AD ASTRA KANSAS NEWS

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Observatory is possible in Kansas

Kansas may be getting an international cosmic ray observatory.

"Come again?" you say. Like a movie that starts in the middle of things, maybe we need some flashbacks.

The Pierre Auger (pronounced oh zhay) Observatory project dates back to 1997 when Nobel Prize winning physicist James Cronin proposed a joint international study of the rare, ultra-high energy cosmic rays that continually rain on our atmosphere.

Seventeen countries, including the U.S., formed a coalition to build the Auger South Observatory in Argentina. Operating since 2004, it only studies the southern hemisphere. For a complete picture, one is needed in the northern hemisphere.

Enter the Great Plains. A second one, Auger North is proposed to straddle eastern Colorado and western Kansas. "We need a large flat plane, dark skies at night and a high altitude. Western Kansas' altitude is around 3,000 feet," says Dr. Nick Solomey, chair of the Department of Physics at Wichita State University and a past colleague of Dr. Cronin. There also has to be a correlation between the Auger South facility in Argentina, meaning a 35 degree northern latitude and not too far off in longitude. Again, check.

This 25-year project is also an international collaboration. The U.S. will contribute $20 million, most from the Department of Energy and the National Science Foundation, and the other $127 million to build it will come from 16 other countries. WSU may be the lead Kansas university and all six Kansas research universities, as well as Bethel and Baker Colleges are interest in participating.

Different from the usual telescope observatory, this one will cover 8,000 square miles and include at least Stanton, Hamilton and Greeley Counties. Two types of observing will be done. Over 4,000 covered water-filled tanks will be spaced 1.5 miles apart to detect shrink-off radiation as it hits the ground. Shrink-off radiation occurs when the cosmic ray particles break up as they hit the earth's atmosphere. Also, four fluorescent power buildings will have sensitive phototubes to detect little blue flashes of shrink-off light particles.

Credit: Auger South Observatory website

At Auger South: On the hill is a fluorescent power building and a communications tower. In the foreground is a typical surface detector tank.

The highest energy level and rarest cosmic rays come from outside our galaxy. These are the ones to be studied. A weak one can be 1 billion electron volts or in scientific terms 1 x 10 9^{th} eV. The highest ever recorded was 1x10 20^{th} eV. High energy particles strike at the rate of about one per square kilometer per year. That's why it takes such a big observatory area.

The project's potential is big also. "An optical observatory can see light out to 10 billion years

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SESQUICENTENNNIAL Project

WHAT: Science in Kansas: 150 Years and Counting

WHY: To recognize scientific work by Kansans both past and present and to inspire Kansas youth to go into STEM fields

WHEN: Jan. 1 to Dec. 31, 2011

HOW: Highlighting 150 Kansas scientists by putting info about them and their work onto free trading cards to be downloaded by teachers and students.

150 YEARS and Counting SCIENCE IN KANSAS

Displays or presentations at science museums or to students

WHO: Sponsored by the Ad Astra Kansas Initiative

Due to numerous requests nominations are still being accepted. Go to: www.adastra-ks.org

KSU studying astronaut physical requirements

Our bodies deteriorate faster in microgravity than on Earth.

"Muscles, bones, cardiovascular, even the immune system malfunction in space. Our bodies don't like it," said Thomas Barstow, professor of kinesiology, at KSU.

Which leads to some questions. What physical characteristics are needed to perform tasks in space? How can astronauts in space assess whether they are physically capable of performing tasks? What are some ways astronauts can maintain their strength and endurance in space?

As part of a $1.2 million grant from NASA, Barstow and a KSU team composed of Steven Warren, associate professor of electrical and computer engineering; Russell Taylor, an engineer in the Electronics Design Laboratory; and Carl Ade, a doctoral student in anatomy and physiology, KSU-Salina, will be studying these issues.

A microgravity environment causes the weakening of muscles and the immune system, and it affects the cardiovascular system's ability to regulate

Cont. KSU page 3

INSIDE:

Above: (l. to r.) Steve Durst, Space Age Publishing Company; Kay Neill, Ad Astra Kansas Initiative; Dr. Holger Meyer, WSU; Dr. Nick Solomey, WSU; Elias Jordan, Kansas Astronomical Observers; Senator Steve Morris; Jeanette Steinert, Ad Astra Kansas Initiative.

