was less than one in a thousand. “This phase data constitutes one of the strongest pieces of evidence for the global nature of the solar oscillations to date,” they reported to their fellow astronomers at the meeting. “In summary, the new set of solar diameter measurements made at SCLERA confirms the existence and repeatability of the solar oscillations and lends strong evidence to their global nature.”

While the scientific community had been debating the reality of Hill’s long-period oscillations, scientists from the Crimean Astrophysical Observatory [3] in the Soviet Union found signs of even longer pulsations. This was exciting because the slower the oscillation the deeper its origin within the sun and the more it should eventually be able to reveal about the sun’s deep interior.

Meanwhile, at Stanford University, solar physicists Philip H. Scherrer and John M. Wilcox quickly began a program to look for the 160-minute oscillations. Similar methods were used at both the Crimean Observatory and the Stanford Solar Observatory (SSO) [4]. The scientists measured the difference in the line-of-sight velocity between a central area of the sun’s disk and a surrounding ring-shaped area. These motions toward or from the earth cause slight shifts in the wavelength of the light, the so-called Doppler effect, and these shifts are what were detected.

Scherrer and Wilcox joined into collaboration with the Soviet observers. The patient efforts of Valerie A. Kotov, who spent four weeks at Stanford, helped iron out some early difficulties in the data analysis. By 1979, after three years of work, the scientists were able to report that the observations at Stanford appeared to support the results first reported by the Crimea Astrophysical Observatory. The Stanford scientists had observed the sun with their equipment for several hundred hours during each of the three previous summers, and they not only saw the oscillations, but also found that they were in phase with the observations in the Crimea. If both groups were observing a solar phenomenon they would expect to see them in phase. In other words, when the start of a new oscillation was seen at Stanford it was also seen at the Soviet observatory. If it was only some terrestrial phenomenon that was being seen, or the effects were due to “noise,” no such phase agreement should be seen. Said Scherrer at the spring meeting of the American Geophysical Union in Washington in 1979, “We do tend at this time to support the reality of these observations [3, 4].”

So, by the end of the 1970s, scientists had almost in their grasp a tool equivalent to the medical diagnostician’s X-rays of the human

body or the seismologists’s seismic profile of the earth’s insides. The subject was in its infancy, yet, the potential was clear. The Sun’s own vibrations would reveal its inner secrets, if only the human observers 93 million miles away can be clever enough to decipher the codes and read and interpret the information they contain. The shaking sun is a revelatory sun.

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Image of Scherrer (left) and Wilcox at SSO, courtesy of Stanford University

Young Astronomers



SCAS Star Parties Want You!

Hello Young Astronomers,

Do you recall the first time that you looked through a telescope? It must have made a serious impression on you or you would not be reading these words now!

The SCAS, as you know, is very serious about bringing astronomy to the young people at our local schools, and young astronomers like you are needed to assist in this good work. Students will relate more easily to you than to more senior amateur astronomers. Also, you will be using the same wonderful Striking Sparks telescopes that we will be awarding next March. Students will see for themselves what's in store if they enter the contest.

Lastly, you have no way of knowing the level of esteem that we have for those of you that have not only won a Striking Sparks scope, but who actually use it to reach out to others of your own generation to show them the wonders of the universe!

Please refer to Lynn Anderson's "Event Horizons" article on public astronomy on page 5 and determine where you can help.

—Len Nelson, SCAS President

Mission: Juno Launch, August 5, 2011

by Jane Houston-Jones

Two weeks after I started work at NASA's Jet Propulsion Laboratory in late 2003 I was given my first "real" assignment. I was asked to sit in on Mission Juno's design meetings and write the E/PO (Education and Public Outreach) proposal outline for the mission, a page-and-a-half summary with a budget. It was exciting to delve into a new kind of out-of-this-world work and begin a dream-come-true job as the informal and public outreach person on the Cassini Mission, with occasional planetary mission proposal writing forays.

Cassini was still 6 months away from arriving at Saturn. Mojo and I had just moved from Northern California and lived in a 900 square foot hotel room for three months—with two cats. And every day I went to work at NASA! I spent my days learning about a mission about to reach Saturn, and one still on the drawing boards—a mission to Jupiter called Juno.

Fast forward nearly 8 years and I find myself sitting in the shadows of Kennedy Space Center writing a blog about my

own adventures at the launch of the mission which launched my own career at JPL. There will be many blogs, photo essays, and tweets from the 150 Tweetup attendees and many other launch guests. Mojo was one of the lucky 150 attendees at the tweetup and his blog is here.

So I'm going to write something different. I'm going to write about "working" the launch, because that's what I did.

I was invited to the launch to play three different roles by three different NASA organizations, some all on the same day but in different locations. My first role was at the NASA tweetup itself. I've been the @CassiniSaturn Twitter persona since June 2008, and so I was working the tweetup backing up my outer planetary mission buddy @NasaJuno on Twitter duty the hours leading up to, at and after launch. I was also on hand to talk about NASA's Year of the Solar System and show my What's Up podcast during the hour just before launch.

