



NEWSLETTER

Winter Solstice 2011

RITTENHOUSE ASTRONOMICAL SOCIETY

Founded 1888 WWW.RITTENHOUSEASTRONOMICALSOCIETY.ORG

OPEN TO PUBLIC AND STUDENTS

7:15 PM

The Franklin Institute

20th Street and Benjamin Franklin Parkway

January's Meeting 8 Years of Mars Rovers & The Search for Life-Mars & Vesta in 3D

Dr. Ken Kremer

Universe Today

Space Flight Magazine Correspondent

NASA JPL Solar System Ambassador

Witness the ongoing 8 Year NASA Rover Mission to Mars and what's ahead

With the new Curiosity rover in this interactive program covering the explorations and adventures of Spirit and Opportunity as these amazing robots have journeyed many miles across the surface of the Red Planet. Comprehensive talk includes the latest news from Mars and Dr. Kremer's widely published and custom created Mars mosaics. Spectacular 3-D images place you "On Mars" and "Circling Asteroid Vesta." A recent mosaic of Ken's is published on Astronomy Picture of The Day: December 12, 2011.



*Opportunity at Santa Maria Crater, January 2011, Sol 2476
Credit: NASA/JPL/Cornell/Marco Di Lorenzo/Kenneth Kremer*

Invitations Extended

Invitations have been sent to some former speakers to speak again at Rittenhouse, such as Dr. Robert Hicks and some new speakers as well from the Johnsonville Science Center in Warminster, PA. If you have anyone who you would like us to invite to speak at one of our meetings just let us know. We will consider all suggestions!



April Special Event

Martin Knablauch, ESQ.

Rittenhouse has the pleasure of having a relationship with a local orchestra! The Chestnut Hill Orchestra has been a guest at Rittenhouse meetings in the past and will again this coming April. In the past, they surprised us with musical works by William Herschel, a well known astronomer, but also a composer.

Come and join us in April to hear their latest choices to entertain us with at Rittenhouse. Although the musical selections are not yet announced, it will no doubt be a memorable evening!

Philadelphia Science
Festival
Spring City-Wide
Telescope Night

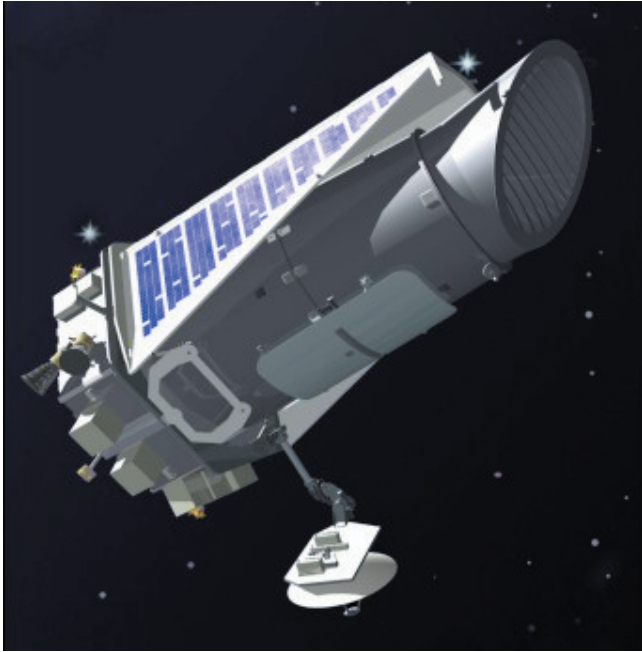
Friday, April 27, 2012



Please consider supporting the ever successful and expanding Philadelphia Science Festival with another telescope night this spring. The date is Friday, April 27th. Consider participating not only in the for the Philadelphia Area, but in your own neighborhood as well!

President's Message

Dr. Milton Friedman



Looking back 20 years or more, we had nine planets in our solar system since 1930 when Clyde Tombaugh discovered Pluto. Beyond our nine, talking about exoplanets was in the realm of science fiction and astronomical dreams. Even the word exoplanet didn't exist. Then in 1990, a radio astronomer from Penn State University, Alexander Wolszczan, reported the detection of a pulsar (a rapidly turning neutron star) with two planets orbiting it. The planets were confirmed in 1992. The star is rotating 9,650 times a minute! Wolszczan was the first to discover exoplanets. Wolszczan was our guest at the Franklin Institute.