Galaxy Forum goes cosmic

Interest in the proposed Auger North Observatory brought about 35 teachers to the second Galaxy Forum held by the Ad Astra Kansas Initiative at the Kansas Cosmosphere and Space Center in August.

Forum presenters were Kansas Senate president Steve Morris and Dr. Nick Solomey, chair of the Wichita State University Department of Physics. Also presenting was Elias Jordan, whose topic was how to interest students in astronomy.

Photos by Kay Neill and Tina Jordan

KU researchers into deep-space telemetry

Telemetry is the measuring of or the transmitting of data over distances. Researchers at the University of Kansas are going the distance in several projects.

Erik Perrins, associate professor of electrical engineering and computer science, is building a NASA deep-space wireless communication system.

"The goal is to get a bunch of data from point A to point B and my job is to come up with the wireless communication to retrieve the data in as streamlined a manner as possible," says Perrins. For this project, jointly supported by NASA Epscor and the Kansas Technology Enterprise Corporation (KTEC), large amounts of data need to be transmitted at a rate up to 44 megabits per second. Our home internets can transmit data in those ranges, but can only do so at a radius of about 100 yards. Here we are talking a 100 mile radius, according to Perrins. Besides the distance the project must also allow for severe size, weight and power restrictions. "There are no wall plug-ins in space. All this work has to be miniaturization friendly," says Perrins.

Another wireless networking system, for the Department of Defense, is being designed by Perrins and James Sterbenz, associate professor of electrical engineering and computer science, for conducting simultaneous tests on multiple aircraft moving at the speed of sound. "Aircraft traveling at Mach speeds are only within range of each other for a second at a time, meaning that wireless networking has to be fast," says Perrins.

As part of the D.O.D. project Perrins and Andy Gill, assistant professor of electrical engineering and computer science, are also developing hardware prototypes of a system that will locate and correct errors that naturally occur in a noisy transmission. This system uses a technology known as forward error correction which can correct errors even in certain weak signals. The prototypes are being implemented using efficient hardware description languages Gill has developed which will greatly reduce the amount of engineering work needed to produce the final design. This type technology has many uses including digital storage media and cell phone systems.

In recognition of KU's efforts to improve the science of telemetering, the non-profit International Foundation for Telemetering has named KU as one of six partner universities and donated $60,000 to the university. This money will be used by KU's Department of Electrical Engineering and Computer Science to fund undergraduate and educational research, such as senior design projects, lab equipment or student travel to conferences.

Randall Chambers awards given

Winners of Randall Chambers Ad Astra Kansas Awards at the Wichita State University Engineering Open House last spring were:

First place was "Cooperative Soaring." Project team members were Zachary Hazen, Kevin Hagin, Jorden Jensen.

Second place was "Greentown in Greensburg: Going Green." Project team members were Kirsten Rieg, Helal Ahibcha and Paul Washington.

The award is given by the Ad Astra Kansas Initiative in memory of Dr. Randall Chambers, NASA pioneer in human factors in space science, Wichita State University Distinguished Professor Emeritus and co-founder of the Ad Astra Kansas Initiative.

NASA seeking Kansas Space Science Student Ambassador

The submission deadline is October 15, but there's still time for university students to apply for the position of Kansas NASA Space Science Student Ambassador in 2011.

This ambassador will be expected to participate in activities that will encourage more involvement at a university level in space science educational activities, give citizens opportunities to learn about space science and become involved on an individual level, promote STEM as it relates to the space sciences and foster excitement about NASA space science discoveries.

The ambassador will receive a stipend of $2,000 plus $600 for materials, supplies and travel. Applicants must be a U.S. citizen, at least 18 years of age and a full-time student at a member university of the Kansas Space Grant Consortium. Submission deadline is October 15, 2010.

This program is an extension of the 2009 NASA International Year of Astronomy Student Ambassador Program. The Kansas NASA IYA Student Ambassador was Karen Ohmes of the University of Kansas.

More information on the program can be found at: **http://**www.spacegrant.org/nssa/ An application form can be found online at: https://secure.spacegrant.org/apps/?pk=nss

Kansans Hired by NASA

For three Kansans, their dream of working for NASA has become a reality.

Mallory Jennings, a Wichita State University spring 2010 graduate in mechanical engineering, began work this past summer at Johnson Space Center. She is working on the new Constellation space suit. Jennings spent five semesters at JSC. During that time she served as lab manager for the Portable Life Support System Ventilation Lab. She was also involved in NASA's education outreach programs organizing more than 50 outreach presentations at JSC and 25 for local schools in Wichita.