I organized a "star party" for the launch guests, including the Juno mission's invited Goldstone Apple Valley Radio Telescope Program students and educators. Each of the several thousand launch goodie bags had a star chart flier featuring Saturn, the moon, Jupiter and Vesta, with a link to my *What's Up for August 2011* podcast and to NASA's *Year of the Solar System* website outreach material. The podcast and website feature Juno and planetary windy worlds like Saturn and Jupiter this month.

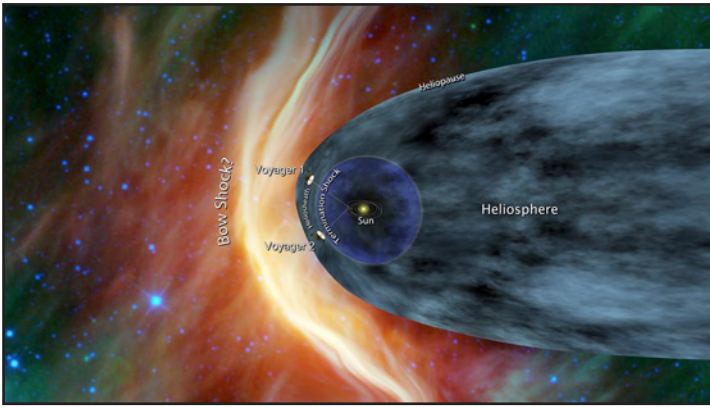
My third role was to participate in the Planetary Science Mission Directorate's "Scientists in Action" webcast, live-streamed to museum audiences remotely. Museum audiences all over the country, and probably the world, watched this and other Juno launch programming.

In addition to the "work," I was also a starry-eyed space girl at the NASA Tweetup, and was beyond excited to see my first launch. Just like the others, I was lapping up all the speaker comments and tweeting from @jhjones like crazy, when I wasn't tweeting from @CassiniSaturn or @NASAJuno. I was stunned at the amazing bus tour stops, in spite of the sweltering heat. And I soaked up the electric camaraderie and atmosphere of everyone at the Tweetup program. Although it was a "you had to be there" kind of event, I hope these pictures and tales give you a taste of the magic that is NASA. I couldn't be any prouder of where I work—on JPL's planetary missions like Cassini, Juno, and next month, Grail. I'm "above" cloud nine all the time!

More photos (including a tour of Harry Potter World at Universal Orlando): <http://photo.whiteoaks.com/2011-08-05-Nasatweetup/index.html>



The day before launch - Atlas V in 551 configuration (5-meter payload fairing, 5 solid rocket strap-ons). Under the fairing is a Centaur second stage and Juno.



This artist's concept shows NASA's two Voyager spacecraft exploring a turbulent region of space known as the heliosheath, the outer shell of the bubble of charged particles around our sun. Image credit: NASA/JPL-Caltech.

Solar System Size Surprise

by Dr. Tony Phillips

News flash: You may be closer to interstellar space than you previously thought.

A team of researchers led by Tom Krimigis of the Johns Hopkins University Applied Physics Laboratory announced the finding in the June 2011 issue of *Nature*. The complicated title of their article, “Zero outward flow velocity for plasma in a heliosheath transition layer,” belies a simple conclusion: The solar system appears to be a billion or more kilometers smaller than earlier estimates.



The recalculation is prompted by data from NASA's Voyager 1 probe, now 18 billion kilometers from Earth. Voyagers 1 and 2 were designed and built and are managed by NASA's Jet Propulsion Laboratory. Aging but active, the spacecraft have been traveling toward the stars since 1977 on a heroic mission to leave the solar system and find out what lies beyond.

To accomplish their task, the Voyagers must penetrate the outer walls of the heliosphere, a great bubble of plasma and magnetism blown in space by the solar wind. The heliosphere is so big, it contains all the planets, comets, and asteroids that orbit the sun. Indeed many astronomers hold that the heliosphere defines the boundaries of the solar system. Inside it is “home.” Outside lies the Milky Way. For 30+ years, the spacecraft have been hurtling toward the transition zone. Voyager 1 is closing in.

Much of Voyager 1's long journey has been uneventful. Last year, however, things began to change. In June 2010, Voyager 1 beamed back a startling number: zero. That's the outward velocity of the solar wind where the probe is now.

“This is the first sign that the frontier is upon us,” says Krimigis.

Previously, researchers thought the crossing was still years and billions of kilometers away, but a new analysis gave them second thoughts. Krimigis and colleagues combined Voyager data with previously unpublished measurements from the Cassini spacecraft. Cassini, on a mission to study Saturn, is nowhere near the edge of the solar system, but one of its instruments can detect atoms streaming into our solar system from the outside. Comparing data from the two locations, the team concluded that the edge of the heliosphere lies somewhere between 16

to 23 billion kilometers from the sun, with a best estimate of approximately 18 billion kilometers.

Because Voyager 1 is already nearly 18 billion kilometers out, it could cross into interstellar space at any time—maybe even as you are reading this article.

“How close are we?” wonders Ed Stone, Caltech professor and principal investigator of the Voyager project since the beginning. “We don't know, but Voyager 1 speeds outward a billion miles every three years, so we may not have long to wait.”

