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Goddard View

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NASA Launches ATREX

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GoddardView

THE WEEKLY

***Hubble* Dazzles with a View of Messier 9**

Hubble has produced the most detailed image so far of Messier 9, a globular star cluster that lies around 25,000 light-years from Earth, near the center of the Milky Way. This ball of stars is too faint to see with the naked eye, yet *Hubble* can see over 250,000 individual stars shining in it.

The MIRI Has Two Faces

A new short video takes viewers behind the scenes with the Mid-Infrared Instrument (MIRI) that will fly on-board the James Webb Space Telescope. MIRI is a state-of-the-art infrared instrument that will allow scientists to study distant objects in greater detail than ever before.

50th Robert H. Goddard Memorial Symposium

Dreams and Possibilities, Planning for the Achievable was the theme of this year's Robert H. Goddard Memorial Symposium, March 28–29, at the Greenbelt Marriott. The American Astronautical Society (AAS), with support from Goddard, sponsors this annual event.

Free Lecture at Goddard: Search for Extraterrestrial Life

Is there life on other planets? What exactly is a "habitable environment" and what conditions on Earth led to the origin of life here? Understanding the basic requirements for life and the prebiotic chemistry that led to the emergence of life on Earth will help guide our search for life beyond Earth. NASA Astrobiologist Dr. Daniel P. Glavin will give an overview of these concepts, as well as the Mars Exploration Program and future plans for sending instrumentation to Mars to explore habitable environments.

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Cover caption: One of the five suborbital sounding rockets launched from Wallops to study the upper level jet stream.

Photo Credit: NASA/Wallops

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:

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Managing Editor: Trusilla Steele

Editor: John M. Putman

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. Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

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SUCCESSFUL ATREX LAUNCH FROM WALLOPS

By: Keith Koehler

NASA successfully launched five suborbital sounding rockets on March 27 from its Wallops Flight Facility in Virginia as part of a study of the upper level jet stream. The first rocket was launched at 4:58 a.m. EDT and each subsequent rocket was launched 80 seconds apart.

Each rocket released a chemical tracer that created milky, white clouds at the edge of space. Tracking the way the clouds move can help scientists understand the movement of the winds some 65 miles up in the sky, which in turn will help create better models of the electromagnetic regions of space that can damage man-made satellites and disrupt communications systems.

The launches and clouds were reported to be seen from as far south as Wilmington, N.C.; west to Charlestown, W. Va.; and north to Buffalo, N.Y.