Lynn Lefebvre, an Emporia State University spring 2010 graduate in physical science, also completed an internship at Johnson Space Center last spring dealing with geographic information systems. He was offered a full-time position with NASA. In the Air Force Reserves, he was deployed to the United Arab Emirates in August and is now in Kurdistan. His assignment will end in February, at which time he will return to Houston to begin his position with NASA, according to his father Tony Lefebvre.

Teresa Sindelar is now an education specialist with the Teaching from Space Office at JSC. She is a graduate of the University of Nebraska-Lincoln in geology/geoscience, with a masters from Wichita State University in curriculum and instruction. Sindelar was a space science educator at the Kansas Cosmosphere and Space Center, Hutchinson, for five years. And taught earth, space and physical science at Buhler High School, Buhler, for three years. At JSC, she will be developing curriculum astronauts will use when teaching from space.

The following is part of an ongoing reference directory featuring representative research projects in Kansas. Ad Astra Kansas' goal is to serve as an information hub in Kansas focusing on different areas of high-tech and space research for networking and educational purposes.

Cont. KSU from page 1

blood pressure. This can hinder an astronaut's ability to perform tasks such as climbing ladders, walking or opening doors.

For safety's sake, NASA wants to make sure that astronauts are physically fit enough to perform those tasks during future missions to the moon and even Mars. "What seems like simple tasks as part of their life on the moon or other destinations could be life threatening if the astronauts aren't strong enough to do those tasks," Barstow said.

Each year of the three-year project will focus on a different aspect of space travel. In the first year the researchers will recruit 100 people to undergo an obstacle course of tasks simulating lunar activities — including dragging a dummy, climbing up and down ladders, pushing a wheelbarrow of rocks, and walking for 10 kilometers.

There will also be physical fitness tests, such as running on a treadmill and arm exercises. Warren is developing sensors to measure muscle activity and the oxygen circulating to them during tasks.

"We're hoping to get a fairly complete description of each person's muscle strength, muscle and cardiovascular endurance, so that with the results of those tests, we then can predict their performances during the simulated lunar tasks," Barstow said.

For the second year Warren and Taylor will develop a support system to simulate different gravity levels. An adjustable cable attached to a platform will suspend the participant like a marionette. The system is hung from a support frame that will follow a subject as he or she walks through a simulated moonscape.

The system will be set so that a 150 pound person would have the equivalent weight of 25 pounds, simulating the moon's gravity.

The third year will have participants performing lunar tasks in space suits. The pressurized space suits astronauts wear could make duties more difficult, especially ones that require using hands to grip objects. Researchers also plan to develop special physical tests just for the arms and forearms.

After the three years the researchers hope to keep working with NASA to develop methods to help maintain strength and endurance in space."NASA has a variety of topics studying human factors in space. All of these factors are like a puzzle. NASA is trying to fill in as many pieces as possible to add to this mosaic of knowledge. We hope to add two or three pieces to that puzzle," says Barstow.

ASTRONOMY / PHYSICS

"Heavy Quark and Neutrino Physics", Timothy Bolton, Glenn Horton-Smith, Andrew Ivanov, Yurii Maravin, Bharat Ratra and Noel Stanton; KSU Dept. of Physics. U.S. DOE funding of $668,000 awarded 5-2010.

ENERGY

"Interface Development for Thermal Battery Models", Mitchell Neilsen, KSU Dept. of Computer and Information Science. Sandia National Labs funding of $40,000 awarded 5-2010.

INFORMATION TECHNOLOGY

"**Human-Robot Teams Informed by Human Performance Moderator Functions,"** Scott DeLoach, KSU Dept. of Computer and Information Science. U.S. DOD funding of $86,331 awarded 4-2010.

MANUFACTURING and ADVANCED MATERIALS

"Bi-Metallic Nanoparticle Catalysts for Reforming of Logistics Fuels", Keith Hohn., KSU Dept. of Chemical Engineering. U.S. Army funding of $50,000 awarded 4-2010.

Cont. Auger from page 1

back in time. An infrared one can go back 12 billion years. The Auger Observatories can go back to within a few seconds of the Big Bang," says Solomey.

