AD ASTRA KANSAS FOUNDATION

AD ASTRA KANSAS

Volume 14, Issue 2 Fall 2015

AAKF points of interest:

- Founded in 2001
- Grassroots organization to promote space science and education in Kansas.
- Unfunded affiliate of the Kansas Space Grant Consortium since 2003
- Sponsor of six Ad Astra Kansas Day Space Celebrations and seven Galaxy Forums since 2008

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Space enthusiasts flock to 2015 Galaxy Forum

Interest in Pluto is alive and well.

Almost 100 people of all ages attended Ad Astra Kansas' 2015 Galaxy Forum on August 29 to listen to native son Glen Fountain's presentation on the New Horizons program at the Kansas Cosmosphere and Space Center.

Fountain, who grew up in Reno County, and attended Hutchinson Community College and Kansas State University, is the project manager for New Horizons at Johns Hopkins University Applied Physics Lab (JHUAPL). JHUAPL designed, tested and operates the spacecraft. Fountain began managing the New Horizons program in 2004. It lifted off in January 2006 and reached Pluto in July of 2015.

Pluto was the first object discovered (in 1930) in what is now known as the Kuiper Belt. Since the 1990s over 1000 Kuiper Belt objects have been discovered. It is now considered a third zone in the solar system.

"As one of the other scientists in my office said, 'Who's the oddball now?'" says Fountain.

Cont. Pluto page 3

Studying Earth rocks helps in search for life on Mars

LAWRENCE: NASA's announcement of the discovery of flowing saltwater on Mars' surface gives new energy to the hunt for life on the Red Planet.

"The fact that it's present on Mars means that the most basic and universal requirement for life was fulfilled," says KU astrobiologist and assistant professor of geography Alison Olcott-Marshal.

Olcott-Marshall studies the geology, chemistry and preserved biology of Mars analogs here on Earth, the better to constrain, limit and understand how to search for life on Mars.

Olcott-Marshall has recently done research on Eocene rocks in the Green River Formation, a lake system in Utah, Colorado, and Wyoming. She and masters student Nicholas A. Cestari have found these rocks have features that visually indicate the presence of life, and in the journal Astrobiology they argue that probes to Mars should identify similar indicators there and double-check them through chemical analysis.

Cored samples of the 50 million-year-old Eocene rocks have included sections of microbial mats. "Microbial mats are the microbial world's version of apartment buildings—they are layered communities of microbes and each layer represents a different metabolic strategy, " Olcott-Marshall says. "Generally, the photosynthetic microbes are at the top, and then every successive layer makes use of waste products of the level above. Thus, not only does a microbial mat contain a great deal of biology, but a great number of chemicals, pigments and metabolic products are made, which means lot of potential biosignatures."

At times during the Eocene period, the Green River Formation's water chemistry purged fish and other organisms from the lake, providing room for these microbes to thrive. "During these times, microbialite formed—these are rocks thought to be...essentially the preserved remnants of microbial mats. The Green River Formation has a wide variety of these structures and [that is] why we went looking in these rocks, as microbialites are one life-detection target on Mars," say Olcott-Marshall.

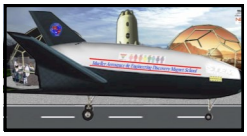
First, researchers visually inspected the cored samples for signs of biology by identifying geological signs associated with microbialites—such as stromatolites.

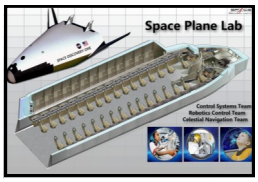
"These are things like finely [layered] sediments, where each [striation] follows the ones below—or signs of cohesive sediments, things like layers that roll over onto themselves or are at an angle steeper than what gravity would allow. These are thought to be signs that microbes are helping hold sediment together," says Olcott-Marshall.

Next, researchers powdered rock samples and used hot organic solvents like methanol to remove organic carbons still preserved in the rocks. That solvent was then concentrated and analyzed with gas chromatography/mass spectroscopy. "GC/MS allows an identification of compound, including organic molecules, preserved in rock."