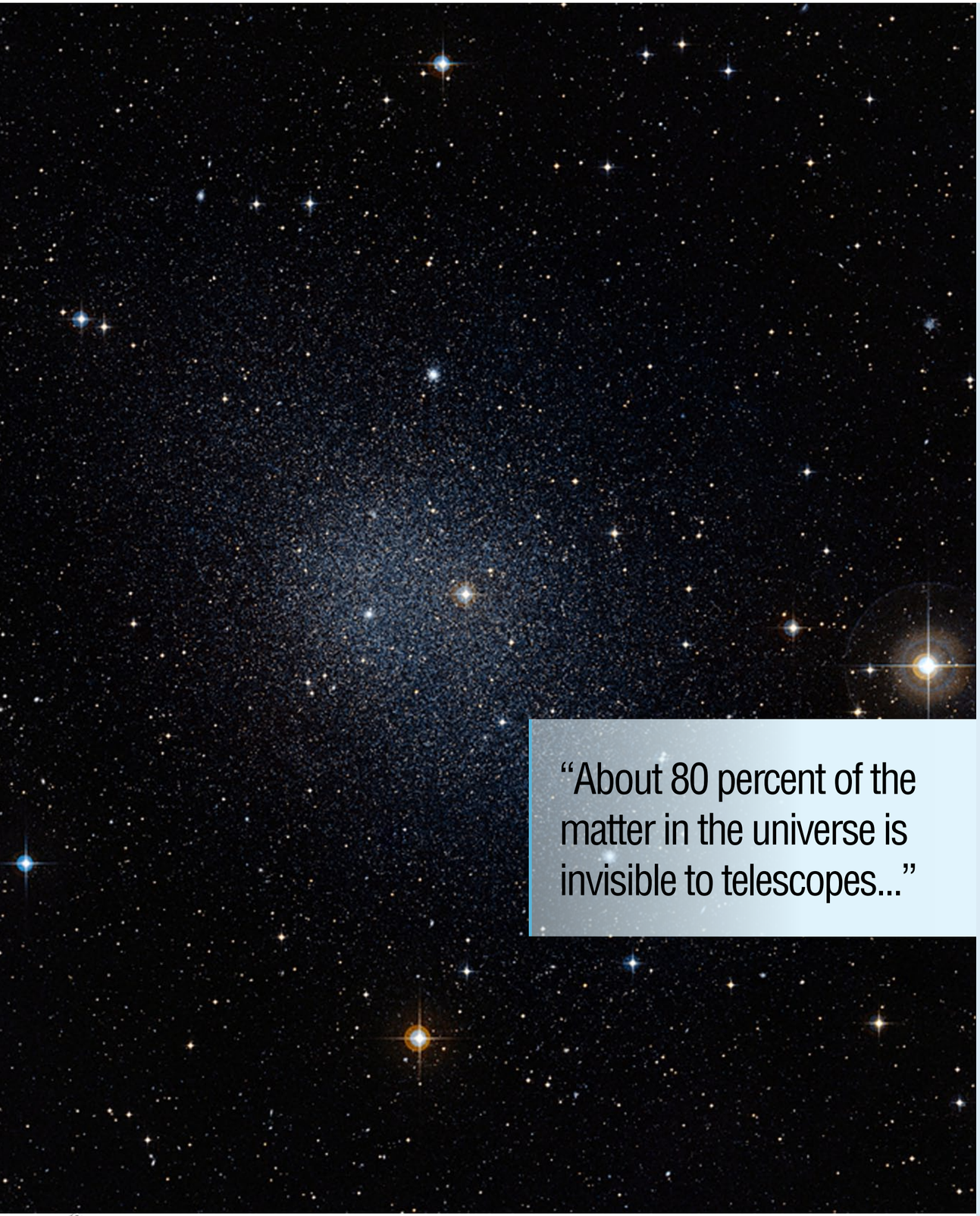
The Anomalous Transport Rocket Experiment (ATREX) is a Heliophysics sounding rocket mission that will gather information needed to better understand the process responsible for the high-altitude jet stream located 60 to 65 miles above the surface of Earth.

The high-altitude jet stream is higher than the one commonly reported in weather forecasts. The winds found in this upper jet stream typically have speeds of 200 to well over 300 mph and create rapid transport from the Earth's mid latitudes to the polar regions. This jet stream is located in the same region where strong electrical currents occur in the ionosphere. It is therefore a region with a lot of electrical turbulence, of the type that can adversely affect satellite and radio communications.

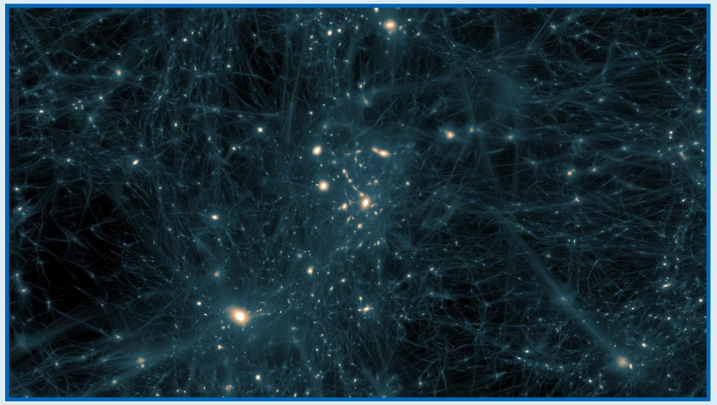
The sounding rockets used for the mission were two Terrier-Improved Malemutes, two Terrier-Improved Orions and one Terrier-Oriole.