Since that time, other astronomers have been busy finding exoplanets. In 1995, Michel Mayor and Didier Queloz of the University of Geneva were the first to discover a planet orbiting around a main sequence star, 51 Pegasi. As of Nov. 7, 2011, the number of exoplanets discovered reached 697.

Many astronomers are using different methods to find planets beyond our solar system. As everyone knows, on the one hand we're searching for distant planets while one of our own, Pluto, was demoted and stripped of its planet status in 2006. At present, only eight planets are present in our solar system.

The Kepler Satellite is out in space orbiting Earth. It is searching for Earth-like planets. Launched on March 6, 2009, Kepler is on a 3 to 5 year mission to determine the presence of Earth sized and larger planets. So far Kepler has examined 160,000 stars and has confirmed that 16 planets have been found and 1,200 are unconfirmed but

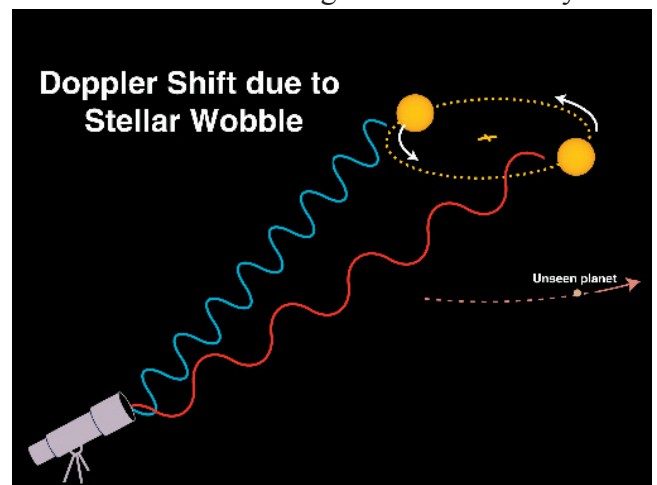
considered good candidates. Kepler uses a Transit Method which measures the drop in brightness as a planet passes in front of the star.

The HARPS mission is another searching for planets. It uses the Radial Velocity Method. Most of the planets have been found using the Radial Velocity (Doppler) Method. This involves finding the change in spectral lines as the planet influences the star it is circling causing the spectral lines to show evidence that the star is moving to and away from us. These two methods account for most of the findings of exoplanets. Other methods used include Gravitational Microlensing, Astrometry and Pulsar Timing.

Beyond just finding planets going around distant stars, a most exciting search is to find life on a distant planet. This involves a rocky planet located in the "habitable zone" also known as the "Goldilocks zone" where water might exist. Nitrogen should also be present because, life as we know it, needs nitrogen for life to form. The Goldilocks zone, is not too hot and not too cold. If the planet is too far from the star, water would be frozen and if too close to the star there would be a runaway greenhouse phase as exists on Venus in our solar system. So far, the experts are studying Gliese 581d and HD85512b for possible life.

The Rittenhouse Astronomical Society has had people connected with stars and distant planets speak at the Franklin Institute. Alexander Wolszczan spoke on his discoveries, which were the first, of exoplanets. Hanno Rein of the Institute for Advanced Study at Princeton was our featured speaker in November, 2011. Clyde Tombaugh, the discoverer of Pluto, received our Silver Medal in 1990. Peter van de Kamp of Swarthmore College had errors in his measurements when he claimed to have found planets orbiting Barnard's Star. He was president of the Rittenhouse Astronomical Society in 1944.


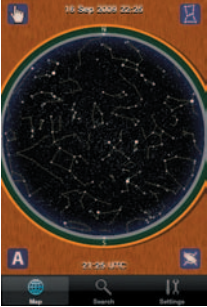


Hopefully, in the near future, we'll have a speaker who has heard from aliens orbiting a distant star. Stay tuned!