Cont. on page 2 "MARS"

Flagship STEM program comes to Wichita magnet





The space plane STEM laboratory at Mueller will have lab space for 30-40 students at a time. Images courtesy of SDI.

A runway for the "landing" of a space plane STEM Lab at Mueller Elementary is just the start. The end product will be a first-of-its-kind in the nation program giving students serious hands-on STEM experiences using space equipment such as a NASA-grade space plane, Mars and lunar rovers and space suits.

Last spring, Mueller Aerospace and Engineering Discovery Magnet Elementary was selected for the program by the Space Discovery Institute (SDI), a non-profit foundation for the advancement of STEM education.

Inspired by NASA education programs, the SDI program will provide unique opportunities for students to experience aerospace technologies in a hands-on accredited educational environment incorporating STEM programs in authentic space science labs. Additionally, the program will make use of a network of mentors, educators and professionals, according to Dr. Arthur Eldridge, chairman of the SDI, a former NASA crew instructor and a NASA education ambassador.

The spacecraft will host real training labs, with students doing actual scientific duties and calculations to complete tasks and operate equipment. Studies will also include Lunar and Mars geology and space exploration training.

Wichita is the first nationally to get one of these sites. The city's aviation and aerospace history and prominence played a significant role in its selection. Schools in Atlanta, Ga., and Columbia S.C., are next in line.

"These are exercises and experiments performed by students worldwide. This puts everyone on an equal level."

"Students will be able to use equipment and perform activities, such as remote controls, to be used for assembly work in space. [There is expected to be] a strong demand for future jobs in space including Space Station and facilities for the Moon and Mars programs. STEM curriculum and labs will help prepare students for this new frontier," says Eldridge.

SDI has initiated an opportunity for sponsors to participate in the development of the Mueller property which will host the NASA-inspired STEM equipment and education labs. Additionally, SDI is currently in the midst of seeking $120,000 in matching funding and sponsorships to complete the operation by spring 2016. Eldridge says that sponsorship is coalescing, but they still require additional sponsorship. "This is a great value for education," he says. For more info, contact Dr. Arthur Eldridge at Space Discovery Institute (407)739-7863

Kansas planetariums educate about the sky

An Evening Under the Stars

Peterson Planetarium

EMPORIA: The recently remodeled **Peterson Planetarium**, an outreach arm of the Science and Mathematics Education Center at Emporia State University, underwent a grand re-opening in September.

Besides the Spitz 512 star projector renovation in 2014, a hemispherical mirror projection was added to span the planetarium dome with audio-video programming. A supplemental digital projector enables interaction through the internet and DVD's.

Special programs can be arranged for K-12 and live shows of night sky and full-dome programs are held for the public on the second Saturday of each month. For info, go to Peterson Planetarium

Other planetariums around the state associated with higher education schools are the:

Science and Mathematics Institute at **Fort Hays State University,** which is extending outreach with a portable digital planetarium available to teachers and community members for educational purposes. Requirements are a 1/2 day training session, after which the planetarium may be checked out and picked up. For info, contact Ann Noble at1-785-628-5449 or amryan@fhsu.edu

L. Russell Kelce Planetarium on the Pittsburg State University campus, which provides both public and private programs. Kelce Planetarium

Spitz Planetarium on the campus of Washburn University, which has scheduled fall open houses. Appointments can be made for programs for schools and other groups. Go to Spitz Planetarium

Barton County Community College Planetarium, which upgraded in 2014 to have a high-def digital projection system for the 360-degree dome. Go to BCC Planetarium

Science education centers with planetariums are the:

Justice Planetarium at the Kansas Cosmsphere. Go to www.cosmo.org

Boeing Dome Theatre and Planetarium at Exploration Place in Wichita. Go to Boeing Dome

ADM Theatre at Rolling Hills Wildlife Adventure Zoo & Museum near Salina. Go to ADM

Abernathy Science Education Center, Girard www.greenbush.org

Also, some K-12 schools have planetariums: Bradley Elementary School, located on Fort Leavenworth Military Post, Leavenworth; Lakin High School, Lakin; and Southwestern Heights High School, Kismet.