The five rockets released a chemical tracer that formed milky, white tracer clouds, allowing scientists and the public to "see" the winds in space. In addition, two of the rockets carried instrumented payloads to measure the pressure and temperature in the atmosphere at the height of the high-speed winds. ■

Above: Wispy luminous clouds light up the night sky over Wallops Island early in the morning of March 27. Photo credit: NASA/Wallops



"About 80 percent of the matter in the universe is invisible to telescopes..."



FERMI PROVIDES NEW INSIGHTS ON DARK MATTER

By: Francis Reddy

There's more to the cosmos than meets the eye. About 80 percent of the matter in the universe is invisible to telescopes, yet its gravitational influence is manifest in the orbital speeds of stars around galaxies and in the motions of clusters of galaxies. Yet, despite decades of effort, no one knows what this "dark matter" really is. Many scientists think it's likely that the mystery will be solved with the discovery of new kinds of subatomic particles, types necessarily different from those composing atoms of the ordinary matter all around us. The search to detect and identify these particles is underway in experiments both around the globe and above it.

Scientists working with data from NASA's *Fermi Gamma-ray Space Telescope* have looked for signals from some of these hypothetical particles by zeroing in on 10 small, faint galaxies that orbit our own. Although no signals have been detected, a novel analysis technique applied to two years of data from the observatory's Large Area Telescope (LAT) has essentially eliminated these particle candidates for the first time.

"In effect, the *Fermi* LAT analysis compresses the theoretical box where these particles can hide," said Jennifer Siegal-Gaskins, a physicist at the California Institute of Technology in Pasadena and a member of the *Fermi* LAT Collaboration. She gave an invited talk on the subject at the April meeting of the American Physical Society (APS) in Atlanta, Ga.

WIMPs, or Weakly Interacting Massive Particles, represent a favored class of dark matter candidates. Some WIMPs may mutually annihilate when pairs of them interact, a process expected to produce gamma rays—the most energetic form of light and exactly what the LAT is designed to detect.

"One of the best places to look for these faint gamma-ray signals is in dwarf spheroidal galaxies, small satellites of our own Milky Way galaxy that we know possess large amounts of dark matter," Siegal-Gaskins explained. "From an astrophysical perspective, these are downright boring systems, with little gas or star formation and no objects like pulsars or supernova remnants that emit gamma rays."

In addition, many dwarfs lie far away from the plane of our galaxy, which produces a broad band of diffuse gamma-ray emission that stretches all around the sky. Selecting only dwarf galaxies at great distances from this plane helps minimize interference from the Milky Way.

The team examined two years of LAT-detected gamma rays with energies in the range from 200 million to 100 billion electron volts (GeV) from 10 of the roughly two dozen dwarf galaxies known to orbit our Milky Way. Instead of analyzing the results for each galaxy separately, the scientists developed a statistical technique—they call it a "joint likelihood analysis"—that evaluates all of the galaxies at once without merging the data together. No gamma-ray signal consistent with the annihilations expected from four different types of commonly considered WIMP particles was found.

For the first time, the results show that WIMP candidates within a specific range of masses and interaction rates cannot be dark matter. A paper detailing these results appeared in the Dec. 9, 2011, issue of *Physical Review Letters*.

For any given properties of a dark matter particle, the particle distribution has a significant impact on the expected gamma-ray signal, a wrinkle that often is handled inadequately, if at all, in previous studies. The motions of a dwarf galaxy's stars trace the profile of its dark matter, but these tiny galaxies often have few stars to track. The result is uncertainty in the way dark matter is distributed along the line of sight to the dwarf, which affects the expected flux of gamma rays detected by the LAT. By addressing these uncertainties, the LAT team's results are among the most accurate.