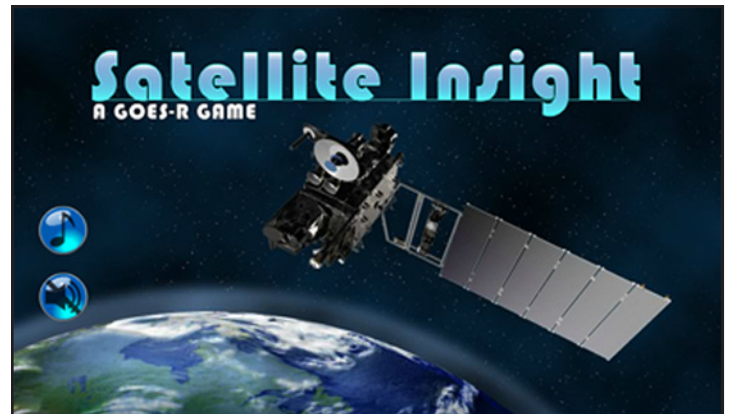
Stay tuned for the crossing.

For more about the missions of Voyager 1 and 2, see <http://voyager.jpl.nasa.gov/>. Another Voyager project scientist, Merav Opher, is the guest on the newest Space Place Live cartoon interview show for kids at <http://spaceplace.nasa.gov/space-place-live>.

—Article provided by JPL/NASA Caption:

“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>



New Game on SciJinks— Satellite Insight

A sea of critical real-time weather data floods into the satellite's memory grid! A storm full of tornadoes is brewing! The Sun is about to blast out a huge solar flare that could destroy satellites! To save lives and protect expensive instruments, the GOES-R weather satellite must not lose any of the data it is collecting.

You can help! The new Satellite Insight game on SciJinks challenges you to keep GOES-R's incoming data “buffer” from overflowing. Keep it going as long as you can and try to beat your best time! Check it out at <http://scijinks.gov/satellite-insight>.



SDO (from page 6)

Since then, a much more flexible tool – helioseismology – had become available for probing the interior solar rotation. Humans were persevering in their quest to probe the inner structure of the Sun.

Philip Scherrer Keeps Following the Sun

After space probes became dedicated to investigating the Sun, Scherrer followed them. In fact, he was very involved with the Michelson Doppler Imager (MDI), one of twelve instruments placed on board the orbiting Solar and Heliospheric Observatory (SOHO) launched in 1995 [5]. He remains the Principal Investigator for MDI, which records the vertical motion or tides of the Sun's surface at a million different points for each minute. By measuring the acoustic waves inside the Sun as they perturb the photosphere, Scherrer and his colleagues have been studying the structure and dynamics of the Sun's interior. MDI also measures the longitudinal component of the Sun's magnetic field.

However, Scherrer's talk this day was billed "The New View of the Sun with SDO – Inside and Out." For something as constant as the sun, humanity often takes it for granted. But these are exciting times under the sun: Under, inside and out. The sun offers a ringside seat for understanding the stars and how they behave. And given that all life is defined by and depends upon the sun, it shouldn't come as any surprise that for such a "normal" star, the sun is a very dynamic body that can be moody. Researchers have never had such a wealth of information coming to Earth in terms of what is being learned about our nearest star, thanks to all the orbiting solar observatories, especially one of the newest and most powerful, the Solar Dynamics Observatory.

Dr. Scherrer worked with the Lockheed Martin group to develop the SDO's Helioseismic and Magnetic Imager, just one of several detectors and experiments on board. We know our sun shakes and vibrates and has the occasional temper tantrums. SDO has just finished its first year of observations. Scherrer says the HMI is an improved version of the SOHO/MDI instrument package, which completed fifteen years of impressive service. This space-based approach is a superior detection method to the original SCLERA and the 1974-christened Stanford Solar Observatory. Time flies as do today's solar observatories.

Scherrer recalls that the pioneering work done by Hill and his collaborators was interesting at the time, but subsequent observations from SOHO failed to find any evidence that Hill was actually measuring long period oscillations. The same is true for the Crimea and his earlier Stanford reports of a 160-minute period signal. At the time "we worried that it could be simply the ninth harmonic of a day. Furthermore, the lack of any detection with SOHO, which had a factor of more than ten times lower noise, shows that the 160-minute oscillation was also not solar."

Hill could not get his results published in the standard journals after the first few years of his investigations, especially when attempts to reproduce his results failed. Scherrer reiterates that, "the real test of any observational result is that it must be reproducible. These are difficult measurements and one must pay excessive attention to systematic errors. Statistical uncertainties can be evaluated by well-developed techniques, but systematic errors do not go away with more observations.

One must always be willing to accept that an earlier published result does not hold up to better observations conducted later."

Hill never did so, as far as Scherrer knows. He goes on to say, "But having started with oscillation measurements in 1975, we have seen a lot of pushing of the best technology back then, only to find that later instruments performed better and our first attempts were shown to be invalid. Life is better now."