Kansas has come late to the project, but Kansas Senate president Steve Morris is not worried. "It's my understanding that the project in Colorado is loosely organized, so Kansas has not lost anything by just coming on board within the last year."

Morris is a staunch supporter. "The impact should be steady with the construction, employees, 400 scientists from around the world coming regularly and visitors to a proposed educational center. Not to mention adding to our brain trust by providing pre-eminent access for Kansas students," says Morris. The project will have a $200-500 million operating budget over next 25 years and need about 100 employees.

Morris has turned to Tom Thornton, president of the Kansas BioScience Authority, for advice. Thornton's extensive experience in helping acquire large federal research projects includes obtaining funding for the high-energy physics Fermi Lab in Batavia, Ill., and for Kansas' new National Bio and Agro-Defense Facility in Manhattan.

According to Thornton, the project is now undergoing internal vetting by the NSF and U.S. Dept. of Energy and in the meantime, Kansas needs to get organized. Thornton suggests:

1) Kansas needs to recruit a dedicated researcher in the area of ultra high cosmic ray research. Something not generally known is that physics is a field with substantial federal investment and physics research in Kansas is already fully funded, indicating the level of expertise we already have here. Bringing a cosmic ray researcher in would raise our stature even more, putting us in the running for even more cutting edge research.

2) The legislature needs to support expansion by way of a resolution. A resolution of support was passed by the Kansas Senate last session and it will come to the House in the next one, according to Morris.

3) A task force of board of regents, academic institutions and congressional delegates needs to be formed.

Cont. Auger page 4

WU near space balloon launch viewable online

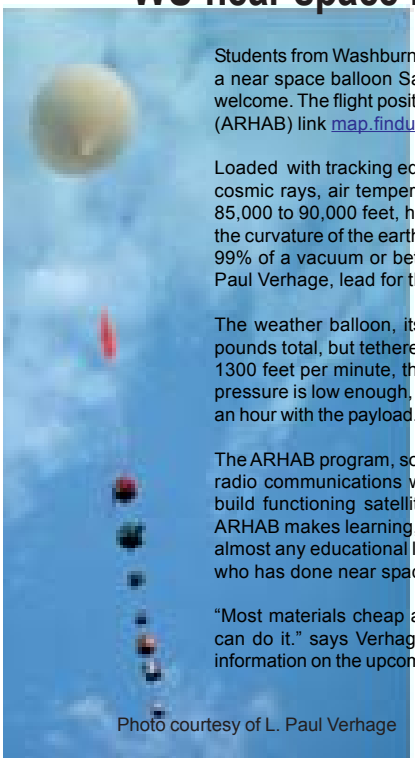

Photo courtesy of L. Paul Verhage

Students from Washburn University's physics and meteorology departments will be launching a near space balloon Saturday, October 16, at 9:00 a.m. on the WU campus. The public is welcome. The flight position can be followed online at the Amateur Radio High Altitude Balloon (ARHAB) link map.findu.com/kd4sth-7.

Loaded with tracking equipment, camera, sensors and electronics for measuring things like cosmic rays, air temperature and humidity, the helium-filled balloon will rise to a height of 85,000 to 90,000 feet, high enough for a space-like atmosphere. There the sky is black and the curvature of the earth is visible on the horizon about 350 miles away. Air pressure reaches 99% of a vacuum or better. Temperatures drop to -60 degrees F or colder, according to L. Paul Verhage, lead for the launch.

The weather balloon, its recovery parachute and electronic payload weigh only about 16 pounds total, but tethered together it can stretch as tall as 50 feet in flight. Ascending about 1300 feet per minute, the apogee is reached in about 90 minutes. When the atmospheric pressure is low enough, the balloon will burst. A parachute will inflate, drifting down for about an hour with the payload. The flight data will be available to the public online after the recovery.

The ARHAB program, sometimes called the Poor Man's Space Program, combines amateur radio communications with weather ballooning. It allows non-professionals of all ages to build functioning satellite models and launch them into a space-like environment. The ARHAB makes learning, researching and teaching about space-related science possible on almost any educational level, according to Verhage who gives presentations to students and who has done near space experiments with grades as young as the 4th grade.