What's next? The team is following up the two-year analysis with new ones that will incorporate additional *Fermi* observing time, higher-energy gamma rays and improvements made to the LAT's sensitivity. Additionally, sky surveys now ramping up may discover new dwarf galaxies that can be included in future studies. ■

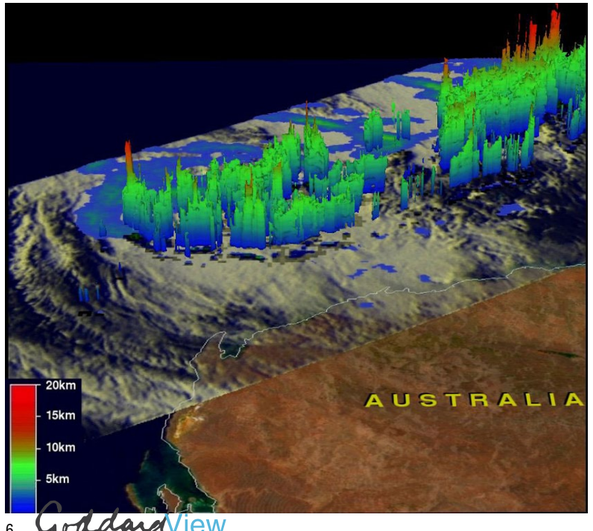
Above: A still from a video about how *Fermi* has produced some of the strongest limits yet on the nature of the hypothetical particles suspected of making up dark matter. Credit: NASA/Goddard

Opposite: This dwarf spheroidal galaxy in the constellation Fornax is a satellite of our Milky Way and is one of 10 used in *Fermi*'s dark matter search. The motions of the galaxy's stars indicate that it is embedded in a massive halo of matter that cannot be seen. Image credit: ESO/Digital Sky Survey 2

NASA's HURRICANE TWITTER EXCEEDS 200,000 FOLLOWERS

Hurricanes aren't just a seasonal event for the U.S. space program. Because either the northern or southern hemisphere is always in hurricane season, the demand is constant for updates on current storms and the latest information, images, and videos are always available via NASA's hurricane Web site, Twitter®, and Facebook® pages.

The value and popularity of this effort was validated recently when NASA's Hurricane Twitter, which posts the Web site's updates, exceeded 200,000 followers—a landmark few NASA Twitter accounts have reached.



By having NASA's hurricane Web page connected to Facebook and Twitter, the agency has created a single stop for anyone interested in hurricanes. The trio highlights NASA's hurricane research efforts in addition to providing the latest storm information.

"Social media like Twitter and Facebook have helped bring a new awareness to NASA's hurricane efforts that wasn't there before," said Rob Gutro, manager of NASA's Hurricane Web Page at Goddard. "That awareness became obvious through the worldwide contacts established through social media."

Weather watchers and meteorologists from around the world are in contact with Gutro. For example, some of the observations he receives come from the Philippines, India, and Mexico to name a few. Several Twitter and Facebook followers around the world told him they rely on the hurricane page for information about tropical cyclones affecting their country. "Social media has given a much more interactive voice to the people being affected by these storms," Gutro said.

Tropical cyclones, the general name for a hurricane, typhoon, cyclone, tropical storm, or tropical depression, form in different regions of the world at different times of the year. When the northern hemisphere hurricane season is active, the southern hemisphere is in winter, and vice-versa. So, when there's snow on the ground in the U.S., chances are the southern Indian Ocean or southern Pacific Ocean is dealing with a tropical cyclone.

NASA has a fleet of Earth observing satellites that continually provide data on various aspects of tropical cyclones. NASA's *Aqua*, *Terra*, Tropical Rainfall Measuring Mission (TRMM), *CloudSat*, *Landsat*, and the NOAA GOES series of satellites from which NASA creates data and animations, are all represented on the NASA

> "Social media has helped bring awareness to NASA's Hurricane efforts."

Hurricane page and social media. Each of these satellites has different instruments that provide different ways to look at tropical cyclones- from infrared to microwave, from visible to rainfall data.

The NASA Hurricane page, Twitter and Facebook pages offer daily storm updates and satellite images, latest research, stunning video animations, educational tools, scientist profiles and historic storm information, on all storms going back to 2005, including monsters like Katrina.