The New View of the Sun with SDO – Inside and Out

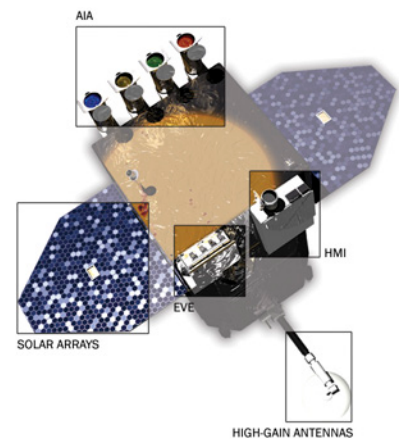
It was almost a year ago, on SDO Day 93, that the orbiting spacecraft became an operating mission. On Friday, May 14, 2010, SDO was declared operational by the Goddard Space Flight Center, the organization responsible for managing flight operations. This meant that the SDO spacecraft and its three science instruments were ready to collect science data. Since then the science teams have been busy working on making that data available to scientists, researchers, and the public.

What is SDO?

The SDO spacecraft contains a suite of instruments that provide observations expected to provide a more complete understanding of the solar dynamics that drive variability in the Earth's environment. It's a form of space weather forecasting. The on-board set of three instruments – AIA, EVE, and HMI – perform the following:

1. Measures the extreme ultraviolet spectral irradiance of the Sun at a rapid cadence,
2. Measures the Doppler shifts due to oscillation velocities over the entire visible solar disk,
3. Makes high-resolution measurements of the longitudinal and vector magnetic field over the entire visible solar disk,
4. Takes images of the chromosphere and inner corona at several temperatures at a rapid cadence, and
5. Makes those measurements over a significant portion of a solar cycle to capture the solar variations that may exist in different time periods of a solar cycle.

At launch, the total mass of SDO was 6,620 lb, of which the instruments comprised only ten percent of the weight (660 lb). The orbiting platform itself weighed in at 2,870 lb and the fuel needed to get it into orbit was almost half its total weight (3090 lb). SDO's overall length along the sun-pointing axis is 4.5 m, and each side is 2.22 m. The span of the extended solar panels is 6.25 m. To operate the spacecraft and the three instruments, the total available power is 1500 watts, which is generated from 6.6 square meters of solar arrays operating at an efficiency of 16 percent, similar to the efficiency of solar panels here on earth. The high-gain antennae rotate once each orbit to follow the Earth.



The science demands that the spacecraft delivers two things:

1. Nearly continuous observations of the Sun and
2. A science data downlink rate of over 100 Megabits per second (Mbps).

continued Page 10

SDO (from page 9)

These two requirements determined the orbit and spacecraft design as well as the definition of the overall SDO mission. In the final analysis, science data is being sent to Earth at a rate of about 130 Mbps on a continuous, high rate data stream at a Ka-Band frequency of about 26 GHz.

SDO Launched in 2010

SDO launched on February 11, 2010, at 10:23 am EST on an Atlas V from SLC 41 at Cape Canaveral. The observatory was successfully delivered into a geosynchronous transfer orbit. Shortly thereafter, SDO's propulsion system [6] performed a circularization maneuver to boost the spacecraft into geosynchronous orbit (GEO), where it underwent an extensive instrument checkout procedure. Thrusters using the same fuel and oxidizer mix will keep SDO in the correct orbit during the projected five-year life span of the mission.

Orbit Selection for SDO

The rapid cadence and continuous coverage required for SDO observations led to a requirement of placing the observatory into an inclined geosynchronous orbit. This allows for a nearly continuous, high-data-rate contact with a single, dedicated ground station. This simplified the design of SDO in that on-board data storage was eliminated and the need to reorient the spacecraft to send data back to Earth was eliminated [7].

The chosen orbit is located on the outer reaches of the Earth's radiation belt where the radiation dose can be quite high. Additional shielding was added to the instruments and electronics to reduce the problems caused by exposure to radiation. It is ironic that SDO is affected by the very processes it is designed to study – space weather!

SDO Instruments

SDO carries the Atmospheric Imaging Assembly (AIA), Extreme Ultraviolet Variability Experiment (EVE) and the HMI. The AIA images the solar atmosphere in multiple wavelengths to link changes in the surface to interior changes. Data includes images of the Sun in ten wavelengths every ten seconds. The EVE measures the solar extreme-ultraviolet (EUV) irradiance with unprecedented spectral resolution, temporal cadence, and precision. EVE measures the solar extreme ultraviolet (EUV) spectral irradiance to understand variations on the timescales that influence Earth's climate and near-Earth space.

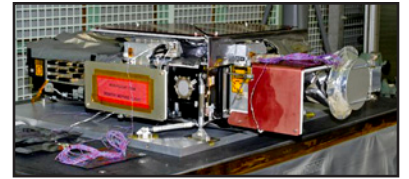
The need for an instrument like HMI was recognized in 1996 with the conceptual design developed in 1998. The SDO mission definition study completed in 2001 clarified the requirements, with real work on HMI beginning after a competitive selection process in 2002. The Helioseismic and Magnetic Imager is a new and improved version of the Michelson Doppler Imager (MDI) instrument on the Solar and Heliospheric Observatory (SOHO). SOHO is a joint project of the European Space Agency and NASA. MDI was developed, starting in 1988, by the same collaboration between Stanford University and Lockheed that developed HMI. Scherer was instrumental in the MDI program too, spending over 15 years on it. SOHO was launched in December 1995. SOHO/MDI is presently operating and has completed helioseismic and magnetic field observation of the Sun for all of solar cycle 23 and the beginning of cycle 24. HMI will continue these important measurements from space into the

next solar cycle. It is expected that SDO/HMI will enable deeper understanding of solar processes during most of solar cycle 24.

