ORION Trapezium

May 2018 Volume 45, Issue 5

Who are we?

ORION was founded in April 1974, by a group of scientists at the United States Department of Energy facilities in Oak Ridge, Tennessee. Our original goal was to perform correlated, instrumented observations of atmospheric and astrophysical phenomena. Since then, we have expanded in many directions, including optical and radio astronomy and instrument design. Have a look at https://orioninc.org and https://orionastronomy.wordpress.com/meetings/upcoming-meetings/

What's Inside

Future Events

ORION Meeting

Wednesday, May 16
Goff Health Sciences & Technology Bldg., Room 104
Roane State Community College
Oak Ridge

TAO Public Stargazes

Saturday, May 5, 2018
Saturday, May 19, 2018
Roane State Community College
Tamke-Allan Observatory (TAO)
7:30 pm to 12:00 am
8:00 pm program
Look at http://www.roanestate.edu/obs/

TAO Notes

ORION people are invited to arrive early (if announced on email) to prepare for evening viewing. Bring a telescope, red flashlight and munchies.
First time visitors – drive out before dark. Map available at www.roanestate.edu/obs.visit.htm

May 2018 Meeting

Wednesday, May 18, 7 PM, Goff Health Sciences and Technology Building, Room 104, Roane State Community College, Oak Ridge

Presentation: Microbes in Weird Places: What Life is Like Deep in the Earth

Speaker: Dr. Karen Lloyd, UTK Dept. of Microbiology

Dr. Karen G. Lloyd applies molecular biological techniques to environmental samples to learn more about microbes that have thus far evaded attempts to be cultured in a laboratory. She has adapted novel techniques to quantify and characterize these mysterious microbes while requiring minimal changes to their natural conditions. Her work centers on deep oceanic subsurface sediments, deep-sea mud volcanoes and cold seeps, terrestrial volcanoes and hot springs, serpentinizing springs, Arctic marine fjord sediments, and ancient permafrost. She is currently an Assistant Professor at the University of Tennessee, http://lloydlab.utk.edu/.

Abstract

We do not currently know how deep life extends into Earth's crust. A major discovery in the past few decades has been that microbial life is abundant and diverse deep into sediments and crust underneath the world's oceans. In addition, deeply-sourced fluids, which are often harshly acidic, basic, or hot, bubble up from the deep subsurface and bring with them many different kinds of microorganisms as well. Microbiologists have two strategies to learn about these microbes: 1) the traditional way where microbes are grown on petri dishes or in test tubes, and 2) the new way where natural samples are analyzed with the tools of molecular biology. The traditional way has given a great leaping-off point for such studies, but the new techniques have shown us that the vast majority of microbial life on Earth has yet to be discovered. I will talk about new discoveries we have made in my lab by applying these new techniques to deep subsurface sediments near the Mariana Trench, hot springs and the inside of volcanoes in Central America, and cold extremophiles at 79°N in the Arctic.

April 2018 Meeting

Wednesday, April 18, 7 PM, Goff Health Sciences and Technology Building, Room 104, Roane State Community College, Oak Ridge

Presentation: Early evolution of the Moon

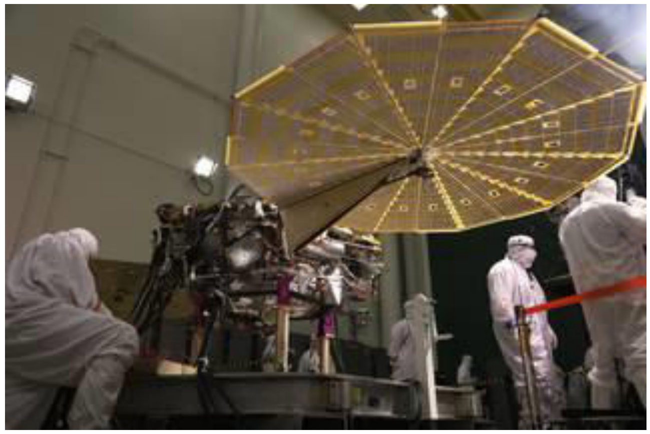
Speaker: Dr. Nick Dygert Assistant Professor, Petrology and Geochemistry UT Department of Earth and Planetary Sciences

Dr. Dygert grew up in Washington State and gained an appreciation for geology climbing mountains in the Cascades and Olympics. As an undergraduate at the University of Rochester, he wrote a thesis on the geochemistry of anomalous crater in the Bolivian Altiplano. He went on to graduate school at Brown University after two years in geotechnical and environmental consulting. His dissertation focused on the physical and chemical evolution of the lunar and terrestrial mantles, and includes chapters on experimental petrology, rock deformation, and the trace element geochemistry of ophiolitic peridotites. Nick moved on to a postdoctoral fellowship at UT Austin, where he acquired experience in numerical modeling and synchrotron-based experimental techniques, and worked on deformed peridotite xenoliths and an enstatite achondrite. He uses experimental and field investigations to understand processes that shape the evolution of planetary interiors and crusts, and to interpret their expressions in the rock record.

Abstract

The globally homogeneous, monomineralic lunar crust suggests the Moon formed after a giant impact between Earth and another body. This energetic event would have produced a whole-Moon magma ocean. Petrologic and geophysical models argue the lunar magma ocean crystallized from the bottom up, forming a gravitationally unstable cumulate mineral pile, with the densest phases overlying less dense phases in the lunar interior. Dense minerals may have flowed toward the core as solids, displacing lower density minerals that flowed upward toward the crust in a process known as cumulate mantle overturn. Cumulate mantle overturn has important consequences for the petrogenesis of the lunar basalts, the spatial distribution of heat-producing radionuclides in the lunar interior, and the efficiency of a lunar core dynamo. This talk presents new experimental constraints on physical and chemical properties of lunar minerals and silicate melts, improving our understanding of lunar magma ocean crystallization, cumulate mantle overturn, and the ways that present-day lunar surface and interior features came to be.