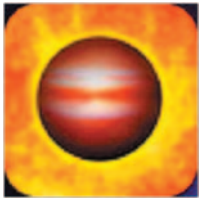



Astronomy Applications

Ted Williams

At our past few meetings I have introduced our members to Astronomy Apps (software applications) newly available to download for mobile smart phones, and tablet PC's. I felt that if Rittenhouse is to assist those in their understanding of astronomy and related astronomical concepts, we should look at the newly widely available tools that are of minimal cost (many times free) to our members. From time to time we plan to share these "Apps" at our meetings so members can justify which are worth the cost and effort to learn, and which might have little use. The Apps below are available through I-Tunes for I-phone and I-PAD devices. Similar applications (some cross platform) may be available on other mobile networks. The ones we have shared at our October and November meetings include:

	<p>AstroLabe (TwoNineEight Software)</p>	<p>This is inspired by the astrolabe, an ancient astronomical instrument used to tell time and to predict the location of the Sun, stars and planets. This modern interpretation gives a view of the sky showing at a glance the time of day, year and the location of the sky of the Sun Moon, planets and stars.</p>
	<p>Planisphere (Horsham Online Limited)</p>	<p>This astronomy application lets you use pinch and finger gestures to manipulate a map of the sky. Zoom in and finer detail appears. You can double tap on stars and planets to get more information. Displays all 88 constellations and their boundaries, 9096 naked eye stars, the Messier deep sky catalogue, the Sun, Moon, planets and the now dwarf planet Pluto. The interaction with the Planisphere application takes the traditional paper based planisphere (with turning star wheel) to an all new level of use. I hope this App evolves into one that can be hooked to a "Go To" style telescope.</p>
	<p>Sky Week (Sky & Telescope Media)</p>	<p>For those of you who could not live without & Telescopes super popular "This Week's Sky at a Glance" (linked to on our website) than you will be elevated to a new level of understanding since this application also includes a 'go to' style locator which allows you to use the application to point out the objects in the sky that you are reading about. I really like this application, I feel the folks at Sky and Tel. got it right! You now have interactive custom sky maps that are automatically set for your location. It has the ability to allow you to pan all around the heavens, change the scene to other times and dates, zoom in or out. Find timely information on all major sky events: eclipses, conjunctions and good meteor showers.</p>
	<p>Living EarthHD (Moshen Chan)</p>	<p>This is a beautiful looking World Clock. View live global cloud patterns along with the most realistic 3D rendering of our planet available. It shows the Earth in continual rotation allowing one to track the terminator line (day/night line) and their location in relation to it. You can mark your favorite cities and tour the globe in real time. Weather patterns reflect real word satellite views. It looks absolutely great on I-Pad devices.</p>

	<p>Messier List (Scott Spencer)</p>	<p>This App includes all the Messier catalog which contains all of the brightest and most prominent objects visible from the northern hemisphere and is extremely popular among amateur astronomers. It features descriptions of all the Messier objects, Fun facts, their positions in the sky, photos where available and also indicates if the object is currently visible. It also provides a handy checklist for amateur astronomers who wish to check off the objects as they view them. Disappointingly it does not include maps to find them, nor a locator that points them out in the sky. Please consider for free it helps one keep an amazing amount of information directly related to the M objects at your fingertips. A worthwhile tool when used in conjunction with a star finder type of application.</p>
	<p>Moon Globe HD (Midnight Martian)</p>	<p>Hold the Moon in our hands. A precision instrument for viewing our only natural satellite at all times, from all locations. I especially like the easily adjustable terminator line allowing one to appreciate every angle of sunlight across the moon's surface. This more of an exploratory tool than a map. The Moon Globe is well labeled showing features, and/or missions that reached the moon. The \$.99 cent HD edition is worth the view. I have projected this in the planetarium and it is an awe-inspiring site. This is well thought out since it has reversible East West and North South orientations so that you can use it by your telescope to easily identify and pull up information about what you are viewing. Drifting across the moon's surface is so smooth it is like a dream. The interaction of the software to the users touch is something to be experienced.</p>
	<p>Exoplanet (Hanno Rein)</p>	<p>Dr. Rein spoke to members this past November and utilized the application to assist in his presentation about the dynamics of exoplanetary systems. It features:</p> <ul style="list-style-type: none"> • A database with physical parameters of every known exoplanet. • Interactive visualizations and animations • Real images of all directly imaged exoplanets • Extensive background information on exoplanets and detection methods • Updated daily tracking all current discoveries • "Find it in the Milky Way" flies one through our galaxy to the location of the targeted star with exoplanets. • Exoplanetary systems are shown as interactive models which exhibit exoplanet orbits around their star at properly scaled distances (in astronomical units!).
	<p>GoSkyWatch (GoSoftWorks)</p>	<p>Easily and quickly identify and locate stars, planets, constellations and more with a touch or by simply pointing to the sky. Have fun with family and friends discovering the images in the night sky. Go outside and explore the night sky.</p>

