



THE CARINA NEBULA

IMAGE CREDIT: NASA, ESA/ STSCI

# Space Science Institute

Newsletter



IN THIS ISSUE

## Big News in Astronomy:

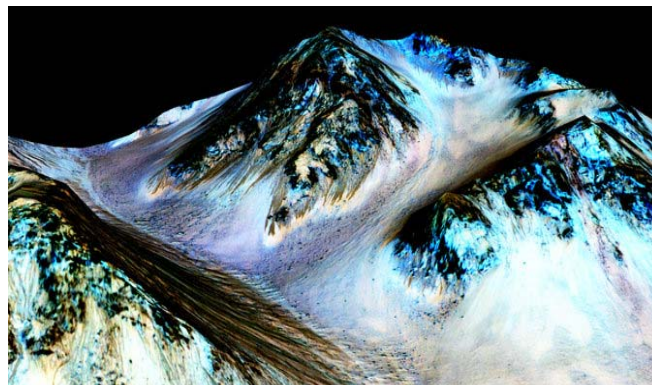
### *Mars Shows Signs of Flowing Water!*

By Dr. Bill Farrand

For several years, slopes on Martian craters and hillsides have been imaged by the Mars Reconnaissance Orbiter's (MRO's) High Resolution Imaging Science Experiment (HiRISE) camera. HiRISE can resolve objects on the Martian surface that are the size of a beach ball and some of the distinctive features seen on equator-facing slopes were dark streaks (Figure). Dubbed "recurring slope lineae" or RSLs, these features generally start near rock outcrops higher on the slopes. The RSLs have also shown a seasonal behavior, forming at the warmest time of the year. Speculation turned to the RSLs being formed by water; however, the low density of the Martian atmosphere does not allow water to persist in a liquid state on the surface and cold Martian temperatures would act to freeze water in any event.  
*More on Page 2...*

### *Enceladus Has A Global Ocean!*

Submitted by Dr. Carolyn Porco



[Figure caption: <http://www.ciclops.org/.../Global-Ocean-on-Enceladus-Artists-...>]

Over the last ten years, we on Cassini have built an edifice of knowledge of Saturn's active moon, Enceladus, that has set planetary exploration abuzz. With ever-growing degrees of confidence, we have found, one discovery after another, that this small world contains a liquid water

*More on Page 3...*



Image Credit: Anne Holland

### *SSI Open House, Logan School Visit, & Space Jam!*

SSI's 2015 Open House kicked off with a morning visit from 6<sup>th</sup> -8<sup>th</sup> grade students from the Logan School for Creative Learning in Denver. 25 students came up to learn all about SSI and what makes us tick. The afternoon and evening followed with a visit from Senator Rollie Heath, during the annual Open House! See pg. 13 for full details!

*NASA Selects Science  
Education Partners & NCIL  
is IN...more on page 9!*

## *Enceladus...an Ocean*

(...Continued from Page 1)

environment, deep beneath the ice capping its southern hemisphere, that is laced with organic compounds, comparable in salinity all Earth's oceans, and of all things under the Sun, venting to space in a spectacular and expansive array of 101 geysers reaching thousands of miles into the space. In all, these findings point to the solar system's most accessible extraterrestrial watery environment -- a habitat -- within Enceladus where, perhaps, a second genesis has taken hold. It is a possibility that can bewitch the mind and strike awe and exaltation in the most stolid of souls.

One unanswered question all this time has been: Just how extensive is the water layer within Enceladus? Evidence has been gathering since Cassini's first visits to this moon for a lens, or sea, of water, as wide as Encelodus South Polar Terrain ... that unique province at the south pole that is ringed by mountainous folds and ridges and slashed by 4 major fractures from which the geysers erupt. Then in 2013/2014, Cassini gravity measurements indicated much stronger evidence for such a south polar sea, about 35 kilometers below the surface and about 10 kilometers thick, but perhaps connected to a thinner global ocean. It was unclear.

Today, the members of my imaging science team, using our high resolution images of Enceladus' surface taken over the last 7 years, have confirmed that Enceladus' water layer is indeed global. How did they do it? By

looking for a libration ... a small, cyclical, back-and-forth deviation from uniform rotation ... and finding that it is present and much too large to be a libration of the entire body. The conclusion: It is a libration in the thin, outer ice shell only, indicating that ice shell and rocky core are decoupled and separated by a liquid layer.

Sacré bleu!

It has been a hard problem to solve, requiring persistence, painstaking analysis, an understanding of orbital and rotational dynamics, and bringing to bear the full and tedious brunt of statistical analysis. But it has yielded gold.

So here's raising a glass to our kind. We have done a remarkable thing ... to set our craft on a long-distance mission in search of lovely blue oceans like those of Earth, and have it answer us with such gratifying certitude. Enjoy!