Why HMI on SDO if MDI is Still Operating on SOHO?

The Helioseismic and Magnetic Imager, pictured below, extends the capabilities of the SOHO/MDI instrument with continual full-disk coverage at higher spatial resolution and new vector magnetogram capabilities, according to Scherrer.

HMI is an instrument designed to study oscillations and the magnetic field at the solar surface, or photosphere. HMI observes the full solar disk at 6,173 angstroms (Å) with a resolution of 1 arcsecond. HMI provides four main types of data: dopplergrams (maps of solar surface velocity), continuum filtergrams (broad-wavelength photographs of the solar photosphere), and both line-of-sight and vector magnetograms (maps of the photospheric magnetic field).



The primary goal of the Helioseismic and Magnetic Imager (HMI) investigation is to study the origin of solar variability and to characterize and understand the Sun's interior and the various components of magnetic activity. HMI makes measurements of the motion of the solar photosphere to study solar oscillations and measurements of the polarization in a specific spectral line to study all three components of the photospheric magnetic field. HMI produces data to determine the interior sources and mechanisms of solar variability and how the physical processes inside the Sun are related to surface magnetic field and activity. It also produces data to enable estimates of the coronal magnetic field for studies of variability in the extended solar atmosphere, which is where the Earth is located. Solar variability that affects the Earth is called "space weather". HMI observations will help establish the relationships between the Sun's internal dynamics and its external magnetic activity. By gaining a better understanding of solar variability and its effects, a more reliable, predictive capability of space weather can be obtained [8].

HMI's investigative goals are to observe and understand these interlinked processes of magnetic activity and internal dynamics including:

1. Convection-zone dynamics and the solar dynamo,
2. Origin and evolution of sunspots, active regions and complexes of activity,
3. Sources and drivers of solar activity and disturbances,
4. Links between the internal processes and dynamics of the corona and heliosphere, and
5. Precursors of solar disturbances for space-weather forecasts.

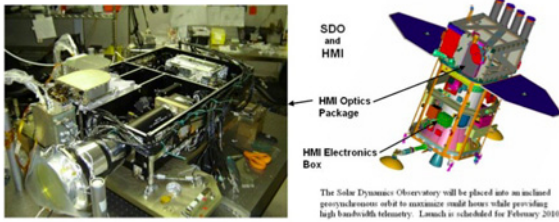
HMI Realization

The HMI instrument design and observing strategy are based on the highly successful MDI instrument, with several important improvements. HMI will observe the full solar disk in the Fe I (iron) absorption line at 6,173Å with a resolution of one arc-second. HMI consists of a refracting telescope, a polarization selector, an image stabilization system, a narrow band tunable filter and two 4,096 pixel CCD cameras with mechanical shutters and control electronics. The continuous data rate for its operation is 55 Mbits/s.

continued Page 11

SDO (from page 10)

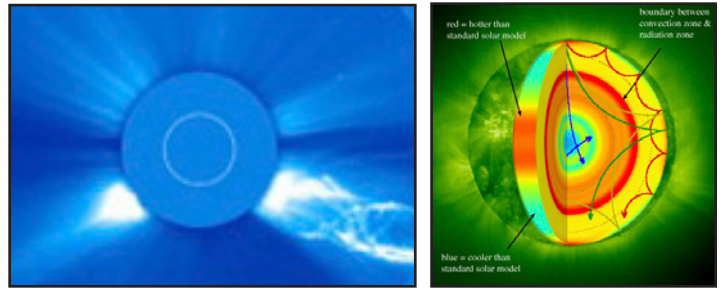
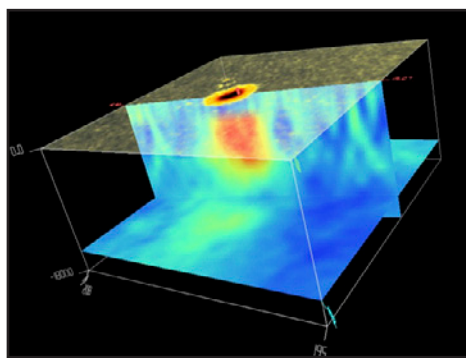
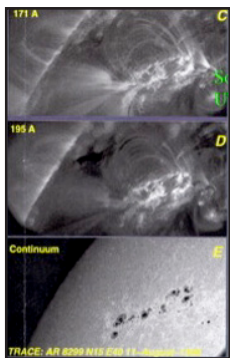
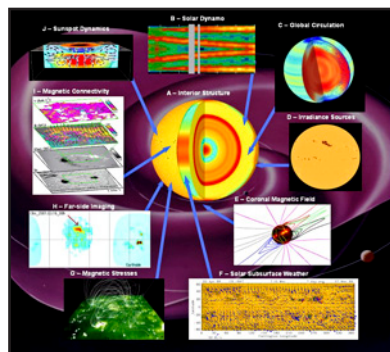
Images are taken in a sequence of tunings and polarizations at a four-second cadence for each camera. One camera is dedicated to a 45-second Doppler and line-of-sight field sequence while the other to a 90-second vector field sequence. All of the images are downlinked for processing at the HMI/AIA Joint Special Operations Center (JSOC) at Stanford University.



