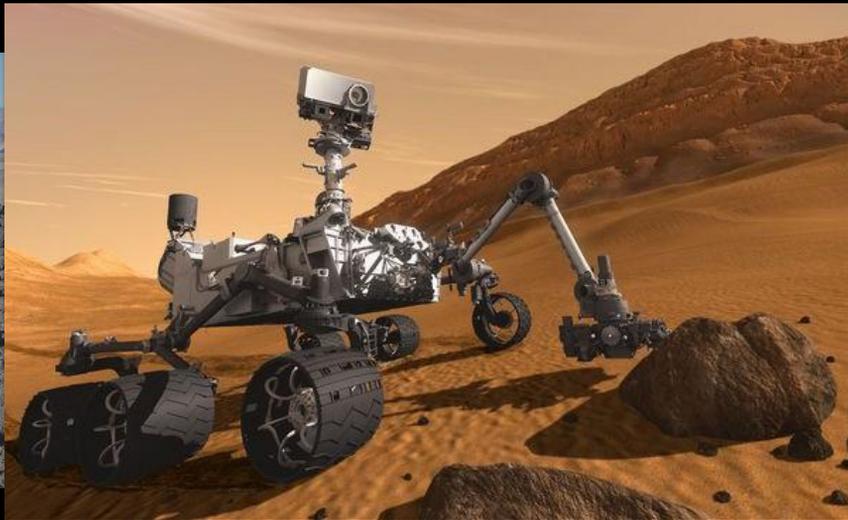


*Join us for the first ever*

# Mars and the Mojave Festival

*Exploring extremes on Earth and beyond*



**March 9 – 11, 2012**

*Death Valley National Park*

Death Valley National Park encompasses some of the most extreme environments on the planet. For decades, planetary scientists have come here for research and instrument testing. Help us celebrate this scientific heritage with:

- Guest lectures from planetary scientists
- Field trips to other-worldly park sites
- An expo with booths, demonstrations, and give-aways



Friday, March 9

Time	Event	Location
7:30pm – 8:30pm	<b>Keynote Address: <i>Curiosity on Mars</i></b> Dr. Chris McKay, plus analog site vignettes on Badwater (S. Douglas), Mars Hill (A. Zent) and Ubehebe (R. Bonaccorsi)	Visitor Center auditorium
8:30pm – 10:30pm	<b>Telescope viewing</b> of planets and more with rangers	Furnace Creek airport



# Program Schedule

Saturday, March 10

Time	Event	Location
9:30am – 12:00pm	<b>Field Trips to Mars Analog Sites:</b> <i>Badwater</i> with Dr. Susanne Douglas <i>Mars Hill</i> with Dr. Aaron Zent	Badwater parking lot
1:00pm – 3:00pm	<b>After-Lunch Lectures:</b> <i>Mars in Death Valley</i> by Dr. Luther Beegle <i>Life in Rocks</i> by Dr. Henry Sun <i>Did Terrestrial Life Evolve on Mars?</i> by Dr. Joe Kirschvink <i>Analogs for Living and Working on Mars</i> by Lucinda Land	Visitor Center auditorium
1:00pm – 5:00pm	<b>Expo:</b> Booths from NASA and other organizations, featuring: <ul style="list-style-type: none"> <li>• <b>Mini-Rover Demonstrations</b> at 2:00pm &amp; 4:00pm</li> <li>• <b>Stars Above, Earth Below: adventures in National Park astronomy</b>, a lecture by Dr. Tyler Nordgren at 3:00pm</li> </ul>	Lawn next to Visitor Center & multi-purpose room
7:30pm – 8:30pm	<b>Keynote Panel: Societal Relevance of Planetary Analog Research</b> Introductory remarks by Dr. Tyler Nordgren, panel with NASA scientists.	Visitor Center auditorium

Sunday, March 11

Time	Event	Location
9:30am – 11:30am	<b>Field Trip: Ubehebe Crater</b> Dr. Rosalba Bonaccorsi	Ubehebe Crater parking lot
1:00pm – 1:30pm	<b>Closing Ceremony: The Exploration Continues!</b> Andrea Jones and other NASA reps	Visitor Center auditorium

# **Mars and the Mojave Festival Guide to Lectures & Field Trips:**

## ➤ **On Friday, March 9:**

*Keynote Lecture, 7:30pm – 8:30pm, in the Furnace Creek Visitor Center Auditorium*

### **Dr. Chris McKay – Curiosity on Mars: The Next Mars Rover Mission**

The Mars Science Laboratory rover, named Curiosity, is on its way to Mars and will land in Gale Crater on August 5, 2012. With a sophisticated set of instruments and a robot arm, Curiosity will search for organics and evidence of life.