[News announcement released today:  
<http://www.ciclops.org/view.php?id=81921>

## *Mars Shows Signs of Having Flowing Water*

*Continued from page 1*

However, Earth-bound motorists who put anti-freeze in their cars in the winter know that the freezing point of water can be depressed by mixing it with certain chemicals. So while the RSLs have been imaged by HiRISE for several years now, it took a study using the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) to find the nature of the

“anti-freeze” in the waters forming the RSLs.

CRISM is used by a number of SSI researchers for both surface and atmospheric studies. It collects hundreds of spectral channels from which spectra can be extracted to search for diagnostic absorption features in atmospheric gasses or surface materials. The team that used CRISM to study the residue of the RSLs (<http://www.nature.com/ngeo/journal/vaop/ncurrent/full/ngeo2546.html>) found the signature of several salts, magnesium perchlorate, magnesium chlorate and sodium perchlorate, associated with them. The observation of the presence of these salts associated with the RSLs provided the mechanism to keep water liquid long enough to form the dark streaks.

As to the source of the water and what the presence of liquid water, even the briny liquid water, means to the search for life on Mars... those are questions that still remain and beckon as a mystery to be solved on the red planet Mars.

Image Credit: Jet Propulsion Laboratory/University of Arizona, via NASA



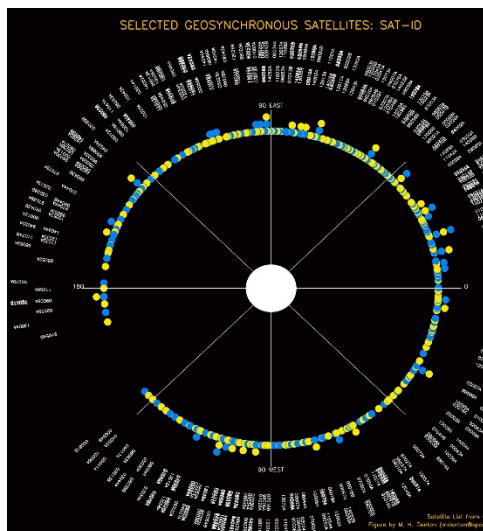
Streaks of Flowing Water on Mars  
Images showing what scientists say is definitive evidence of salty liquid water flowing on Mars.



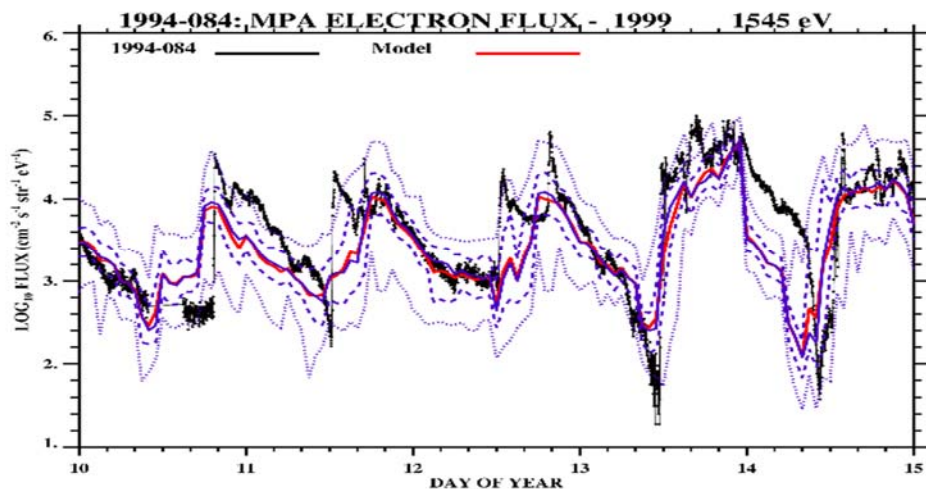
# Improved Predictions of Space Weather Effects at Geosynchronous Orbit

Written by: Dr. Mick Denton and Dr. Joe Borovsky

Geosynchronous orbit (GEO) is one of the most popular locations for satellite hardware. Satellites located in this orbit travel around the Earth with a period of 24 hours,



environment in this region is of great interest to satellite designers and operators. We recently developed a new model of the flux



meaning that they always remain roughly above the same geographic location. Over 400 satellites used for communications, scientific, and military purposes are currently in orbit at GEO (see Figure 1 and <http://www.satsig.net/sslist.htm>).

Knowledge of the plasma flux environment at GEO is important when designing and operating such satellites since impacts from energetic electrons and ions can damage satellite hardware. Hence, being able to predict the plasma

of electrons and ions at GEO, for energies between  $\sim 1$  eV and  $\sim 40$  keV, as a function of local time, energy, geomagnetic activity, and solar activity [Denton *et al.*, 2015]. The energy range of the model encompasses the plasmasphere, the electron plasma sheet, the ion plasma sheet, and the substorm-injected suprathermal tails of both the electron and ion plasma sheets. Each of these populations is encountered regularly by satellites on station at GEO. A test of the model predictions is shown in Figure 2, for a five day period in 1999. The model predictions match observations extremely

well, even though this period was a stormy period in terms of “space weather”. The model is freely available to satellite operators and developers.