Abell 545 - Star Pile

Ivin Williams

Dr. Mitchell Struble from the University of Pennsylvania was the guest speaker at our October Rittenhouse Astronomical Society (RAS) meeting and he spoke about his contribution to the fascinating study of galaxy clusters which are the largest structures in the known universe that are gravitationally bound together. Speaking with a breadth of knowledge that could only come from someone who has probably spent countless hours studying extreme minute differences of various deep sky images and prints, Mr. Struble gave a talk that I am sure challenged even the most astute astrophysical minds in the audience.

Our Milky Way galaxy is a good 100,000 light years in diameter and it belongs to a group of some 50 plus galaxies called the Local Group which spans some 10,000,000 light years in diameter. This Local Group in turn belongs to a much larger group of galaxies called the Virgo Super Cluster and it has a diameter of at least 100,000,000 light years. By the way, there is no clear cut definition of what constitutes a group of galaxies from a cluster of galaxies. It is in the realm of galaxy clusters though that in 1988, Dr. Struble made a most interesting discovery while looking at images taken years before of the central region of a huge galaxy cluster named Abell 545 located some 2 billion light years away in the constellation Lepus.

The core regions of large galaxy clusters can be extremely hostile and violent due to the enormous gravitational tidal forces that can be exerted because of the amounts of concentrated matter that are often found there. Imagine a train wreck resulting not only from two trains coming together from opposite directions but one that takes place as a result of trains coming together from each and every possible direction at extremely high speeds. Elegant shaped spiral galaxies such as our own Milky Way would most likely be shredded as easily as breakfast cereal if it tried to make a home for itself in the core region of a huge galaxy cluster like Abell 545 which is one reason why these particular clusters often have only one huge elliptical galaxy at it's core.

It is this knowledge of galactic cores that made Dr. Struble's discovery so interesting because what his keen eyes stumbled upon was not a huge galaxy at the core of

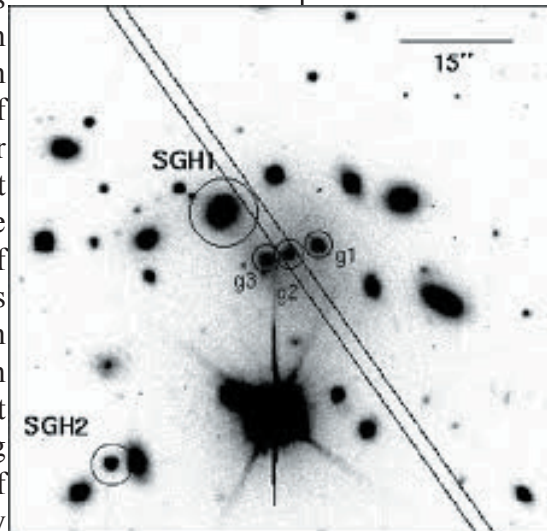
Abell 545 but a fuzzy elongated patch of light now known to be some 200,000 light years in diameter and that so far has no real explanation for it's creation or continued existence. Dr. Struble dubbed his patch of light "Star Pile" and such light that can be found in regions between various galaxies is also known as intracluster light (ICL). This particular ICL is some sort of grouping of stars where it seems that a huge elliptical or irregular galaxy should reside instead. This ICL has also been found to be part of Abell 545 and not foreign to it as earlier studies have suggested. Keep in mind that at these vast distances, X-ray observations bounce optical ones from their pedestal and the in-depth study of the cores of giant galaxy clusters can be very crucial going forward not only in the study of dark matter since a large percentage of these cores have been found to consist of it but also in the study of the creation of large scale structures

of the universe. One simple possible explanation for Dr. Struble's Star Pile and confirmed by someone else who has serious knowledge on this particular topic is that not every star actually resides within the defined boundaries of their host galaxy but sometimes a given star or group of stars can be knocked out of or pulled out of a particular galaxy in a variety of ways.