Examples of improved science data products from HMI observations include the following:

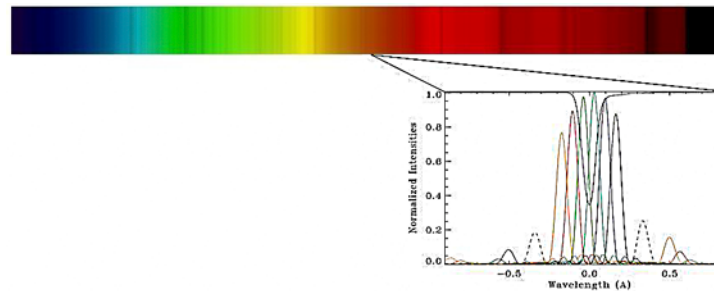
1. Sound speed variations relative to a standard solar model,
2. Solar cycle variations in the sub-photospheric rotation rate,
3. Solar meridional circulation and differential rotation,
4. Sunspots and plage contribute to solar irradiance variation,
5. MHD model of the magnetic structure of the corona,
6. Synoptic map of the subsurface flows at a depth of 7,000 km (or 7 Mm),
7. SOHO/EIT image and magnetic field lines computed from the photospheric field,
8. Active regions on the far side of the sun detected with helioseismology.
9. Vector field image showing the magnetic connectivity in sunspots, and
10. Sound speed variations and flows in an emerging active region.

An illustration of these data products is shown here. Furthermore, HMI's role is to help to derive images of magnetic structures (below, top left), the solar substructure (top right), corona mass ejections or CMEs (next page, top left), and the solar interior (next page, top right).



How HMI Works

HMI measures a long sequence of Dopplergrams (maps of solar surface velocity) and magnetograms (maps of magnetic field at the Sun's visible surface, the photosphere.) Each map of motion or magnetic field is computed on the ground from a set of twelve images of the Sun, each obtained with a different combination of wavelength tuning and polarization direction. The wavelength tuning compared to the chosen solar spectral absorption line is shown in the figure below. The black line at the top shows the solar iron spectral line profile. The colored lines show the HMI filter transmission profiles at 7.6 pm tuning spacing. The black dashed line is the profile used for the continuum filtergram. A picture is made for each tuning and the results are used to compute velocity and magnetic field strength at each pixel. The polarization selector needed for magnetic field measurements is a set of waveplates that can be rotated to different angles for detection of different polarization parameters. The wavelength selection and tuning is accomplished with a set of successively narrower bandpass filters. These are the front window, blocking filter, a five-element Lyot filter, and two Michelson interferometers. The last three filter stages can be tuned by rotating retarder waveplates. The combination results in a 7.6 pm bandpass that can be tuned over 68 pm and is centered on the 617.3 pm solar line. (Note: 1 pm = 10 mÅ)



Evolution of Solar Viewing with New Instruments

The resolution capabilities of the SDO, STEREO, and SOHO spacecrafts differ. SDO's AIA instrument has twice the image resolution than STEREO and 4 times greater imaging resolution than SOHO. The image cadence also varies. SDO takes 1 image every second. At best STEREO takes 1 image every 3 minutes and SOHO takes 1 image every 12 minutes. Look for a lot of great science to come from the next four years of SDO investigations.

—Submitted by R.K. Koslowsky, SCAS Member

<http://worldperspective.bravehost.com/astronomy.html>

Notes:

[1] Philip Scherrer is a Professor of Physics at Stanford University, and is a Principal Investigator for SDO/HMI and the SOHO/

continued Page 12

SDO (from page 11)

MDI observatories. He received his PhD from UC Berkeley in 1973, and has been at Stanford University since then.

[2] “Perturbations of the Sun’s gravitational field due to solar oscillations,” Hill, H.A. Presented at the International Symposium on Experimental Gravitational Physics, Guangzhou, China, 3 Aug. 1987. Abstract: Considerable evidence has been presented for the detection of low-degree internal gravity modes of the Sun. By combining the observations obtained at the Crimean Astrophysical Observatory and at SCLERA, a number of the modes have been classified with respect to their spatial properties. The number of such classifications has been extended in a subsequent gravity-mode project by Gu and Hill. These mode classifications have been tested using three additional sets of independent observations. Positive results have been obtained. These low-degree modes lead to oscillatory perturbations of the Sun’s gravitational field. The amplitudes of these perturbations at the Earth are inferred from the observed temperature eigenfunctions. For the $l = 2$ modes with frequencies near 100 microHerz, it is projected that these perturbations in the gravitational field will produce strains of the order of $1.0E-18$ in gravitational radiation detectors based on free masses. The signals are expected to have coherence times of hundreds or more years. The detection of these signals by gravitational radiation detectors would make available a new technique for use in solar seismological studies, which could be quite useful. The detection of these signals could also serve as a way of monitoring the performance of a given set of gravitational radiation detectors.