The paper describing the model was recently chosen as a spotlight in the American Geophysical Union “Space Weather” journal and highlighted in the EOS periodical, also published by AGU.

Further development of the model is planned in two areas:

1. Geomagnetic/Solar Conditions - While Kp is a good proxy for general geomagnetic activity, it would be useful to be able to drive the model with upstream solar-wind conditions, such as the solar-wind electric field ( $-v_{sw}B_z$ ).

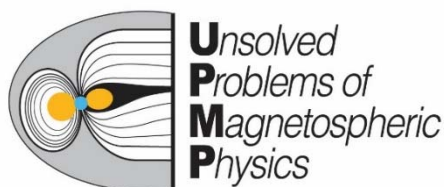
## 2. Extended Coverage

- (a) Extending the model in spatial extent (inwards and outwards of GEO);
- (b) Extending the energy range of the model (upwards from 40 keV);
- (c) Extending the model to consider geomagnetic latitude (off-equator) effects.

Work in these areas will be presented at the Fall AGU meeting in San Francisco in December.

Model website and download:  
<http://gemelli.space-science.org/mdenton/>

M. H. Denton, *et al.*, An empirical model of electron and ion fluxes derived from observations at geosynchronous orbit, *Space Weather*, doi:10.1002/2015SW001168, 2015.



WORKSHOP • SCARBOROUGH, UK • SEPTEMBER 2015

Submitted by: Dr. Mick Denton

**Meeting Website:**

<http://spacescience.org/upmpw/>

The “*Unsolved Problems of Magnetospheric Physics Workshop*” was held in Scarborough, UK from 6-12th September, 2015. The meeting was convened in order to formulate, and address, our current state of knowledge regarding magnetospheric physics and solar-wind/magnetosphere interactions.

57 scientists (plus guests) attended the workshop and > 6 day workshop. The oral presentations centered on what we currently don't know about the magnetosphere, rather than what we already do know. The workshop also contained a number of dedicated discussion sessions. Throughout the week lively and productive discussions were the order of the day, as attendees sought to find agreement on the major unsolved problems that our community should tackle in future. These problems included the nature of the solar-wind/magnetosphere coupling, the role of ion composition in the magnetosphere, the formation mechanisms for auroral arcs, and the need for improved quantification of the Earth's ionospheric conductivity, on the dayside and the nightside.

In common with current ideas within the community, there was a feeling that magnetospheric research has reached a point where system-science studies are needed more than ever. The workshop discussed the current international funding climate for magnetospheric research in this regard. There was general agreement that there should be more attention (and funding!) devoted to: (i) co-ordinated, multi-spacecraft studies, (ii) co-ordinated ground-and-spaced-based investigations, and (iii) analysis of legacy datasets in conjunction with new mission priorities. A large investment has already been made in producing the vast magnetospheric data-sets that are currently available for analysis. The meeting was unanimous in its belief that these data-sets can and should contribute substantially to solving the questions listed above.



Image from : <http://spacescience.org/upmpw/>



In addition to this meeting report, we have submitted a summary of the workshop to the AGU/EOS periodical. One further concrete outcome of the workshop will be a Special Section of papers in the Journal of Geophysical Research Space Physics on “*Unsolved Problems in Magnetospheric Physics*”. Submission of papers for the Special Section will be open from 1st October 2015 to 1st February 2016. The workshop is the fourth in a series of meetings previously held in Chile and the USA. We are already looking forward to the next meeting in the series - to be held in Chile in the autumn of 2017!!!

Mick Denton (on behalf of the UPMP Workshop Organising Committee)

*Joe Borovsky (Space Science Institute, USA)*

*Mick Denton (Space Science Institute, USA)*

*Marina Stepanova (Universidad de Santiago de Chile, Chile)*

*Juan Alejandro Valdivia (Universidad de Chile, Chile)*

***Big thanks to SSI's Evaldas Vidugiris for running the website for this meeting!!!***

## SSI IN THE PRESS!



### 2015 Roy L Shafer Leading Edge Award for Leadership in the Field (Nonexecutive Leadership)

Congratulations to SSI Board Member **Dr. Marilyn Johnson**, recently retired Science Director at the [Oregon Museum of Science and Industry \(OMSI\)](#), for winning the 2015 Roy L Shafer Leading Edge Award for Leadership in the Field (Nonexecutive Leadership).

Great job Marilyn!!