*Planet-gazing, 8:30pm – 10:30pm, at the Furnace Creek Airport*

**Park Rangers and friends**

## ➤ **On Saturday, March 10:**

*Field Trip, 9:30am – 10:45am, meet at the Badwater Parking Lot*

### **Dr. Susanne Douglas – Field Trip to Badwater**

Many areas of Death Valley have groundwater springs which rise at the edges of the salt pan. The resulting salts which form are called evaporites and these evaporites are inhabited by a variety of different microbial communities. Within these evaporites, the communities find protection from harsh light and fluctuating water levels and, in turn, affect the mineralogy of the salts they inhabit. These mineral-dwelling microbial communities are analogues for possible life forms in the evaporites of Mars, and are being studied in order to define what needs life has in an evaporate environment. We will be touring a number of pools at Badwater. These pools are within hundreds of meters of each other yet have differing chemical compositions. We will see different types of microbial communities in these pools and the minerals they produce. If you have a magnifying glass, you may wish to bring it. We will be traversing some rough, but flat ground and handling samples that will dry your hands.

*Field Trip, 10:45am – 12:00pm, coming from Badwater*

### **Dr. Aaron Zent – Field Trip to Mars Hill**

Mars Hill has been used to test engineering solutions to entry, descent, landing and trafficability problems of scientific craft bound for the planet Mars. In practice, this means that the rocks on the surface of Mars Hill are comparable in size, shape and abundance to those at the two Mars landing sites. Mars Hill and some of the Mars landing sites, particularly during the Viking 1 and Pathfinder missions, share a similar geologic origin. For instance, the evolution of alluvial fans in windy environments, like Death Valley, has produced a very good analog to the surface roughness of the Mars landing sites. Examples of alluvial fans, desert pavement, ventifacts and sand tails almost identical to those on Mars will be examined as field trip participants explore Mars Hill.

*Lecture, 1:00pm – 1:30pm, in the Furnace Creek Visitor Center Auditorium*

### **Dr. Luther Beegle – Mars in Death Valley**

Mars is the most Earth-like planet in our solar system. If Earth can be called the water planet, then Mars can be considered the "had surface water planet", as there is copious evidence that Mars at one point in its past had oceans, lakes and rivers. In Death Valley and the Mojave, we see a similar environment were wet environments slowly dried out as the Earth emerged from the last ice age. In this presentation, Dr. Luther Beegle of the Jet Propulsion Laboratory will discuss similarities between Mars and sites within Death Valley and the Mojave, and the importance of utilizing analogs for both science and technology activities.

*Lecture, 1:30pm – 2:00pm, in the Furnace Creek Visitor Center Auditorium*

**Dr. Henry Sun – Life in Rocks**

The sandstone and granite in Death Valley may seem lifeless. Break them open, you will find a “zoo” of microscopic organisms (cyanobacteria, algae, fungi, bacteria) living in pore spaces just below the rock surfaces. In this presentation, Dr. Henry Sun from the Desert Research Institute will explain how the rocks protect the organism from the harsh climate and why NASA is looking for similar life forms on Mars.

*Lecture, 2:00pm – 2:30pm, in the Furnace Creek Visitor Center Auditorium*

**Dr. Joe Kirschvink – Did Terrestrial Life Evolve on Mars?**

Nearly 10 years ago, Prof. Kirschvink's group at Caltech demonstrated that the famous meteorite, ALH84001, traveled from the surface of Mars to the surface of Earth without its interior being heated even to 40°C (104°F). This temperature was too low to sterilize bacterial spores, doubling the 'problem' of the origin of life: If life had evolved on Mars, it could have been brought to Earth on meteorites, and we would not know it. Recent discoveries suggest the environment of early Mars may have been much more conducive to the origin of RNA (ribonucleic acid, a building block of life similar to DNA), than conditions on Earth at the time. Simply put, ribose (a critical component of RNA) forms easily in a desert environment with evaporite minerals that contain borax. However, 4 billion years ago Earth was a water-covered planet with little, if any, land, whereas Mars had many environments like Death Valley. Dry environments with clays also promote the polymerization of large, complex molecules such as RNA. All of the ingredients were there. Hence, we may all be the descendants of space-traveling Martian microbes!