[3] <http://crao.crimea.ua/>

[4] <http://sun.stanford.edu/>. “The continued agreement in phase and amplitude between the two observatories...supports the interpretation that we are indeed observing solar oscillations.” Note that the Stanford Solar Observatory was renamed the Wilcox Solar Observatory in 1983. <http://wso.stanford.edu/>

[5] SOHO revealed the first images a star’s convection zone (its turbulent outer shell) and the structure of sunspots below the surface. It also discovered new dynamic solar phenomena such as coronal waves and solar tornadoes. Please see the SOHO fact sheet: http://sohowww.nascom.nasa.gov/about/docs/SOHO_Fact_Sheet.pdf

[6] SDO’s main engine is a bi-propellant system using monomethyl hydrazine (MMH) fuel and nitrogen tetroxide (NTO) oxidizer.

[7] Nearly continuous observations of the Sun can be obtained from other orbits, such as low Earth orbit (LEO). However, if SDO were placed into an LEO it would be necessary to store large volumes of scientific data onboard until a downlink opportunity occurred. The large data rate of SDO, along with the difficulties in managing a large on-board storage system, resulted in this requirement of continuous contact. The disadvantages of this orbit include higher launch costs and increased orbit acquisition costs, relative to LEO, and loss of signal during eclipse seasons twice annually, resulting from Earth shadow. During these 2- to 3-week eclipse periods, SDO will experience a daily interruption of solar observations. There will also be three lunar shadow events each year from this orbit that affect continuous operation.

[8] This is one of the key elements of Goddard Space Flight Center’s Living With a Star (LWS) program. <http://lws.gsfc.nasa.gov/>

[9] Visuals are the best way to see the SDO results. Please visit the following web sites:

The launch of SDO (note the ripples in the upper atmosphere that are produced):

There are a number of other YouTube videos that show a view of hot flares recorded by SDO, a summary of the first year of SDO images, and traveling sunspots across the face of the Sun. How the SDO destroyed a sundog, the ripple effect from another angle: http://science.nasa.gov/media/medialibrary/2010/02/18/18feb_coolmovie_resources/anna-herbst1.mov

NASA’s *SDO video gallery*

References:

[1] Kendrick Frazier’s *Our Turbulent Sun* (1982), Prentice-Hall, Inc., Englewood. This article includes passages featuring Scherrer. *Our Turbulent Sun* was a selection of the History Book Club.

[2] “Something New Under the Sun,” Robert Irion, *Smithsonian* magazine, April 2011. Scientists are probing deep beneath the surface of our nearest star to calculate its profound effect on Earth: <http://www.smithsonianmag.com/science-nature/Something-New-Under-the-Sun.html>

JWST Update (from page 3)

Webb Space Telescope may go down. If the Super Collider can be killed, so can the JWST.”

But the astronomical community should remain hopeful. Lynn Woolsey, a senior member of the House Committee on Science, Space, and Technology, on August 1, 2011 wrote to R.K. Koslowsky, “Like you, I believe we must provide adequate funding for scientific research and education. The ability of the United States to develop and prosper depends upon our nation’s investments in the scientific community. If science and technology development isn’t given support, we run the risk of losing our place in the world as preeminent innovators of new technology. H.R. 1473, the Department of Defense and Full-Year Continuing Appropriations Act for Fiscal Year 2011, included \$4.945 billion for NASA’s Science Mission Directorate, the department which develops space telescopes, a \$448 million increase from the previous year’s spending level. H.R. 1473 was signed into law by President Barack Obama. . . Be assured I will keep your thoughts in mind as Congress considers its budget priorities for Fiscal Year 2012.”