## NERD NIGHT DENVER!



Dr. Bill Farrand was a featured speaker at Nerd Nite Denver on October 22, presenting

“These Wheels are made for Roving : Exploring the surface of Mars with Spirit, Opportunity and Curiosity”.

Nerd Nite is a World Wide monthly lecture series that strives for an “Inebriated, Salacious, yet deeply academic vibe”.

## COLORADO GIVES DAY LAUNCHES WITH \$1 MILLION INCENTIVE FUND

Submitted by: Courtney Stanton

SSI has recently joined forces with Colorado Gives, an online development resource featuring Colorado charities and nonprofits.

If you or someone you know are thinking of giving to SSI this year, please support us through the Colorado Gives portal, especially on **Tuesday, December 8, 2015 (Colorado Gives Day)**. Colorado Gives Day is an annual drive to celebrate and increase philanthropy to Colorado nonprofits through online giving.

The \$1 Million Incentive Fund made possible through a partnership between Community First Foundation and First Bank, is one of the largest gives-day incentive funds in the country. And the more a non-profit raises during this big event, the better our chances are for receiving the incentive corporate matching funds! See the following link for the formula

<https://www.coloradogives.org/cogivesday/nonprofitFAQS>

### When:

24 hours starting at 12 a.m. on **Tuesday, December 8, 2015**  
[Add to Outlook](#) | [Add to Google Calendar](#) | [Add to iCalendar](#)

### How:

Donate online at CO Gives to help support SSI,  
<https://www.coloradogives.org/SpaceScienceInstitute/overview> at ColoradoGives to help support SSI! Or, you can even schedule

your donation in advance (starting November 2015).

### Why:

Because you love SSI and to help strengthen SSI’s activity as an organization toward completing any and all work we can to achieve our mission!

## Amazon Smile!

Want to help SSI earn extra funding while you are doing your 2015 holiday shopping? Use the link below to get to AmazonSmile and select Space Science Institute as your charity of choice! As a result, SSI will earn an extra .5% from each purchase you make.

### [smile.amazon.com](http://smile.amazon.com)

Be sure to tell your family and friends as well...the more we earn, the more flexibility we have to continue the great work you have all come to know and love

## Lab Notes – SSI’s Dr. Travis Metcalfe is a regular columnist!



Dr. Travis Metcalfe, one of SSI's local Boulder Research Scientists is

now also a published monthly columnist for Boulder Weekly! To read his article in full, go to:

<http://www.boulderweekly.com/article-14941-covering-science-news-around-boulder.html>

### **COMING UP NEXT ISSUE:**

Meet the SSI Board of Directors!  
 &  
 See NCIL’s newest library exhibits!



## Stratospheric Chemistry After the Massive 2010 Storm on Saturn

Submitted by Dr. Julianne Moses

Colossal storms dubbed "Great White Spots" are observed to erupt occasionally on Saturn. In December 2010, one such storm spawned in Saturn's northern hemisphere. Fortunately for astronomers, the *Cassini* spacecraft was already in orbit, and its instruments could record the storm's consequences in exquisite detail. The most obvious side effect was the formation of thick, white, tropospheric clouds that eventually spread across an entire latitude band (see Figure 1). However, the storm also had some profound and unexpected consequences for higher-altitude regions of the atmosphere. In particular, the storm triggered major changes in stratospheric temperatures and molecular abundances that were observed to persist for years after the original outburst. The stratospheric regions affected by the storm have been nicknamed "beacons" due to their prominent infrared-emission signatures (see Figure 1). The two beacon regions that had initially formed ended up merging together in April 2011 to form a single, large, anticyclonic vortex. Stratospheric temperatures within this merged vortex were observed to increase by an unprecedented 60%, most likely as a result of wave activity and/or subsidence and adiabatic heating within the region. Stratospheric constituents such as ethylene and water were observed to increase in abundance by as much as two orders of magnitude within the merged beacon. To better understand how and why the storm affected Saturn's stratosphere, a team led by SSI senior research scientist Julianne Moses analyzed data from the Composite Infrared Spectrometer



NASA/JPL-Cassini ISS image: Feb. 25, 2011

Fig 1

(CIRS) instrument on *Cassini* and developed theoretical models to track the expected photochemical evolution of stratospheric constituents within the storm beacon region. Their results are published in the November issue of the journal *Icarus*.