Photo courtesy of WSU College of Engineering

Cont. from page 1 "MARS"

Through GC/MS, the researchers found that rock structures appearing to be biological indeed hosted living organisms millions of years ago: analysis showed lipid biomarkers. "A lipid biomarker is the preserved remnant of a lipid, or fat, once synthesized by an organism. These can be simple or very complex. Different organisms make different lipids so identifying the biomarker can often allow a deeper understanding of the biota or the environments present when a rock formed. These are a type of biosignature," says Olcott-Marshall.

This shows that visual inspection can help select the most promising rock candidates for further biosignature analysis.

This could be very helpful for samples selection on Mars. There is a GC/MS on Curiosity right now, but only nine sample cups dedicated to looking for biomarkers like these. It's crucial those nine samples are ones most likely to guarantee success. Additionally, one goal for the planned 2020 rover mission is to identify samples for eventual return to Earth.

KU seniors receive Astronaut Scholarship Foundation awards

Two undergraduates are the first KU recipients of $10,000 Astronaut Scholarship Foundation awards.

Senior Jennifer Stern is an ecology and evolutionary biology major. Jessica van Loben Sels, also a senior, is a microbiology major.

The Astronaut Scholarship Foundation was founded in 1984 by the six surviving members of the Mercury 7 Mission to encourage students to pursue scientific endeavors to keep the U.S. on the leading edge of technology.

Since then, astronauts from many other space programs have joined the ASF which has awarded $4 million in scholarships to more than 370 top scholars.

Admission into the scholarship program is highly competitive, and the University of Kansas is one of only 32 research universities in the country chosen to participate in the program.

Over 300 attend Ad Astra Kansas Day Space Celebration at Washburn University




Photos courtesy of the Wichita Homeschool Warriors Robotics Team, the Washburn University Chemistry Club and Bill Kuhn.

NSF, NASA, NCAR, NOAA, and the DOE study Kansas storms

From June 1 through mid-July this past summer, 350 scientists and researchers took to Kansas roads and skies to study a phenomenon unique to the Plains states—nighttime thunderstorms.

Funding by the National Science Foundation (NSF), National Aeronautics and Space Administration (NASA) the National Center for Atmospheric Research (NCAR), the National Oceanic and Atmospheric Administration (NOAA) and the Department of Energy (DOE) enabled this Plains Elevated Convection at Night (PECAN) project.

PECAN delved into actions and interactions of four weather phenomena which seem to influence warm weather nighttime thunderstorms—deliverers of our main source of precipitation as well as violent weather.

Of interest were the organized groups of small storms that clump together to make one big storm or form a line that travels across the state. Known as a mesoscale connective system, "what is the mechanism that initiates, organizes and maintains this complex?" asks Tammy Weckwerth, principal investigator on PECAN with NCAR.

Another element affecting the weather mix is nocturnal low level jet streams. Usually strongest at about 1000 feet, they are strong ribbons of wind (up to 70 mph) coming from the south. What is their part in the creation and sustenance of storms?

Researchers were also looking for conditions or indicators that might give a clue as to how or when these storms might occur. Daytime storms occur when low level heat rises, cools and condenses to form clouds and thunderstorms. At night it is cooler at the ground, the air is stable and does not rise. This is a real puzzler since "the source of the air that produces [rain] is not at ground level," says Weckwerth.

Adding more complexity are gravity waves. For example, if a stone is thrown into a pond, the resulting ripples are an illustration of how gravity waves (the ripples) and thunderstorms (the stone) can affect each other when the stability of the atmosphere has been perturbed. Gravity waves can create thunderstorms and vice versa.

Thirty universities and 11 research groups brought 110 scientific instruments, including ten PISA vehicles that measure temperature, moisture and wind to a height of three miles. Hays, Salina, Ellis, Brewster, Great Bend and Greensburg were activity / equipment headquarters. National Weather Services in Dodge City, Wichita and Topeka also sent staff.