*Lecture, 2:30pm – 2:00pm, in the Furnace Creek Visitor Center Auditorium*

**Lucinda Land – MDRS and FMARS: Analogs for Living and Working on Mars**

The Mars Society, an international non-profit based out of Colorado, hosts two habitats (Habs), the Mars Desert Research Station (MDRS) in Utah, and the Flashline Mars Arctic Research Station (FMARS) on Devon Island in the Canadian High Arctic. Both Habs serve as analog research stations that are laboratories for learning how to live and work on another planet.

*Lecture, 3:00pm – 4:00pm, in the Furnace Creek Visitor Center Multi-purpose room*

**Dr. Tyler Nordgren – Stars Above, Earth Below: adventures in astronomy in the national parks**

The national parks that protect our daytime enjoyment of beautiful landscapes, also protect our enjoyment of the sky above at night. A view of the stars and Milky Way overhead has become as rare as the view of glaciers, grizzlies, and granite cliffs that bring millions of visitors to the parks every year. Through pristine views of a starry sky at night we learn about where our planet has come from and where it is going. By day the geology under foot opens a door to landscapes on other planets. By day and night, the national parks are our window to the Universe.

*Keynote Panel, 7:30pm – 8:30pm, in the Furnace Creek Visitor Center Auditorium*

**Dr. Tyler Nordgren – The Universe at Your Feet**

A night in the national parks is an opportunity to sleep under the stars and see the sky the way every generation of human beings once did. But astronomy in the parks doesn't end when the sun comes up. The national parks are also a window to the other worlds of our solar system. A hike through the red rocks of Utah, or the geysers of Yellowstone is to experience the sands of Mars and ice volcanoes on a moon of Saturn. In America's national parks, come for the landscape, stay for the Universe.

**– and NASA scientists discussing the Societal Relevance of Planetary Analog Research.**

➤ **On Sunday, March 11:**

*Field Trip, 9:30am – 11:30am, meet in the Ubehebe Crater Parking Lot*

**Dr. Rosalba Bonaccorsi – Studying Mars from Earth at The Ubehebe Volcanic Field**

The Ubehebe Volcanic Field includes a dozen craters formed during hydro-magmatic explosions during the last few thousand years. The craters can serve as analogs for upcoming astrobiology-driven missions at several Martian sites, including the Mars Science Laboratory (MSL) Mission. The terrain of the Ubehebe Volcanic Field presents a variety of geologic environments, from coarse-grained river deposits, to clay-bearing lake deposits, to volcanic ashes. With precipitation patterns in Death Valley similar to a “warmer and wetter” early Mars, and a similar variety of minerals present, the Ubehebe Volcanic Field offers an ideal test site for formulating hypotheses about the potential of minerals, rocks, and sediment to support microbial life in dry, hot deserts on Earth and, possibly, on Mars.

*Closing Ceremony, 1:00pm – 1:30pm, in the Furnace Creek Visitor Center Auditorium*

**Andrea Jones and NASA friends – The Exploration Continues!**

Andrea is a member of the Education and Public Outreach Team for the SAM instrument suite onboard the Mars Science Laboratory Curiosity rover. SAM scientists frequently conduct fieldwork in locations in and around National Parks in places that share similarities with environments on other planets. Andrea will discuss the SAM Team’s plans to continue working with National Parks, helping develop products and programs that compare exploring Mars through Gale Crater (Curiosity’s landing site) to exploring Earth through National Parks.

## **Mars and the Mojave Festival Speaker Biographies**



**Dr. Luther Beegle** is a scientist within the Planetary Science section at the Jet Propulsion Laboratory/California Institute of Technology. One of his many research interests at JPL is the development of instruments to identify and characterize life in extreme environments. His research takes into account all aspects of measurements in a complex environment, including understanding the effect on the sample of acquisition, handling and processing surface material.