Dr. Moses and her colleagues confirm the previously reported strong increase in the ethylene abundance in the beacon region and determine that other stratospheric molecules such as acetylene and ethane also exhibit increases, albeit not as dramatically as was seen for ethylene. The photochemical models indicate that the increased temperatures alone cannot account for the increased constituent abundances in the beacon. Although a moderate increase in the ethylene abundance is expected due to a key chemical production reaction with a strong temperature dependence, the models that consider temperature changes alone, with no changes in atmospheric dynamics, are found to under predict the abundance of  $C_2H_x$

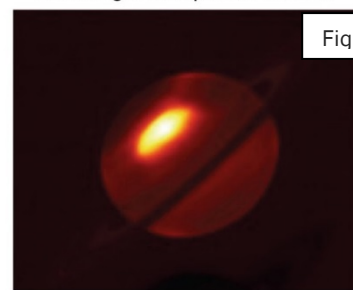
Tropospheric storm

hydrocarbons by a factor of 2-7 at the core of the newly merged beacon, suggesting that other processes are affecting the hydrocarbon profiles. Further modeling suggests that vertical downwelling winds of the order of -10 centimeters per second in the middle stratosphere within the beacon vortex are needed to explain the observed hydrocarbon abundances. Such downwelling winds also lead to increases in the abundance of oxygen species such as

$CO_2$  and  $H_2O$ , whose source is presumed to be external to the planet (that is, from Enceladus plume material, ring debris, interplanetary dust, or comets). Moreover, the increased beacon temperatures lead to the evaporation of stratospheric aerosols and to a corresponding increase in the gas-phase abundances of diacetylene and benzene at low altitudes. Although a  $-10 \text{ cm s}^{-1}$  vertical wind is very large by most planetary standards, some apparently similar extreme downwellings do occur in the nightside mesosphere of Venus due to the sub-solar to anti-solar upper-atmospheric flow, and in stratospheric sudden warming events at high latitudes in the Earth's mesosphere. The team concludes that acetylene and ethane have long-enough chemical lifetimes that they can be used to trace the complex dynamical consequences of the storm in an atmospheric region that has no cloud features or other natural tracers of atmospheric motion.

In the *Icarus* paper, Moses and her colleagues discuss the general chemical behavior of stratospheric constituents in the beacon region,

Resulting stratospheric "beacon"



July 2011, VLT mid-IR  
L. Fletcher/Oxford/ESO

Fig 2

demonstrate how the evolving beacon environment affects the species vertical profiles and infrared emission characteristics, make predictions with respect to compositional changes that can be tested against *Cassini*, *Herschel*, and ground-based observations of the beacon region, and discuss future measurements and modeling that could further our understanding of the dynamical origin and evolution of and chemical processing within the unexpected stratospheric vortices that were generated after the 2010 convective event.

# Deciphering the embedded wave in Saturn's Maxwell ringlet

[Richard G. French<sup>a</sup>](#), [Philip D. Nicholson<sup>b</sup>](#), [Mathew M. Hedman<sup>c</sup>](#), [Joseph M. Hahn<sup>d</sup>](#), [Colleen A. McGhee-French<sup>a</sup>](#), [Joshua E. Colwell<sup>c</sup>](#), [Essam A. Marouf<sup>f</sup>](#), [Nicole J. Rappaport<sup>g</sup>](#)

The eccentric Maxwell ringlet in Saturn's C ring is home to a prominent wavelike structure that varies strongly and systematically with true anomaly, as revealed by nearly a decade of high-Signal to Noise Ratio (SNR) Cassini occultation observations. Using a simple linear "accordion" model to compensate for the compression and expansion of the ringlet and the wave, we derive a mean optical depth profile for the ringlet and a set of rescaled, background-subtracted radial wave profiles. We use wavelet analysis to identify the wave as a 2-armed trailing spiral, consistent with a density wave driven by an  $m=2$  outer Lindblad resonance (OLR), with a pattern speed of  $\Omega_p = 1769.17^\circ \Omega_p = 1769.17^\circ \text{d}^{-1}$  and a corresponding resonance radius of  $a_{\text{res}} = 87530.0 \text{ km}$ . Estimates of the surface mass density of the Maxwell ringlet range from a mean value of  $11 \text{ g cm}^{-2}$ , as inferred from the wave's phase profile and a theoretical dispersion relation. The corresponding opacity is about  $0.12 \text{ cm}^2 \text{ g}$ , comparable to several plateaus in the outer C ring (Hedman, M.N., Nicholson, P.D. [2014]. *Mont. Not. Roy. Astron. Soc.* 444, 1369–

