



# GoddardView

Volume 8 Issue 4  
May 2012

## Discovery's Final Flight

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## Lightning Signature Could Help Reveal Solar System's Origin

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## Aura Takes the A Train to Washington

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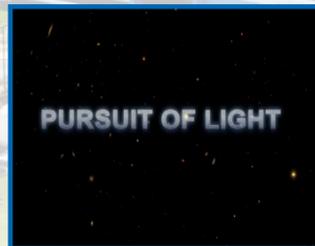
## THE WEEKLY



**Chat with John Mather on Twitter**  
JWST is hosting a "Tweetchat" on May 17, 2-3:00 p.m. on Twitter. Nobel Laureate and Webb telescope project scientist John Mather will answer your questions about Webb science. Tweet your question with the Twitter hashtag #JWSTscience and your question might get an answer from Dr. Mather.

### Pursuit of Light

NASA takes aim at wide audiences with a bold, inventive short film built from some of the biggest data sets ever captured. Combined with arresting time lapse footage of the natural world and a moody, energetic score, *Pursuit of Light* presents an exciting take on daring NASA science.



**Sunday Experiment May 20, 2012**  
May's Sunday Experiment will focus on solar science and space weather. Participants will learn about solar storms and how they effect the Earth from an SDO scientist. They can also participate in hands-on activities that explore the magnetic fields of the Sun, electromagnets, and ultraviolet light.

### Sunspot Produces M-Class Flares

A particularly large and complex sunspot appeared over the left limb of the sun on Saturday, May 5, beginning its two-week trek across the face of the star in conjunction with the Sun's rotation. The sunspot, dubbed Active Region 1476, has so far produced seven M-class flares and numerous C-class flares, including two M-class flares on May 9, 2012.



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**Cover caption:** Goddard employees gaze skyward to witness space shuttle *Discovery* on its final flight.

Photo Credit: NASA/Goddard/Debora McCallum

## GoddardView Info

*Goddard View* is an official publication of NASA's Goddard Space Flight Center. *Goddard View* showcases people and achievements in the Goddard community that support Goddard's mission to explore, discover, and understand our dynamic universe. *Goddard View* is published weekly by the Office of Communications. Archived issues are available at: <http://www.nasa.gov/centers/goddard/news/goddard-view.html>

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News items for publication in *Goddard View* must be received by noon Wednesday of each week. You may submit contributions to the editor via e-mail at [john.m.putman@nasa.gov](mailto:john.m.putman@nasa.gov). Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

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# NASA EXHIBITS INSPIRE MARYLAND DAY EXPLORERS

By: Michelle Jones

On Saturday, April 28, 2012, representatives from the Office of Communications and the Applied Engineering and Technology Directorate participated in the University of Maryland's annual family-friendly event, Maryland Day 2012. Over 65,000 people took part in a day full of exploration, learning, and fun. The theme, "Explore Our World," gave visitors an opportunity to move throughout the 1,250-acre campus to learn about the University of Maryland and its partners through tours, exhibits, and demonstrations.

The Goddard booth was comprised of representatives from the Office of Communications and the Applied Engineering and Technology Directorate. Attendees were able to learn about several upcoming missions and events, and take part in several interactive demonstrations. The Office of Communication's photo booth allowed attendees to see their face in space through the use of a digital camera and imaging software. Over 600 pictures were taken in just a few short hours, and all were beyond excited to see their face superimposed into an astronaut helmet with a cool science image as the backdrop.

Attendees who participated in the Engineering demonstrations got an up-close view of the diverse range of NASA Goddard's engineering and technology development. At the optical engineering table,

attendees learned how optical principles like diffraction and polarization are used in instruments to study objects in the distant universe, as well as here on Earth. At the thermal engineering table, attendees learned about heat pipes and thermal blankets. The heat pipe demonstration showed how spacecraft hardware is cooled very quickly and also offered examples of how we use this technology in our everyday lives in devices such as laptops.

At the Thermal Coating and Contamination engineering tables attendees learned about two new technologies Goddard is developing to mitigate molecular and particulate contamination.

Amy Pruett of Goddard's Office of Communications said, "Maryland Day was an excellent opportunity for us to share our exciting Goddard missions, interact with the public through intriguing demos, and invite the community to our public engagement activities. It was an honor to coordinate our presence, and I hope we will be able to participate again next year." ■

Above: Trusilla Steele of Goddard's Office of Communications interacts with Maryland Day visitors. Photo credit: NASA/Goddard/Bill Hrybyk



“...a tantalizing clue to the way the planets formed.”