I found Dr. Struble's talk extremely fascinating and in the weeks that followed I came up with several questions that I wanted him to answer but I never got the chance to have him do so primarily because I waited too

long to touch base with him I am sure. As luck would have it though, at the very last minute I decided to try and contact Dr. Aaron J. Romanowsky whose name I have seen at the top of a couple of in-depth academic papers on the topic and he allowed me to email him a few of my questions. He answered my questions in simple terms that really filled in some of the blanks that I had so I send out a thank-you to Dr. Romanowsky. Perhaps one day we can get him to come here and be our guest speaker on a topic of his choice.

There are over 4000 galaxies in the Abell catalog of galaxy clusters named after George Ogden Abell who cataloged many of them in the 1950's so that means that beyond Dr. Struble's most interesting discovery, there are surely many other hidden treasures out there residing on various long forgotten images and prints that are just waiting to be discovered and just possibly by some of the budding scientists who regularly attend our RAS meetings.



A Proposal

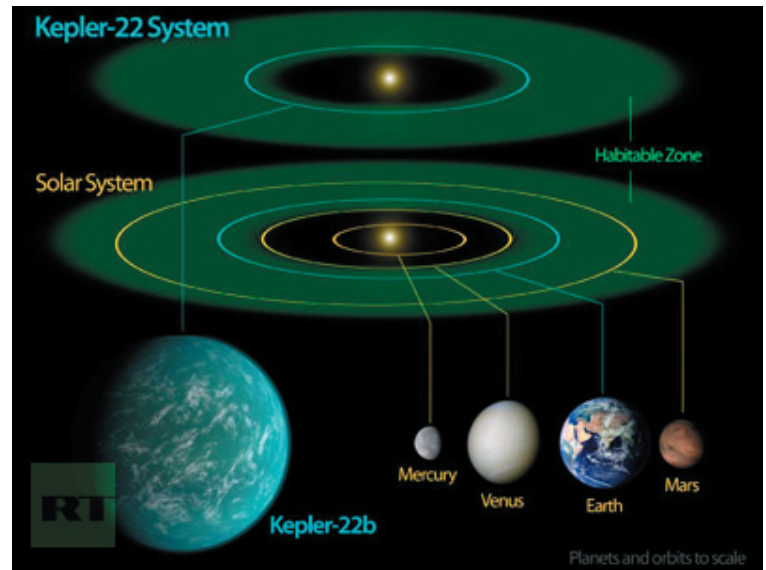
Christopher Richardson - Report 1

I have been attending the meetings for the past year. I have volunteered to assist with Rittenhouse for the Philadelphia Science Festival. I did some celestial sphere demonstrations to visitors on the Parkway and assisted with the setup of our astronomy display. I also assisted this past City-Wide Telescope Night (the fall edition) in October of this year. I currently work at the Franklin Institute in the theaters department, alongside Shawn Rush and Dave Walker, also members of Rittenhouse. I am aspiring to go into the astronomy field as a profession once I am finished school. I am currently taking some prerequisite calculus, physics, and chemistry courses at the Community College of Philadelphia. Once I am finished my final semester at CCP, I plan to transfer out as an undergraduate physics major, with a concentration in astronomy. My areas of interest are in the fields of astrobiology and planetary science, and the areas in those fields I would like to focus on are exoplanetary bodies and mechanics, origin and habitability of life, and geology.

I am writing proposal for an idea I had, which will keep more involved in the Rittenhouse meetings and newsletters. I propose to give a regular update on the discoveries and experiments that are taking place in the fields planetary science and astrobiology, including: exoplanet discoveries and characteristics of the planet, possible scientific instruments and technology, microbial life that may exist on these planets, etc.

I feel that this field is growing in popularity, and as more exoplanets are discovered, as well as extremophile organisms that can thrive in places hostile to humans, the popularity will only increase. I would greatly appreciate the opportunity to share the discoveries and information of my favorite field in astronomy with the members of our astronomy society. Included here is my first report for a column I want to establish called "Searching for Life." I intend to

give brief updates at future meetings on scientific developments of interest that are related to the search for life.