NASA Hurricane Facebook page was started in 2010, and currently has over 7,500 followers. The "NASAHurricane" Twitter account hit the 200,000 mark when Cyclone Irina was in the Mozambique Channel in early March, after causing damage in Madagascar. Between Facebook, Twitter, and the NASA Hurricane Web page, NASA strives to keep people around the world informed of tropical cyclones at any time of year. ■

Above: NASA's Hurricane Twitter feed with 203,629 foloowers. Image credit: NASA/Goddard/Lynn Jenner

Opposite page: 3-D image of Cyclone Lua created from NASA's TRMM satellite. The area covered by TRMM's precipitation radar on March 13, 2012 showed thunderstorm towers in feeder (thunderstorm) bands located to the southwest and northeast of Cyclone Lua's center reached heights of almost 15km (9.3 miles), indicating strong thunderstorms. Credit: NASA/SSAI/Hal Pierce

The Space Network Ground Segment Sustainment effort successfully completed its Key Decision Point-B review at NASA allowing the project to proceed into Phase B of its lifecycle, the Mission Definition Phase. During this next phase, lasting approximately eight months, the network will hold its Preliminary Design Review and complete additional project planning.

Approval to move forward was granted during a recent Agency Project Management Council meeting at NASA Headquarters, chaired by William Gerstenmaier, Associate Administrator for the Human Exploration and Operations Mission Directorate (HEOMD).

"Completing Key Decision Point-B (KDP-B) is a major achievement and reflects the fact that we have a very capable team in place," said Roger Clason, Space Network Ground Segment Sustainment (SGSS) Project Manager at Goddard. "It was gratifying to see, at all levels of management, recognition of SGSS's importance to the future of NASA's space communications capabilities," he said.

SGSS's development and implementation of next generation space communications ground terminals is part of an overall effort to sustain NASA's Space Network. The SGSS Project Office at Goddard manages the development effort for the ground terminals. The SGSS Program Office is located at the Space Communications and Navigation office within HEOMD at NASA Headquarters. Operation of the network is the responsibility of the Space Network Project at Goddard.

SGSS is updating NASA's Space Network ground communications infrastructure with new, state-of-the-practice technology. These upgrades involve the installation of an entirely new architecture in each Tracking and Data Relay Satellite System (TDRSS) ground terminal, which enables easier technology refreshes, simplified future expansions, and an increase in customer data rate capabilities, while lowering operations and maintenance costs. Furthermore, SGSS is developing the architecture to allow for extensibility and expandability, enabling the network to continue to grow after the SGSS initial delivery is complete.

First implemented in the early 1980s and refreshed in the mid-1990s, the TDRSS ground terminal hardware and software is old and increasingly difficult and expensive to sustain. These factors pose substantial risk to the highly reliable service that has been provided to Space Network customers for over two decades.

The SGSS Project has the responsibility to refurbish the three existing Space Network ground terminals at the White Sands Complex in New Mexico and in Guam. In addition, SGSS will build a new terminal at Blossom Point, Md.

"Successful completion of Phase B of the project is the next step before we finalize the designs for the project and begin implementing the systems," said David Jacintho, SGSS Deputy Project Manager for Resources at NASA Goddard. "In this next phase, we will begin to develop the system moving forward through critical design. Once operational, the system will provide state-of-the-practice technologies and services to users of NASA's national resource for decades to come," Jacintho said.

SGSS's new architecture is expected to be fully operational by the end of 2016. ■

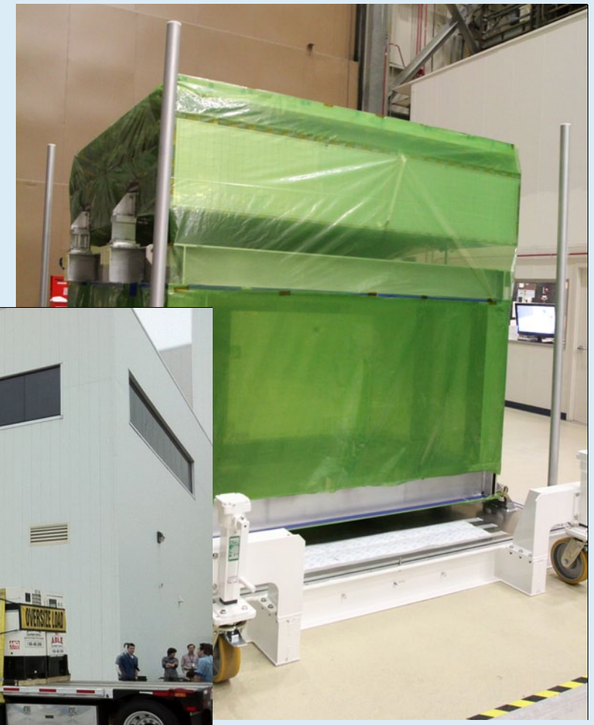
Above: A TDRSS ground terminal in White Sands, N.M. Photo credit: NASA