## LIGHTNING SIGNATURE COULD HELP REVEAL SOLAR SYSTEM’S ORIGINS

By: Karen Fox

Every second, lightning flashes some 50 times on Earth. Together, these discharges coalesce and get stronger, creating electromagnetic waves circling around Earth, to create a beating pulse between the ground and the lower ionosphere, about 60 miles up in the atmosphere. This electromagnetic signature, known as Schumann Resonance, had only been observed from Earth’s surface until, in 2011, scientists discovered they could also detect it using NASA’s Vector Electric Field Instrument (VEFI) aboard the U.S. Air Force’s *Communications/Navigation Outage Forecast System (C/NOFS)* satellite.

In a paper published on May 1 in *The Astrophysical Journal*, researchers describe how this new technique could be used to study other planets in the solar system as well, and even shed light on how the solar system formed.

“The frequency of Schumann Resonance depends not only on the size of the planet but on what kinds of atoms and molecules exist in the atmosphere because they change the electrical conductivity,” says Fernando Simoes, the first author on this paper and a space scientist at Goddard. “So we could use this technique remotely, say from about 600 miles above a planet’s surface, to look at how much water, methane, and ammonia is there.”

Water, methane, and ammonia are collectively referred to as “volatiles” and the fact that there are different amounts on different planets is a tantalizing clue to the way the planets formed. Determining the composition of a planet’s atmosphere can be done with a handful of other techniques—techniques that are quite accurate, but can only measure specific regions. By looking at the Schumann Resonance, however, one can get information about the global density of, say, water around the entire planet. Simoes and his colleagues believe that combining this technique with other instruments on a spacecraft’s visit to a planet could provide a more accurate inventory of the planet’s atmosphere.

“And if we can get a better sense of the abundance of these kinds of atoms in the outer planets,” says Simoes, “We would know more about the abundance in the original nebula from which the solar system evolved.”

Accurate descriptions of planetary atmospheres might also help shed light on how the evolution of the solar system left the outer planets with a high percentage of volatiles, but not the inner planets.

Detecting Schumann Resonance from above still requires the instruments to be fairly close to the planet, so this technique couldn’t be used to investigate from afar the atmospheres of planets outside our solar system. Instead, scientists imagine something much more dramatic. After a spacecraft is finished observing a planet, it could continue to detect Schumann resonance as it begins its death dive into the atmosphere. During the process of self-destruction, the spacecraft would still provide valuable scientific data until the very last minute of its existence. ■

Above: As lightning flashes, it creates low frequency waves that circle Earth, a phenomenon known as Schumann Resonance, which tells scientists what kinds of atoms exist in a planet’s atmosphere. Click image to watch video. Image credit: NASA/Goddard/Conceptual Image Lab

Opposite: Lightning lights up the Vehicle Assembly Building at NASA’s Kennedy Space Center in Florida during thunderstorms on Monday, Sept. 27, 2010. Photo Courtesy of Tom Moler



# FORECAST CALLS FOR MILD AMAZON FIRE SEASON IN 2012

By: Kathryn Hansen

Forests in the Amazon Basin are expected to be less vulnerable to wildfires this year, according to the first forecast from a new fire severity model developed by university and NASA researchers.

Fire season across most of the Amazon rain forest typically begins in May, peaks in September, and ends in January. The new model, which forecasts the fire season's severity from three to nine months in advance, calls for an average or below-average fire season this year within 10 regions spanning three countries: Bolivia, Brazil, and Peru.

"Tests of the model suggested that predictions should be possible before fire activity begins in earnest," said Doug Morton, a Co-Investigator on the project at Goddard. "This is the first year to stand behind the model and make an experimental forecast, taking a step from the scientific arena to share this information with forest managers, policy makers, and the public alike."

The model was first described last year in the journal *Science*. Comparing nine years of fire data from NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) on the *Terra* satellite, with a record of sea surface temperatures from NOAA, scientists established a connection between sea surface temperatures in the Pacific and Atlantic oceans and fire activity in South America.

"There will be fires in the Amazon Basin, but our model predictions suggest that they won't be as likely in 2012 as in some previous years," said Jim Randerson of the University of California, Irvine, and Principal Investigator on the research project.