Ryan Isbell, a science teacher at Beloit High School, took advantage of the teacher's workshop at Fort Hays in which they also went to an onsite location. "It was great to have such a large scale research project so close and to actually be able to go and learn. Pretty impressive," says Isbell.

Three aircraft assisted, each flying a different altitude on the storm fringes. Flying in advance of the storm at 30,000 feet was a NASA DC-8, with its on-board laboratory. Its LASE sensing system profiled water vapor in the air. The distribution of atmospheric water vapor is important to weather and climate studies, atmospheric radiation studies, and other related fields. This LASE system is a first step in a NASA program to develop both airborne and spaceborne sensors.

Four years in preparation, this 6-week project will yield useful data for years. Out of 45 days there, teams followed storms on 36 of them into just about every Plains state.

There have already been surprises. "It is amazing how many differences there were from night to night and storm to storm," says Weckwerth. "We have standard models of thunderstorms we use for reference and not one night did any of those storms match the standard model."

"A one degree difference in temperature at two miles up can make a difference between whether a storm grows or dies. Small scale variability [seems to have] a huge impact," says Weckwerth.

"...and not one night did any of those storms match the standard model."

Cont. from page 1 "PLUTO"

Throughout the 1990s, a number of missions including Pluto were canceled, much to the chagrin of scientists and eventually the public. NASA received 10,000 letters from the angry public when the last mission was canceled. "So we do listen to you," Fountain says.

Only about 5% of the data has been looked at and it will continue to stream throughout 2016. Retrieval is slow. The power to transmit data is about the same as four nightlights. It takes eight hours back and forth for communication. Final data retrieval will be in about a year.

Some of the surprises are that Pluto is relatively smooth, and really young. It's about 1 billion years old— versus over 4 billion for the rest of the universe. Surprises include mountains that are 10,000 feet high.

Speaking of the precision needed to send the grand piano-sized spacecraft over three billion miles to come within an astounding 6500 miles of Pluto, Fountain gives an example. "It's like doing a hole-in-one in golf where you tee off in New York and hit the cup in Los Angeles."

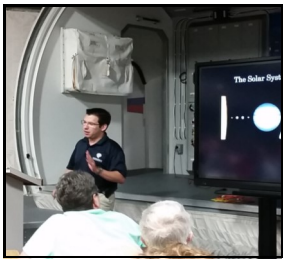
Pluto's next target has recently been selected, though not yet officially approved. Kuiper Belt object 2014 MU69 is slated for a flyby in 2019.

"It's only a billion miles further—in the neighborhood," says Fountain.

New Horizons is good value for the money-- it cost $722 million, less than many professional football stadiums.

How long New Horizons will last? Not as long as Voyager, Fountain says. There's a side A and a side B to the spacecraft. Side A is already using its back-up generator. He estimates another 7 to 8 years.

This event was sponsored by Ad Astra Kansas Foundation. It also included presentations from The Kansas Cosmosphere education staff and recent NASA intern Caleb Gimar.



Caleb Gimar spoke about Clyde Tombaugh, the Kansan who discovered Pluto. Photos by Ken Moum

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INTERSTELLAR R & D

Ad Astra Kansas News

This "Interstellar R&D" feature in the Ad Astra Kansas News twenty-eighth issue continues an enterprise to research and gather information on the most important developments preparatory to humanity's greatest adventure—voyaging to the stars. Now, at the millennium's turn, is an appropriate time for grand vision and forward thinking, and there are strong signs of a renaissance in interstellar travel thought and activity. This new feature and newsletter, thus, now set forth to develop a national / international / global clearing center and storehouse of knowledge and know-how for travel to the stars: Ad Astra—
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Observation

Astronomy From The Moon In The 21st Century

Pioneering a new frontier for astronomy, building on the advancing successes and growth of Earth-based and Space-based observatories, the first accomplishments for Astronomy from the Moon point to 21st Century expansive possibilities including a "condominium of observatories", a Moon ringed with observatories, and ultra-large as well as extra-small Luna-based telescopes.