SPACE NETWORK TO BEGIN NEW DESIGN PHASE

By: Dewayne Washington

DUAL FREQUENCY RADAR ARRIVES AT GODDARD

By: Aries Keck



The Dual-frequency Precipitation Radar (DPR), built by the Japan Aerospace Exploration Agency (JAXA) for the Global Precipitation Measurement (GPM) mission's Core Observatory, arrived on March 16 at Goddard. Comprised of two radars, the DPR is one of two instruments that will fly on the Core Observatory scheduled for launch in February 2014.

The GPM mission will provide a new generation of satellite observations of rain and snow worldwide. The instrument will provide 3-D measurements of the shapes and sizes of raindrops and snowflakes and other physical characteristics that will allow scientists to better understand the physical properties of storms.

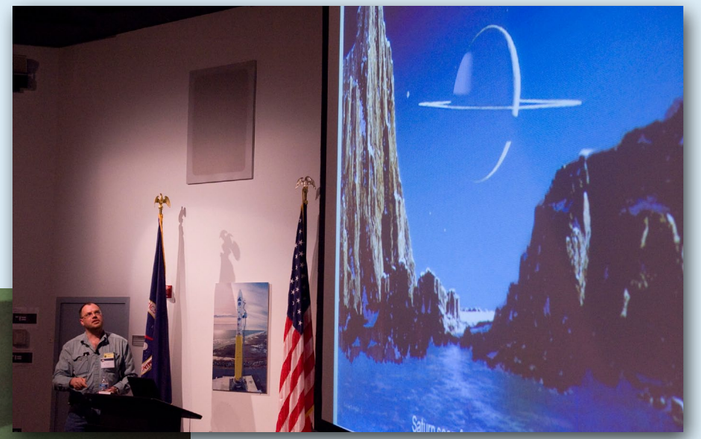
The team of Japanese engineers that built the DPR accompanied the instrument to give it an initial post-travel check-up. In the coming months, it will be integrated onto the spacecraft at Goddard. GPM's other instrument, the GPM Microwave Imager, was delivered in late February and has been mechanically integrated onto the GPM Core Observatory.

"Together these two instruments will provide a unique database to characterize precipitating particles in different parts of the world," said GPM Project Scientist Arthur Hou. "This dataset will be key to obtaining more accurate precipitation estimates from all the satellites in the GPM constellation and combining them into a uniform global precipitation dataset." ■

Photo credit: NASA/Goddard

VISITOR CENTER HOSTS TITAN TALK

By: John M. Putman



The latest edition of the Gerald Soffen Lecture Series explored how Titan has been portrayed in science fiction and art over the years, from Chesley Bonnestell's iconic painting with a Saturn in a blue sky behind jagged hills, through Arthur C. Clarke's "Imperial Earth," where Titan resounds to the howl of ramscoops from spacecraft refueling in its atmosphere, and more. The talk also reviewed world history around key events in Titan exploration—some recurrent themes emerge even across the centuries since Titan's discovery.

The lecture was presented by Dr. Ralph Lorenz, a scientist at the Johns Hopkins University Applied Physics Laboratory in Laurel, Md., who specializes in research on Titan, especially its climate, weather and landscape. In 1990 and 1991, he worked for the European Space Agency on the design of the Huygens probe, which landed on the surface of Titan in January 2005. He is presently the Project Scientist for the Titan Mare Explorer (TiME) mission being proposed to NASA for flight to Titan's polar sea Ligeia Mare in 2023.