Specifically, sea surface temperatures in the Central Pacific and North Atlantic are currently cooler than normal. Cool sea surface temperatures change patterns of atmospheric circulation and increase rainfall across the southern Amazon in the months leading up to the fire season.

"We believe the precipitation pattern during the end of the wet season is very important because this is when soils are replenished with water," said Yang Chen of UC Irvine. "If sea surface temperatures are higher, there is reduced precipitation across most of the region, leaving soils with less water to start the dry season."

Amazon forests, however, are particularly relevant because of their high biodiversity and vulnerability to fires. Amazon forests also store large amounts of carbon, and deforestation and wildfires release that carbon back to the atmosphere. Predictions of fire season severity may aid initiatives—such as the United Nation's Reducing Emissions from Deforestation and Forest Degradation program—to reduce the emissions of greenhouse gases from fires in tropical forests.

"The hope is that our experimental fire forecasting information will be useful to a broad range of communities to better understand the science, how these forests burn, and what predisposes forests to burning in some years and not others," Morton said. "We now have the capability to make predictions, and the interest to share this information with groups who can factor it into their preparation for high fire seasons and management of the associated risks to forests and human health." ■

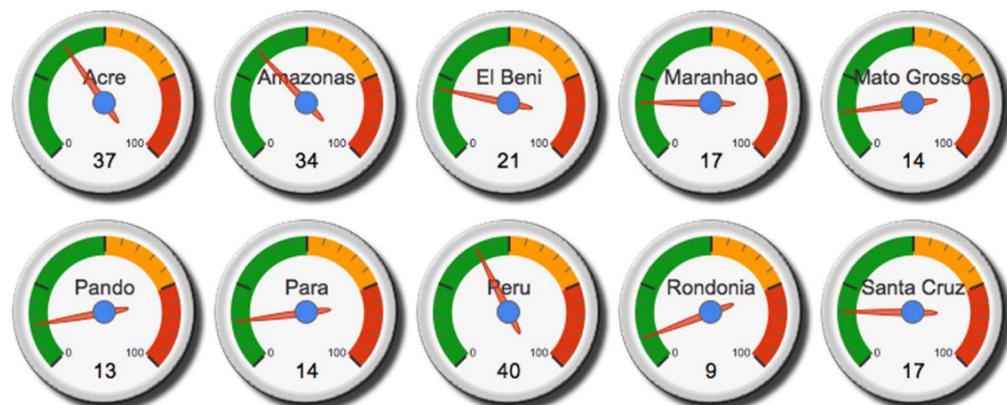
“...the model suggested that predictions should be possible before fire activity begins in earnest.”

Without sufficient water to be transported from the soil to the atmosphere by trees, humidity decreases and vegetation is more likely to burn. Such was the case in 2010, when above-average sea surface temperatures and drought led to a severe fire season. In 2011, conditions shifted and cooler sea surface temperatures and sufficient rainfall resulted in fewer fires, similar to the forecast for 2012.

Building on previous research, the researchers said there is potential to adapt and apply the model to other locations where large-scale climate conditions are a good indicator of the impending fire season, such as Indonesia and the United States.

Above: Improvements to the model are possible by incorporating data from the MODIS instrument on NASA's *Aqua* satellite, accounting for fires that occur in the afternoon when conditions are hotter and drier. Image provided by Doug Morton.

Opposite page: Gauges convey the fire severity forecast for 10 regions in the Amazon Basin where fire activity varies greatly from year to year, and where climate conditions have a significant impact on fire activity. Image credit: Yang Chen/UC Irvine





Whether it's a giant solar flare or a beautiful green-blue aurora, just about everything interesting in space weather happens due to a phenomenon called magnetic reconnection. Reconnection occurs when magnetic field lines cross and create a burst of energy. These bursts can be so energetic they could be measured in megatons of TNT. To study this phenomenon, NASA is readying a fleet of four identical spacecraft, the [Magnetospheric Multiscale](#) (MMS) mission, for a planned launch in 2014.

At Goddard, a team of scientists and engineers are working on a crucial element of the MMS instrument suite: the Fast Plasma Instrument (FPI). Some 100 times faster than any previous similar instrument, the FPI will collect a full sky map of data at the rate of 30 times per second—a necessary speed given that MMS will only travel through the reconnection site for under a second.

“Imagine flying by a tiny object on an airplane very rapidly,” says Craig Pollock, the Co-Investigator for FPI at Goddard. “You want to capture a good picture of it, but you don’t get to just walk around it and take your time snapping photos from different angles. You have to grab quick shots as you’re passing. That’s the challenge.”