**Dr. Rosalba Bonaccorsi** is an interdisciplinary scientist working at NASA Ames Research Center. In 2001 she obtained her Ph.D. in Geological, Marine and Environmental Sciences from the University of Trieste (Italy). Since 2005 she has expanded her interest to the habitability of mineralogical Mars analogs, and very dry desert regions worldwide, including the Mojave, Antarctica, Atacama (Chile), and Australia, often as a NASA Spaceward Bound team member. Rosalba joined the SETI Institute in 2008, and is keen to achieve a wide picture of where life and its

signatures are most successfully distributed, concentrated, preserved, and detected. Since 2008, Rosalba has been working in Death Valley on the Ubehebe Volcanic Field. In collaboration with NASA scientists, she is applying results from this research to Mars Science Laboratory mission objectives. Formerly a teacher, she has been involved with Education and Public Outreach with non-profit organizations since 1989.



**Dr. Susanne Douglas** has a Ph.D. in Geomicrobiology from the University of Guelph in Canada. Her work since then has focused on determining the inter-relationships between minerals, microorganisms, and geochemistry in the Earth's extreme environments. She has studied saline alkaline lakes in northern Canada, closed marine basins in the Bahamas, evaporative hot spring pools in Iceland and California, and endolithic microbial communities in various deserts including the Antarctic Dry Valleys. Her main research area at present is Death Valley National Park, where she holds an active research permit and conducts investigations of microbe-mineral inter-relationships.



**Dr. Joe Kirschvink** is the Nico and Marilyn Van Wingen Professor of Geobiology at the California Institute of Technology. He also known for discovering the geomagnetic sensory organs used by migrating animals to find their way, for formulating the 'Snowball Earth' Hypothesis to explain low-latitude glaciations, and for recognizing the role of True Polar Wander events as a driving force for biological evolution.



**Andrea Jones** is an Education and Public Outreach (EPO) Specialist for the SAM (Sample Analysis at Mars) instrument on the Curiosity Rover. She earned her undergraduate degree in Geology from the College of William & Mary in 2005, and a Masters degree in Geosciences, with a focus in planetary geology, from the University of Arizona in 2009.



**Lucinda Land** is the Executive Director of the Mars Society, an international non-profit organization that conducts Mars analog simulations and research to forward human missions to Mars. In addition to completing a crew rotation at the Mars Desert Research Station (MDRS) in Utah, Ms. Land has also been a part of the NASA Spaceward Bound expeditions to Abu Dhabi and Australia in 2011. Her goal for MDRS is to create an, "Introduction to Field Science on Mars" 101 course utilizing NASA Planetary Scientist Dr. Chris McKay's results from his four year study at MDRS to further science education and communication beyond Earth. She looks forward to when students state excitedly that they are, "Spaceward Bound". Currently, she

teaches Earth Science at Latino College Preparatory Academy, to inspire her students to focus on Mars and study science and engineering at University.



**Dr. Chris McKay** of NASA Ames Research Center is part of the science teams on two of the MSL instruments.



**Dr. Tyler Nordgren** is a professor at the University of Redlands. Earning his PhD in astronomy at Cornell University, Dr. Nordgren has used modern observatories around the world as part of his research. Over the last two decades he has seen the steady spread of urban lighting that shines up into the sky to blot out the view of distant stars. Since 2005, he has worked in National Parks to promote astronomy education, where the public still has a chance to see a natural nocturnal landscape. In 2004 Dr. Nordgren was part of a small group of artists and astronomers that designed a small sundial for NASA's Mars Rovers Spirit, Opportunity and Curiosity. His book *Stars*

*Above, Earth Below: A Guide to Astronomy in the National Parks* was published in 2010 as a way to spread the message of the importance of protecting the naturally dark night sky.



**Dr. Henry Sun** is currently an assistant research professor at the Desert Research Institute, Las Vegas. He studies microorganisms that live at the cold and dry extreme, such as the Antarctic Dry Valleys and the Atacama Desert.



**Dr. Aaron Zent** got his Ph. D. in Geology from the University of Hawaii in 1988, and has been at NASA Ames ever since. He has been involved with several Mars missions, most recently the 2008 Phoenix lander. His research focuses on the physical and chemical interactions between planetary atmospheres and their surfaces.