*Kepler-22b – Comfortably Circling within the Habitable Zone
(image from <http://www.nasa.gov>)*

Searching for Life

Christopher Richardson - Report 1

Kepler 22b

The most recent Earth-like exoplanet discovered by NASA's Kepler Telescope. The planet is located around 600 light-years away in the constellation Lyra. The planet is estimated to be around 2.4 times the radius of the Earth. The planet orbits its star, G-class star like the Sun, in 290 days. Scientists are unsure of planet's composition.

HD 85112b

Discovered in September by European scientists of the European Southern Observatory using the High Accuracy Radial velocity Planet Searcher (HARPS) in Chile. The planet is 36 light-years away in the constellation Vela. It is estimated to be around 3.6 times the mass of the Earth. It orbits an orange dwarf star, at a distant that is equivalent to a little farther out than the orbit of Venus. Scientists are waiting to confirm the percentage of clouds in the planet's atmosphere before determining its habitability.

Planetary Lake Lander Team

A team of scientists, funded by NASA's Astrobiology Science and Technology for Exploring Planets (ASTEP) program, are camping out at Laguna Negra in Chile. The team's mission is to design and test a lake lander that can be used on Saturn's moon, Titan. For more info, check www.astrobio.net.

The Habitable Exoplanets Catalog

Online database for exoplanetary discoveries. Website: www.phl.upra.edu

NASA'S Curiosity Mars Rover blasts off in Search of Signs of Life

Dr. Ken Kremer

Atop a towering inferno of sparkling flames and billowing ash, Humankind's millennial long quest to ascertain "Are We Alone?" soared skywards on Nov. 26 with a sophisticated spaceship named 'Curiosity', NASA's newest, biggest and most up to date robotic surveyor that's specifically tasked to hunt for the 'Ingredients of Life' on Mars - the most 'Earth-like' planet in our Solar System.

Curiosity zoomed to the heavens with the pulse pounding blastoff of NASA's huge Mars rover mounted atop a United Launch Alliance Atlas V rocket at 10:02 a.m. EST from Space Launch Complex 41 on Cape Canaveral Air Force Station in Florida. I was very lucky to be among the few to witness the launch from on top of the VAB (Vehicle Assembly Building) with a special restricted access press pass.

Curiosity's noble goal is to meticulously gather and sift through samples of Martian soil and rocks in pursuit of the tell-tale signatures of life in the form of organic molecules - the carbon based building blocks of life as we know it - as well as clays and sulfate minerals that may preserve evidence of habitats and environments that could support the genesis of Martian microbial life forms, past or present.

The Atlas V booster carrying Curiosity to the Red Planet vaulted off the launch pad on 2 million pounds of thrust and put on a spectacular sky show for the throngs of spectators who journeyed to the Kennedy Space Center in Florida from across the globe to witness the liftoff of the \$2.5 Billion Curiosity Mars Science Lab (MSL) rover.

The car sized Curiosity rover is the most ambitious, important and far reaching science probe ever sent to the Red Planet - and the likes of which we have never seen or attempted before.

"Science fiction is now science fact," said Doug McCuistion, director of the Mars Exploration Program at NASA Headquarters at the post launch briefing for reporters at KSC. "We're flying to Mars. We'll get it on the ground... and see what we find."

"'Ecstatic' - NASA is Ecstatic. MSL is enormous, the equivalent of 3 missions frankly."

NASA is utilizing an unprecedented, rocket powered precision descent system to guide Curiosity to a pinpoint touch down inside the Gale Crater landing site, with all six wheels deployed. Gale Crater is 96 mi wide. It is dominated by layered terrain and an enormous mountain rising some 3 mi above the crater floor which exhibits exposures of



Curiosity rover soars to Mars atop an Atlas V rocket on Nov. 26 at 10:02 a.m. EST from Cape Canaveral, Florida. Credit: Ken Kremer (kenkremer.com)

minerals that may have preserved evidence of ancient or extant Martian life.

"I hope we have more work than the scientists can actually handle. I expect them all to be overrun with data that they've never seen before. It will be like sitting at the bottom of the Grand Canyon," said McCuistion.