FPI is being assembled at Goddard, from sub-assemblies built there, at the Southwest Research Institute in San Antonio, Texas, and at the Meisei Electric Company, Ltd. in Isasaki Japan. FPI sensors are being tested at Goddard, NASA’s Marshall Space Flight Center in Huntsville, Ala., and at Japan’s Institute of Space and Astronautical Science near Tokyo.

During the last week of March, 2012, researchers from all four teams came together at the Low Energy Electron and Ion Facility (LEEIF) at the National Space Science and Technology Center in

Huntsville to test part of the FPI: the Dual Ion Spectrometer (DIS) flight sensors built at Meisei. The tests focused on the instrument’s response when exposed to the space environment.

In the LEEIF facility, scientists and engineers expose the Dual Ion Spectrometer to ion beams of specific energy from specific directions to determine the response. This known response will be used to calibrate the flight data. Each of the MMS spacecraft will need four spectrometers, so there are 16 DIS instruments total. They will be paired with 16 Dual Electron Spectrometers (DES) and 6 Instrument Data Processing Units (IDPUs) that are being built at Goddard to complete the full FPI.

Goddard manages the MMS mission. Dr. James L. Burch at Southwest Research Institute is the principal investigator for the MMS science investigation. Marshall is a Co-Investigator institution and part of the FPI team. ■

Above: From left to right: Takanobu Omoto (Meisei Lead Engineer), Mark Cox (MSFC), and Toshihiro Kobayashi (Meisei) test an MMS Dual Ion Spectrometer in the clean tent. Photo credit: NASA/MSFC

## INTERNATIONAL COLLABORATION ON MMS

By: Karen Fox

## AURA TAKES THE A TRAIN TO WASHINGTON

By: Ginger Butcher



**A**ura’s Education and Public Outreach lead, Ginger Butcher, exhibited the new “Engineer a Satellite” activity in Washington, D.C. for the 2012 Earth Day event on the National Mall and the US Science and Engineering Festival. Over 1,200 children and adults engineered and constructed their own model satellites highlighting instruments from NASA’s A-Train of Earth observing satellites.

The activity focuses on the subsystems required for all satellites and the different types of instruments used for Earth observation. Participants could choose from a variety of unique LEGO® components representing NASA’s A-Train satellite instruments like *Aura*’s OMI imaging spectrometer and *Aqua*’s AIRS sounder spectrometer. After completing math calculations to determine the energy requirements for their satellite, participants constructed their satellite model with all instruments and subsystems. They weighed their satellite model to test for launch readiness and then took their model home.

Both children and adults were engaged and often worked together to complete the calculations. Content included the types of information that can be measured by space-based instruments. The addition of weight constraints provided an opportunity to discuss the efficiency of launching multiple smaller satellites on one launch vehicle. This activity has potential to work in a variety of informal venues including museums and afterschool events. A classroom version of this activity is available using materials readily available from education supply stores.

For more details and downloadable pdfs of the [Engineer a Satellite](#) activity, visit the *Aura* mission [Web site](#). ■

Photo credit: NASA/Goddard



# DISCOVERY'S FINAL FLIGHT

By: Ed Campion



For her last mission, Space Shuttle *Discovery*, mounted atop a modified Boeing 747 Shuttle Carrier Aircraft, journeyed from NASA's Kennedy Space Center in Florida to Dulles International Airport in Chantilly, Virginia for installation at the [Smithsonian Air and Space Museum's Udvar-Hazy Center](#).

But before her final landing took place, *Discovery* took a "victory lap" as part of a D.C. area flyover event designed to salute, inspire, and honor.

She flew past Washington's National Cathedral and for many the sight of a space shuttle passing near the cathedral's prominent towers served as a reminder of the incredible things that can be accomplished through faith and inspiration.

*Discovery* flew above the U.S. Capitol where, in 1972, Congress approved the creation of the space shuttle program. The shuttle passed over the various buildings that have served as the headquarters for the space agency and where each and every one of the 135 shuttle missions flown was ultimately managed.

She flew over the downtown National Air & Space Museum, home to 50 plus years of space exploration history including the test vehicles and lifting body aircraft that led the way for the Space Shuttle system.