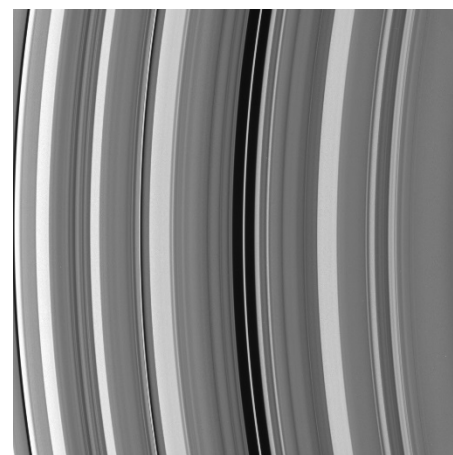
1388). A linear density wave model using the derived wave phase profile nicely matches the wave's amplitude, wavelength, and phase in most of our observations, confirming the accuracy of the pattern speed and demonstrating the wave's coherence over a period of 8 years. However, the linear model fails to reproduce the narrow, spike-like structures that are prominent in the observed optical depth profiles. Using a symplectic N-body streamline-based dynamical code (Hahn, J.M., Spitale, J.N. [2013]. *Astrophys. J.* 772, 122), we simulate analogs of the Maxwell ringlet, modeled as an eccentric ringlet with an embedded wave driven by a fictitious satellite with an OLR located within the ring. The simulations reproduce many of the features of the actual observations, including strongly asymmetric peaks and troughs in the inward-propagating density wave. We argue that the Maxwell ringlet wave is generated by a sectoral normal-mode oscillation inside Saturn with  $\ell=m=2$ , similar to other planetary internal modes that have been inferred from density waves observed in Saturn's C ring (Hedman, M.N., Nicholson, P.D. [2013]. *Astron. J.* 146, 12; Hedman, M.N., Nicholson, P.D. [2014]. *Mont. Not. Roy. Astron. Soc.* 444, 1369–1388). Our identification of a third  $m=2$  mode associated with saturnian internal oscillations supports the suggestions of mode splitting by Fuller et al. (Fuller, J., Lai, D., Storch, N.I. [2014]. *Icarus* 231, 34–50) and Fuller (Fuller, J. [2014]. *Icarus* 242, 283–296). The fitted amplitude of the wave, if it is interpreted as driven by the

$\ell=m=2$   $\ell=m=2$ f-mode, implies a radial amplitude at the 1 bar level of  $\sim 50 \text{ cm}$ , according to the models of Marley and Porco (Marley, M.S., Porco, C.C. [1993]. *Icarus* 106, 508).

## CASSINI ISS INSTRUMENT OPERATIONS AT SSI

For more about what the SSI Cassini ISS team members are up to on a regular basis, and Dr. Carolyn Porco's Captain's Log, please check out: [www.ciclops.org](http://www.ciclops.org)

Image of Maxwell Ringlet



***The National Center for Interactive Learning (NCIL) leverages SSI's successful experience in research, museum, science center and library educational programs, public outreach, and digital technologies into accessible and inspiring learning opportunities.***

## **NASA Selects Science Education Partners for STEM Agreements – Proposal Win for NCIL!**

Written by: NASA

Submitted by: Courtney Stanton – SSI Business Office

NASA has selected 27 organizations from across the United States to begin negotiations for Science Education Cooperative Agreement Notice (CAN) awards totaling \$42 million to implement a new strategic approach to more effectively engage learners of all ages on NASA science education programs and activities.

Agreement awards can run up to five years, with an additional five-year option. Selectee activities will support Earth science, astrophysics, planetary science and heliophysics.

“NASA seeks to innovate, explore, discover, and inspire and these selections build upon a legacy of excellence from our science education community,” said John Grunsfeld, astronaut and associate administrator of SMD. “STEM education is the enabler of future space exploration and these awards, together with efforts in NASA’s Office of Education and other partners, will advance STEM efforts in this country, improve U.S. scientific literacy, and help to inspire our nation.”

*We heartily congratulate SSI’s Director of NCIL Dr. Paul Dusenbery and his team (Jaime Harold, Anne Holland, Naomi Carlson and Evaldas Vidugiris) for their project:*

*“NASA@ My Library: A National Earth and Space Science Initiative that Connects NASA, Public Libraries and their Communities”*

*To view the full list of the 27 selected organizations, along with an introductory video from Grunsfeld, visit:*

<http://www.nasa.gov/feature/list-of-science-education-partners-for-nasa-...>

*For more information on NASA’s science programs, please visit: <http://science.nasa.gov>*

## **2015 Public Libraries and STEM Conference**

Submitted by Anne Holland, NCIL, SSI HQ Office

Image Credit: SSI

The conference brought together 151 leaders and decision-makers from both the public library and STEM education communities at the Sheraton Hotel in downtown Denver, Colorado. This conference took place August 19th-22nd.

Public libraries are undergoing a profound transformation as they continue to re-define their role as a valued, knowledge-based community resource. At the same time, STEM organizations (e.g., science museums, STEM professional associations, universities/colleges, research institutions, state and federal agencies) seek to more effectively reach groups historically underrepresented in STEM fields – such as underrepresented minorities, lower-income populations, and women. Together, public libraries and STEM organizations have the potential to dramatically increase the availability of STEM learning opportunities in communities of all sizes.

The *Public Libraries & STEM* conference will help to establish an important foundation for the transformational changes that are taking



place in public libraries and their communities.