The 197 ft tall Atlas booster's powerful liquid and solid fueled engines ignited precisely on time with a flash and thunderous roar that grew more intense as the expanding plume of smoke and fire trailed behind the rapidly ascending rocket's tail.

The engines powered the accelerating climb to space and propelled the booster away from the US East Coast as it majestically arced over in between broken layers of clouds. The Centaur second stage successfully fired twice and placed the probe on an Earth escape trajectory at 22,500 MPH and lofted the spacecraft out of Earth orbit into a 352-million-mile journey to Mars.

"Our spacecraft is in excellent health and it's on its way to Mars," said Pete Theisinger, Mars Science Laboratory Project Manager from the Jet Propulsion Laboratory in California at the briefing. "The launch vehicle has given us a first rate injection into our trajectory and we're in cruise mode."

Curiosity is a 2000 pound behemoth. She measures 10 ft in length and is nearly twice size and five times as heavy as Spirit and Opportunity, NASA's prior set of twin Martian robots.

"We are ready to go for landing on the surface of Mars, and we couldn't be happier," said John Grotzinger, Mars Science Laboratory Project Scientist from the California Institute of Technology at the briefing. "I think this mission will be a great one. It is an important next step in NASA's overall goal to address the issue of life in the universe."



Curiosity rover bound for Mars punches through Florida clouds. Credit: Ken Kremer (kenkremer.com)

Curiosity is equipped with a powerful 165 pounds array of 10 state-of-the-art science instruments weighing 15 times more than its predecessor's science payloads. A drill and scoop located at the end of the robotic arm will gather soil and powdered samples of rock interiors, then sieve and parcel out these samples into analytical laboratory instruments inside the rover. A laser will zap rocks to determine elemental composition.

"Our mission is about looking for ancient habitable environments - a time on Mars which is very different from the conditions on Mars today." The promise of Mars Science Laboratory, assuming that all things behave nominally, is we can deliver to you a history of formerly, potentially habitable environments on Mars," Grotzinger said.

The liftoff was the culmination of 10 years of efforts by the more than 250 science team members and thousands more spread across the United States and NASA's international partners including Canada, Germany, Russia, Spain and France.

Prior to launch I was with the Atlas V rocket and Curiosity after they were rolled out to Space Launch Complex 41 under the watchful eyes of ground crews, mission scientists, reporters and photographers. A few months earlier I was with the very last group to visit Curiosity in the clean room just before she was folded up for flight.

Check Ken's Curiosity Mars rover features online at Universe Today:

- Curiosity Mars Rover Launch Gallery – Photos and Videos
- Curiosity Majestically Blasts off on 'Mars Trek' to ascertain 'Are We Alone?'
- Mars Trek – Curiosity Poised to Search for Signs of Life
- Curiosity Rover 'Locked and Loaded' for Quantum Leap in Pursuit of Martian Microbial Life
- Science Rich Gale Crater and NASA's Curiosity Mars Rover in Glorious 3-D – Touchdown in a Habitable Zone



NASA's Curiosity Mars rover is encapsulated inside the 5 meter payload fairing and loaded atop the Atlas V rocket at Pad 41. Credit: Ken Kremer

- Curiosity Powered Up for Martian Voyage on Nov. 26 – Exclusive Message from Chief Engineer Rob Manning

Astronomy Outreach:

Dr. Ken Kremer

Please contact Ken for more info or science outreach presentations:

- **Rittenhouse Astronomical Association (RAS)**, Franklin Institute, Philadelphia, PA, Jan. 11, Wed, 8 PM, "8 Years of Mars Rovers -- Mars and Vesta in 3 D". Website: <http://www.rittenhouseastronomicalsociety.org/>
- **New Jersey Astronomical Association NJAA**- Vorhees State Park: High Bridge, NJ, March 24, Sat., 8 PM "Atlantis, the End of America's Shuttle Program and What's Beyond for NASA". Website: <http://www.njaa.org/>

Ken has a selection of his Shuttle photos and Mars mosaics for sale as postcards and frameable prints.

Ken Kremer: Spaceflight magazine & Universe Today

Please contact Ken for more info or science outreach presentations:

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Rittenhouse Astronomical Society

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