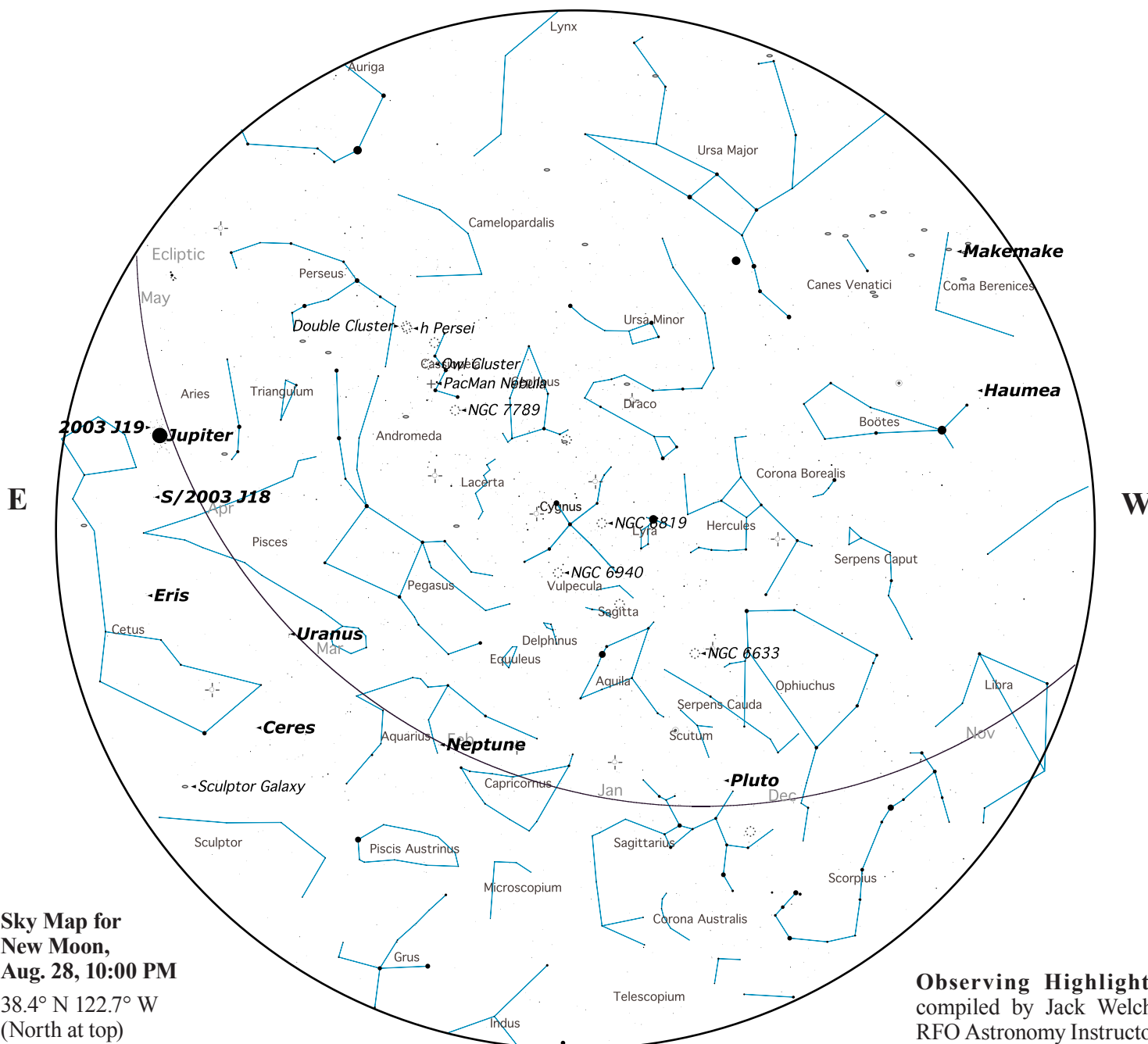
Stay tuned for further updates.

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

[1] The NPR radio interview and the associated transcript of this news are found here: <http://www.npr.org/2011/07/15/138164326/funding-for-james-webb-space-telescope-in-jeopardy>



September 2011 Observing Highlights

- 9/1** Mercury in East through 9/16. Good morning apparition of Mercury. Look for Mercury in the ENE 30 to 40 minutes before sunrise. Maximum altitude is on 9/4 (nearly 11° 30 minutes before sunrise). Greatest elongation west is on 9/2.
- 9/2** Mercury at greatest elongations West 23:00
- 9/9** Mercury very near Regulus. Look for Mercury very near the bright blue star Regulus in Leo in the east between 6:00 and 6:20am.
- 9/12** Full Moon 02:30
- 9/16** Moon near Jupiter. Look for the moon near Jupiter on the nights of 9/15-16 and 9/16-17.
- 9/16** Ceres opposition. The asteroid Ceres is at opposition at magnitude 7.6. It begins the month near 6 Cet, passes near 2 Cet at opposition, and ends the month about 2° east of 104 Aqr.
- 9/23** Autumn Equinox 0205 PDT.
- 9/23** Crescent Moon near Mars, 3:30
- 9/25** Zodiacal Light in East through 10/8, 05:00
- 9/25** Uranus opposition, 17:00. Uranus is at opposition in Pisces. It is magnitude 5.7 with a disk size of 3.7"
- 9/27** Large Tides through 9/30. The new moon occurs just 14 hours before perigee.
- 9/27** New Moon, 04:00



Observing Highlights
compiled by Jack Welch,
RFO Astronomy Instructor

September 2011

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
				Mercury in East	Mercury at greatest elongation West	
 4	5	6	7	8	9	10
					Mercury very near Regulus	
11	 12	13	14	15	16	17
			SCAS Meeting 7:30 PM		Moon near Jupiter Ceres Opposition	
18	19	 20	21	22	23	24
		RFO Night Sky Class 7:00 PM			RFO Observing Lab 7:00 PM	RFO Pubic Observing Solar: Noon-4 Night: 8PM >
					Autumn Equinox Crescent Moon near Mars	
25	26	 27	28	29	30	
Zodiacal Light in East through 10/8 Uranus Opposition		RFO Night Sky Class 7:00 PM				
		Large Tides through 9/30				

See Page 4 for more detailed information on events.

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: _____

Telephone: _____

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

- School Star Parties SCAS Board
 Newsletter Striking Sparks
 Mentoring Young Astronomers
 Yosemite Star Party Other _____

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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