The organizers would like to thank the following prime sponsors for supporting this conference and associated events: National Science Foundation, The Morgridge Family Foundation, Denver Museum of Nature and Science, KEVA



Planks, National Renewable Energy Laboratory, Condit and Google.

We are working on a Google site that will allow you to see all the posters presented as well as view the Power Point presentations and read the first hand notes from various sessions. It is coming soon.

Sandy Toro, Institute of Museum and Library Services, discusses STEM learning in public libraries as well as the impacts the conference can have on both the public library and STEM communities. For more details visit: <https://www.ims.gov/news-events/upnext-blog?p=5969>



## Come see the Great Balls of Fire exhibit in a city near you!

### Tour Dates/Locations:

#### Fall 2015

Museum of Discovery and Science  
Ft. Lauderdale, FL

#### Spring 2016

Delaware Museum of Natural History  
Wilmington, DE

#### Summer 2016

Museum of Arts & Sciences  
Macon, GA

#### Fall 2016

Gateway Science Museum  
Chico, CA



### FOR MORE INFORMATION

Click on :

[www.GreatBallsofFireExhibit.org](http://www.GreatBallsofFireExhibit.org)

or contact Anne Holland directly at :

[aholland@spacescience.org](mailto:aholland@spacescience.org)



## STEAM Fest 2015!

Space Science Institute participated in the inaugural Rocky Mountain STEAM Fest September 5<sup>th</sup> & 6<sup>th</sup>, at the Boulder County Fairgrounds in Longmont, CO. More than 800 people visited our booth, with ~500 people joining us for solar viewing and almost 300 kids getting the chance to make comets out of dry ice! Visitors to the SSI booth also had the opportunity to play Dr. Jaime Harold's *Planet Families*, learn more about our online games and apps, handle real meteorites, and learn more about current NASA and ESA missions.

On October 10 & 11<sup>th</sup> SSI's also showcased at the NoCo Mini Maker Faire in Loveland, CO. We hope to see you at our next public event!



Image Credits: SSI





## SSI's Space Jam, Open House and the 2015 Picnic!

Submitted by: Courtney Stanton

The Space Science Institute held its annual Open House event on September 16, 2015 with a wonderful turnout and successful new morning event! From 10am – 2pm, 24 students and 6 teachers came up to SSI Headquarters from the Logan School for Creative Learning in Denver to meet in-person with SSI scientists and educators.

Dr. Ralph Shuping, Dr. Mick Denton, Dr. Karly Pitman, Dr. Bill Farrand, Dr. Colin Mitchell, and Dr. Jaime Harold all spent time talking about their areas of expertise and answering student's questions before lunch. After lunch, Naomi Carlson and Anne Holland took to the students outside to enjoy the beautiful fall weather, while they learned about (and participated in) solar viewing, comet making, and hands-on meteorite lessons.

In the Afternoon the Space Science Institute opened its doors to the public and our colleagues for the more formal portion of our Open House. Formal presentations were given by Dr. Ralph Shuping, Dr. Colin Mitchell, Dr. Bill Farrand, Dr. Mick Denton, and Dr. Paul Dusenbery throughout the afternoon and evening as other attendees mingled and enjoyed the complimentary hors d'oeuvres and beverages. It was a wonderful mix of attendees with a surprise visit from SSI Board Members Ann Goldman and Larry Satkowiak, as well as Senator Rollie Heath in the mix!

On Thursday, September 17<sup>th</sup>, Space Jam kicked off in earnest with a new format from our new leader. SSI staff members were given access to outside resources for benefits and retirement questions/information and there was a wide selection of internal information shared during the collaboration sessions. Awards were handed out for time of service with SSI, dedication, hard work, and even for a small handful of PIs who did a fantastic job meeting or exceeding their proposal submission process deadlines for 2014! The day wrapped up with birthday cake in honor of all the SSI staff members with September birthdays and the annual staff/Board member SSI Banquet at the Chop House in Boulder. It was good food, great company, and fabulous weather for another successful banquet, enjoyed greatly by all.



Image Credit: Dr. James Harold

On Friday, September 18<sup>th</sup> (or Space Jam day 2), there was a strong effort toward internal collaboration for improving proposal processes and win rates, opening up the floor for suggestions and ideas on how to continue improving and growing SSI successfully, and several Q & A sessions for IST and the Business Office.

The week's events wrapped up on Saturday, September 19<sup>th</sup>, at Carr Park in Longmont for the annual SSI Picnic. With family and friends in attendance, there was BBQ, plenty of sunshine, and lots of activities and fun utterly enjoyed by

Image Credit: Dr. Luca Montabone



everyone who was able to attend. From young to old, we had – unequivocally – one of the largest picnics in many years and we look forward to seeing even more of the SSI family and friends in attendance at next year's event!