The lecture series is inspired by Dr. Gerald Soffen (1926-2000). During his 30-year NASA career, Soffen led the science team for NASA's *Viking* program, was Director of Life Sciences at NASA Headquarters, Project scientist for NASA's Earth Observing System, and created NASA Academy, NASA's premiere leadership training internship. The *Viking 2* lander was posthumously named after Dr. Soffen and a crater on Mars was named "Soffen." He was best known, however, for his passion for inspiring the next generation of scientists and engineers.

Goddard's Daniel Glavin will present the next Soffen lecture on April 12 at 7:00 p.m. The topic will be "Astrobiology and the Search for Extraterrestrial Life." Advance registration is required. ■

Photos by: NASA/Goddard/Bill Hrybyk

OUTSIDE GODDARD

Bob Wingard

By: Elizabeth M. Jarrell

I'm 6 feet 9 inches tall and my son is a little guy at 6 feet 4 inches tall," says Goddard Systems Engineer Bob Wingard. "I had to build our own sports car so we could fit." Along the way, Wingard acquired most of the Shelby Series 1 factory creating their 427 Roadster that Motor Trend recently described as looking like a 21 Century Cobra. "Our 427 Roadster is a street car built on a Formula One platform. I'm an adrenaline junkie."

"I was a high school muscle car kid." Wingard still has the 427 motor from his Ford GT. After he got married, he sold the car but kept the motor and stored it in a drum of oil under the garage steps for the next 20 years.

In 2007, Wingard and his son rebuilt that motor, now a collectable worth close to $50,000, and then looked for a car to house it. Wingard had always wanted a Shelby Cobra. Explains Wingard, "Shelby is the icon for the American muscle cars." Wingard ran across a Shelby Series I, one of only 250 built, which he bought at auction. "It was my family car," says Wingard. His son learned to drive a clutch on this car. Not surprisingly, the car soon needed a new clutch and floor mats.

Later in 2007, Wingard visited the Shelby factory in Las Vegas looking for those parts. The warehouse had been shut down for six years. Tools were everywhere. "All I wanted was a few parts and to build a Cobra for my son and me using my old 427 motor," says Wingard. He left with a phone number to call, but no parts.

Two years later, he returned to the factory, which was undergoing liquidation. He ended up buying about 100 completed or almost completed frames, most of the parts to complete them, plus the tooling, all of which he shipped to Crofton, Md. via nine tractor trailers "For the want of a floor mat and a clutch, I bought most of the factory," notes Wingard. Wingard and his team spent the next year secretly designing and building their first 427 roadster production prototype.

Says Wingard, "The really wealthy are buying toys because they cannot make any money in investments." He continues, "Who is my size, has money, and likes sports cars? They play pro ball and many cannot fit into a regular sports car. So that's my market." In 2009, Wingard took a prototype to a Washington Redskins' fundraiser to rave reviews.

In March 2011, he began marketing the 427 in earnest. He sold his first car in June 2011 and, as of November 2011, he has sold seven cars without motors for $105,000 each. Every car has a $15,000 paint job done by Wingard himself. Clients include one pro ball player, several businessmen both from the U.S. and abroad, and Shelby fans.

"I had one built for me," says Wingard. "The rest are for everybody else. I ended up with all the marbles, but I didn't mean to grab them all. But I also have the only three Shelby Series II still in existence at our shop." Wingard has taken his 427 to 150 mph easily, but is confident it can top 200 mph on a track. "It doesn't feel like you're going that fast," he says. "Once you exceed 140 mph, it all feels the same." Says Wingard, "The standard colors are blue and white, but you can have any color you want."

"I don't look at my success as luck," he says. "It is all about being open to the possibilities, to opportunity." He continues, "What makes me successful at Goddard is that I take on a problem and then I fix it. That's normal here at Goddard. So I just apply the same principles to these cars. Also, you need to find the right people, which I did. I'll hold the dumb end of a tape measure if that moves the job along. And we'll do whatever the customer wants; even match the thread of the seat to the car color."

Wingard sums up his playing with one word: "Fun." ■