After crossing over the Potomac River and National Airport, *Discovery* flew over the Nation's most hallowed ground to honor the two Shuttle Challenger and three Shuttle Columbia astronauts who are buried at Arlington National Cemetery, Va.

The 747 and *Discovery* then began a counter-clockwise trip around the Capital Beltway that then led the duo to Goddard.

For Goddard employees gathered outside, *Discovery* appeared from the south before she crossed directly over the NASA center that supported each of her 39 missions. Her flight over the Goddard campus took in many buildings that had a key role in all shuttle missions – the Network Integration Center, the Space Telescope Operations Control Center, and the Flight Dynamics Facility.

And of course she passed over the Spacecraft Test & Integration Facility and Spacecraft Systems Development and Integration Facility where instruments, hardware, tools, procedures, and training for the original *Hubble Space Telescope* deployment mission and all five servicing missions were developed.

*Discovery's* overall flyover event probably only lasted about an hour but during that brief period, the greater Washington D.C. area and employees at NASA Goddard had the chance to gaze skyward as history flew right before their eyes. ■

Photo credit: NASA/Goddard

# OUTSIDE GODDARD

## Mark Cascia

By: Elizabeth M. Jarrell

**G**oddard systems engineer and vintner Mark Cascia lives by the expression, “If you want to make a small fortune in the wine business, start with a large one.” From 1991–1993, Cascia worked in Toulouse, France. He arrived in France a beer drinker but, after visiting “almost every wine region in France,” he left a confirmed wine connoisseur. Once back home, he began making wine from concentrate, which he describes as “pretty awful looking stuff though surprisingly tasty.”

In 1998, Cascia and his wife Kimberly bought a 17th century house on 20 acres on Kent Island and started a twelve acre vineyard. Says Cascia, “I am the first person to grow grapes on Kent Island and one of the first to do so on the Eastern Shore.” Everyone told him it was impossible to grow grapes there, but Cascia became a pioneer in the fledgling Maryland wine industry. “My wife insisted on the name ‘Mark Cascia Vineyards.’ She believes that all good vineyards have two names,” explains Cascia, “as, for example ‘Robert Mondavi.’”

Planting their vineyard proved to be both challenging and amusing. A friend’s young child, who now assists in negotiating nuclear proliferation treaties, insisted on planting the vines upside down because “they looked better that way.” Cascia and his wife now do almost all of the work themselves.

Explains Cascia, “It takes about four to five years after planting to get something, if you get anything. Then you find out about birds and deer.” His first harvest in 2001 did not yield much. Cascia was stranded on the west coast due to the events of 9/11, which coincided with harvest time. Although his wife kept telling him that their vineyard looked like the set of Alfred Hitchcock’s “The Birds,” he thought she was just exaggerating. Cascia now admits that his wife was right. We are on the migratory path of lots of birds. They ate seven tons of grapes that week. The deer ate most of the rest.”

Cascia wound up harvesting just enough grapes to fill a few tubs but found that his wife and two daughters Greer and Mia were too light to crush the grapes. “So I hopped in and was able to crush the grapes,” remembers Cascia. “It was exhausting. It’s like slogging in heavy, deep snow. It’s not at all easy like in the infamous ‘I Love Lucy’ episode.” What little wine he produced “turned out very nicely.”

In 2002, Cascia bought \$2,000 worth of bird scare devices which, though effective in discouraging the migratory birds, did little to move the resident bird population. “The residential birds were so aggressive,” says Cascia, “that some of them actually landed on my shoulders. So each day I had to go out at sunrise and again at sundown and drive around on my tractor like a madman shrieking at the top of my lungs at these birds to scare them away.”

In 2005, he obtained all the necessary winemaker’s licenses. That year, he made a Bordeaux blend called Queen Anne’s Reserve using a cabernet sauvignon, cabernet franc, merlot, petit verdot, and malbec all from his own grapes. He released this wine in 2009, entered it in the Maryland Governor’s Cup Wine Competition that year, and won a Gold Medal. In 2009, both his 2005 nebbiolo and his 2003 zinfandel won Silver Medals.

Cascia sold his first bottle in May 2008 at the Chesapeake Wine Festival on Kent Island. Concludes Cascia, “My wife and I do this as a big hobby now with our daughters. We get a lot of enjoyment producing something we can enjoy and share with others. We also want something to pass on to our kids.” ■

Below: Cascia and his daughter Greer, circa 1999, ride the tractor around the vineyards. Photo provided by Mark Cascia