Image Credit: KaYee Boudouridis



Image Credit: KaYee Boudouridis



**SSI Facebook Roundup:**

Top stories for SSI from August – October 2015 on SSI's Facebook page:

<https://www.facebook.com/spacescienceninstitute>

August 7: SSI's Dr. Bill Farrand was invited to speak at the ENVI Analytics Symposium, in Boulder.

August 10: Black Holes detection, see the twitter feed coming out of the 2015 International Astronomical Union meeting going on in Honolulu.

August 12: 1 year Anniversary of the Mars Orbiter's launch, new Pictures and Seasonal Flows in Mars' Valles Marineris.

August 13: SSI's very own Dr. Luca Montabone gave a talk at the local "Observatoire des Bauges" (Bauges Observatory) France.

August 17: Cassini's last close flyby of Saturn's pockmarked moon Dione!

August 20: NCIL STEM & Public Libraries Conference 2015.

August 20: Read Dr. Carolyn Porco's post about Cassini's flyby of Dione.

September 5: SSI had a busy day making comets at Rocky Mountain STEAM Fest.

September 6: STEAM Fest Solar Viewing Outreach Event.

September 16: SSI's Executive Director Dr. Karly Pitman and Senator Rollie Heath enjoyed the SSI 2015 Open House.

September 18: Friday's SSI 2015 Space Jam Picture.

September 22: Congratulations to SSI's Board Member Dr. Marilyn Johnson for winning a 2015 Roy L Shafer Leading Edge Award for Leadership in the Field (Nonexecutive Leadership)!!

October 2: Congratulations to Dr. Paul Dusenbery and the NCIL Team for winning a NASA CAN Award!

October 2: SSI's Dr. Carolyn Porco, Speaking with Carbon – Chauvinist Blog keeping science in the forefront!

October 5: Meteor Showers and Shooting Stars: Formation, Facts and Discovery

October 6: White House Astronomy Night is coming up! See our link for full details!

October 6: Carolyn Porco and her Team posted picture of Cassini artful confluence of spectaculars: Titan, Pandora and Saturn's rings

October 6: Nerd Nite is coming, SSI's own Dr. Bill Farrand will be speaking October 22<sup>nd</sup>.

October 7: Amazon Smile, come support SSI by shopping on Amazon Smile!

October 14: Learn about the Decadal Reports for Astronomy, Astrophysics and Planetary Science, if you are so inclined and haven't viewed it yet.

October 15: 2015 Super Science Saturday is being held at UCAR Center for Science Education in Boulder on November 7, 2015!

October 18: Because even after so many years, Mars still has so much to teach us?

October 19: NASA looking for 3D-Printed Mars Habitat Design Contest, what do you think you can contribute to help?

October 19: SSI's *Discover NASA* Exhibition has officially opened at the Louisville Public Library.

October 21: Dust left behind by Halley's Comet slams into our atmosphere and creates celestial fireworks.

October 26: Star.net and STAR Library Network – STEM Learning in Libraries – Education

October 27: New Beautiful Picture of our Milky Way Galaxy, never been seen before.

October 27: Updated pictures of Enceladus from Dr. Porco and her great team!

October 27: Mar's Mysterious South Pole Revealed in New Photo!

October 30: Video: Dark Oceans: Surveying Saturn's Moons

November 3: Captivating Science – Acid Fog Likely Dissolved Rocks on Mars: Discover News.

## **Congratulations to SSI PIs on the following New Awards:**

When in the Major Merger Sequence is (Obscured) Black Hole Growth Triggered? – Dr. Franz Bauer – Award from NASA.

Derivations of Optical Constants of Mars Carbonate Analogs – Dr. Karly Pitman – Award from NASA.

Refractive Indices for Martian Remote Sensing and Extended Boundary Condition Method Modeling for Surface Reflectance Analysis – Dr. Karly Pitman – Award from NASA.

Measuring the Light Curves of the Binary Black Hole Candidate OJ287 and Other Fermi Blazars – Dr. Ann Wehrle – Award from NASA.

Rotation Periods of Very Low Mass Stars and Brown Dwarfs in Open Clusters – Dr. Dawn Peterson – Award from NASA.

Optical Time Variability of OJ287, 3C446, and other Fermi Blazars in Kepler K2 Fields – Dr. Ann Wehrle – Award from NASA.

Simulations of Space Plasmas – Dr. Peter Porazik – Award from DOE.

Major and Minor Components of the Surface Layer of Mars: An Investigation Using the MER Pancam and Mini-TES Instruments – Dr. Bill Farrand – Award from JPL.

Aerosol Studies and the Boundary Layer: Things Are Looking Up – Dr. Michael Wolff – Award from JPL.

Mars Exploration (MER) Science Investigation – Dr. Ben Clark – Award from JPL.

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Do you have something you'd like to see in the next SSI Newsletter?

If so, please contact Barbi or Courtney with your details!

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