NASA's InSight Spacecraft Launched on May 5th



While in the landed configuration for the last time before arriving on Mars, NASA's InSight lander was commanded to deploy its solar arrays to test and verify the exact process that it will use on the surface of the Red Planet.
Credits: Lockheed Martin Space

Mission Overview

InSight (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) is a NASA Discovery Program mission that will place a single geophysical lander on Mars to study its deep interior. But InSight is more than a Mars mission - it is a terrestrial planet explorer that will address one of the most fundamental issues of planetary and solar system science - understanding the processes that shaped the rocky planets of the inner solar system (including Earth) more than four billion years ago.

By using sophisticated geophysical instruments, InSight will delve deep beneath the surface of Mars, detecting the fingerprints of the processes of terrestrial planet formation, as well as measuring the planet's "vital signs": Its "pulse" (seismology), "temperature" (heat flow probe), and "reflexes" (precision tracking).

Why Mars?

Previous missions to Mars have investigated the surface history of the Red Planet by examining features like canyons, volcanoes, rocks and soil, but no one has attempted to investigate the planet's earliest evolution - its building blocks - which can only be found by looking far below the surface.

Because Mars has been less geologically active than the Earth (for example, it does not have plate tectonics), it actually retains a more complete record of its history in its own basic planetary building blocks: its core, mantle and crust.

By studying the size, thickness, density and overall structure of the Red Planet's core, mantle and crust, as well as the rate at which heat escapes from the planet's interior, the InSight mission will provide glimpses into the evolutionary processes of all of the rocky planets in the inner solar system.

In terms of fundamental processes that shape planetary formation, Mars is a veritable "Goldilocks" planet, because it is big enough to have undergone the earliest internal heating and differentiation (separation of the crust, mantle and core) processes that shaped the terrestrial planets (Earth, Venus, Mercury, Moon), but small enough to have retained the signature of those processes over the next four billion years. Within its own structural signature, Mars may contain the most in-depth and accurate record in the solar system of these processes.

The InSight mission will follow the legacy of NASA's Mars Phoenix mission and send a lander to Mars, which will delve deeper into the surface than any other spacecraft - to investigate the planet's structure and composition as well as its tectonic activity as it relates to all terrestrial planets, including Earth.

Objectives

The InSight mission will seek to understand the evolutionary formation of rocky planets, including Earth, by investigating the interior structure and processes of Mars. InSight will also investigate the dynamics of Martian tectonic activity and meteorite impacts, which could offer clues about such phenomena on Earth.

Spacecraft and Payload

The InSight mission is similar in design to the Mars lander that the Phoenix mission used successfully in 2007 to study ground ice near the north pole of Mars. The reuse of this technology, developed and built by Lockheed-Martin Space Systems in Denver, CO, will provide a low-risk path to Mars without the added cost of designing and testing a new system from scratch.

The InSight lander will be equipped with two science instruments that will conduct the first "check-up" of Mars in more than 4.5 billion years, measuring its "pulse", or internal activity; its temperature; and its "reflexes" (the way the planet wobbles when it is pulled by the Sun and its moons). Scientists will be able to interpret this data to understand the planet's history, its interior structure and activity, and the forces that shaped rocky planet formation in the inner solar system.

The science payload is comprised of two instruments: the Seismic Experiment for Interior Structure (SEIS), provided by the French Space Agency (CNES), with the participation of the Institut de Physique du Globe de Paris (IPGP), the Swiss Federal Institute of Technology (ETH), the Max Planck Institute for Solar System Research (MPS), Imperial College and the Jet Propulsion Laboratory (JPL); and the Heat Flow and Physical Properties Package (HP3), provided by the German Space Agency (DLR). In addition, the Rotation and Interior Structure Experiment (RISE), led by JPL, will use the spacecraft communication system to provide precise measurements of planetary rotation.

Mission Details

The InSight mission is part of NASA's Discovery Program. It will rely on proven technologies used on NASA's Mars Phoenix mission, and will send a lander to the Martian surface that will spend two years investigating the deep interior of Mars - as well as the processes that not only shaped the Red Planet, but also rocky planets throughout the inner solar system.

Retrieved from https://www.nasa.gov/mission_pages/insight/overview/index.html

More About ORION

ORION is an amateur science and astronomy club centered in Oak Ridge, TN that was founded in April 1974 by a group of scientists at the United States Department of Energy facility in Oak Ridge, Tennessee. We serve Oak Ridge, Knoxville, and the counties of Anderson, Knox, and Roane.

ORION's mission is to support science research, teaching, and amateur astronomy in East Tennessee, and therefore we are closely associated with and support TAO by volunteering to host their public events, share our knowledge of the skies with a variety of telescopes, and help provide intellectually stimulating programs at the observatory. ORION works to share the wonders of the cosmos and the culture of science to people from all walks of life.

Members are scientists, engineers, technicians, and others with varied talents and expertise. Over half have telescopes, many are amateur radio operators, and some have a technical interest in astrophotography.

ORION has working relationships with several organizations, including museums and amateur astronomy groups.

Membership is open to individuals who will actively contribute their time and ideas. Our annual membership dues are $20.00 and student discounts are available.

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