From the pioneering Far Ultraviolet Camera / Spectrograph emplaced by Apollo 16 Commander John Young in April 1972 at the Descartes Highlands, to December 2013 / current operations and observations by the Lunar Ultraviolet Telescope atop the China Chang'e-3 Moon Lander at Mare Imbrium / Sinus Iridum, Astronomy from the Moon is now increasingly projected by Chang'e-4,-5,-6 landers, India Chandrayaan-2, Japan SLIM-1, ILO-1, Moon Express and Shackleton Energy Company.

A Lunar Astronomy / Robotic Village may arise mostly at and from the Moon South Pole / Aitken Basin region, much like a first experimental 60 cm telescope tested by Gerard Kuiper atop Mauna Kea Hawai`i led to an astronomy village / complex and a late 20th century global center of Earth-based astronomy. With no significant atmosphere to distort light imagery, firm stable platform for long duration observation, and far-side radio free environment, Astronomy from the Moon can be conducted in many varying wavelengths with far superior results than Earth-based observatories and at least equal to Space-based ones.

Astronomy from the Moon, while not a sufficient reason by itself for the vast resource investment necessary for maintaining lunar surface operation, is now validating its enduring potential as the first sustained human directed activity on Luna. Its catalytic capability to enable expanding lunar development and eventual lunar base buildout for a thriving Multi World Species should be increasingly apparent and highly valued as the 21st Century progresses.

Communication

Interstellar Power Signal

SETI has long listened for radio or TV transmissions which might indicate an unknown culture, but the distance between stars is so vast as to render such signals imperceptible. Alternatively, one might ignore broadcast signals and search instead for leakage from intense power sources, indicative of a society with advanced technology.

Harvard researchers James Guillochon and Abraham Loeb have published a paper entitled "SETI via Leakage From Light Sails in Exoplanetary Systems" which is the first to quantify power-beaming leakage as a detectable indicator of advanced technology.

Power beaming commonly uses lasers, millimeter-wave beams and high-power microwave beams, providing a powerful, tightly focused signal. From a distance of 326 light years (100 Parsecs), the intensity of these beams would be 100 times easier to detect than SETI radio searches.

Power beams also carry their own signature. A radio telescope would register a signal that rises and falls as the beam begins to pass, the drop resulting from the shadow of the sail. It is even possible for a message to be embedded on the beam.

Transportation

Icarus Interstellar Drexel Chapter And Project Tin Tin

Icarus Interstellar's mandate is to train the next generation of interstellar engineers, and students at Drexel University in Philadelphia, PA have taken steps to be the first in line for that honor.

Undergraduate Damien Turchi reached out to classmates John Breslin, Michael Daily and Zachary Block to start the Interstellar Research Club at Drexel, and then formally propose the first collegiate chapter of Icarus Interstellar in 2013. The chapter has since grown to over 60 students and hosted the 2015 Starship Congress.

The Drexel Chapter now has its sights on Project Tin Tin, the first mission to our closest star system, Alpha Centauri. Students are working to develop propulsion designs for Cubesats, tiny research spacecraft valued for their cost-effective approach to revolutionary exploration opportunities.
At the 2015 Starship Congress, sophomore Noah Alessi's poster presentation focused on work he had done through the Office of Undergraduate Research's STAR (Students Tackling Advanced Research) Scholar's Program which examined experimental use of a field emission electric propulsion system.

Additionally, ME major David Evinshteyn spoke at the Congress about the Plasma Jet Magneto Inertial Fusion (PJMIF) propulsion system which is a highlight of the Drexel Chapter's theoretically designed spacecraft called Zeus.

During the Congress, students also had the opportunity to network with interstellar propulsion visionaries such as Harold " Sunny" White who is the Advanced Propulsion Team Lead at NASA and sustainability innovator Rachel Armstrong.

At this time, the only mission that may reach another solar system is Voyager, probably taking tens of thousands of years to do so after its launch in 1977. Tin Tin will be flying with a revolutionary new propulsion system and may be the first salvo into interstellar exploration.