"Most materials cheap and easily obtained. Students build their own payload. Any school can do it." says Verhage who has been involved with the program since 1996. For more information on the upcoming launch or presentations, contact Verhage at nearsys@gmail.com

Interstellar R&D

Ad Astra Kansas News

This "Interstellar R&D" feature in this ***Ad Astra Kansas News*** *eighteenth 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 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. — Steve Durst, Michelle Gonella*

OBSERVATION

The Exoplanet Revolution and the Kepler Mission

Officially totaling about 500 by October 2010, exoplanets — or 'extrasolar' planets, for planets beyond the Solar System — have long been speculated and anticipated (by G. Bruno in the 16th century, and I. Newton in the 18th), but their confirmation through science has occurred only in the few years before, and now in, the first decade of this new millennium.

The first definitive exoplanet detection by M Mayor and D Queloz of 51 Pegasi b in October 1995, confirmed by G Marcy and P Butler, opened the modern era of exoplanetary discovery — accelerated by technological advances such as high-resolution spectroscopy which enables Doppler or Radial Velocity, and Transit methods of detection. Microlensing, Astrometry and Pulsar Timing also are current detection techniques.

The launch of NASA's Kepler spacecraft in March 2009 on a 3-6 year mission to discover Earth-like planets orbiting other stars is sparking expectations that many hundreds of such worlds may soon be confirmed.

With brightness of more than 150,000 main sequence stars continually monitored through Ames Research Center mission control, multiple exoplanets transiting the same star recently have been discovered, and a Harvard scientist predicts a 50% likelihood that the first habitable exoplanet will be confirmed by May 2011.

Notable exoplanets besides 51 Pegasi b include 55 Cancri, COROT-Exo-7, Fomalhaut b, Gliese 581c, d and e, HD 189733b, HD 80606b, HD 209458B, HR 8799, VB 10b. A Carnegie Institute of Science researcher estimates there may be a "hundred billion" terrestrial planets in our Galaxy, many with simple life forms, and that there could be thousands of civilizations among them.

COMMUNICATION

What's Taking THEM So Long?

In 2008, Johns Hopkins researcher Richard Conn Henry addressed the American Astronomical Society, postulating that our first contact with Extra Terrestrial Intelligence will most likely occur when a signal is sent to Earth by a civilization that has spotted our planet's transit across the Sun.

He was making explicit reference to the ecliptic, the plane of Earth's mean orbit around the Sun.

In relation to the Galactic Disk, the ecliptic sits at a 60 degree angle, delineating a specific and limited area of 3% of the sky. The two points of intersection are in Sagittarius and in Taurus, marking out a prime territory for SETI. Researchers in a star system close to the ecliptic could reasonably have already observed Earth as it crossed the disc of the Sun, and a simple spectroscopic analysis of our atmosphere would confirm that Earth reeks with life.

But just in case ET doesn't notice us, the ecliptic will keenly focus a new search of tremendous power. To date, about 2000 stars have been studied. The Allen Telescope Array (ATA), under construction in Northern California, currently consists of 42 dish antennas. Upon completion, there will be 350 dish antennas conducting radio interferometry and examining up to 10 million stars in the next ten years. Coupling the vast power of ATA with the focus of searching less than 3% of the sky – the ecliptic between Sagittarius and Taurus – would provide a more detailed search than has ever been available before. SETIQuest, which calls on the power of the internet community to examine information and participate in SETI, will certainly have a role in processing the huge amount of data generated.

So if you are tired of waiting for ET to "call," go the SETI Institutes SETIQuest website and learn to use the tools that could make you the first person to discover a civilization in another star system.

TRANSPORTATION

Moving Beyond the Solar System

In light of the amazing journeys of Voyagers 1 and 2, heading out of the solar system and flirting with the heliopause and interstellar space, one must wonder what the possibilities are for a true, dedicated interstellar mission at this time. Where can our current technology take us?

A properly powered spacecraft could reach the heliopause in about 20 years, with another 30 years of life for exploration in interstellar space. A small, nuclear fission reactor would be needed to supply electricity for communications and science functions, but the electricity could also be used to fuel an electric ion propulsion system. The constant, slight acceleration of such a system would eventually offer incredible speed, possibly even ample to overtake the Voyagers.

If the spacecraft were constructed in Earth's orbit, much of the work could take place at a space station. It would take weeks, once the electric ion propulsion system was activated, for the spacecraft to escape the gravity of Earth. During that time, the probe could be pulled back to the space station if it became apparent adjustments were needed.

Once the spacecraft passed the Moon, it would probably examine some of the host of small worlds – some with unusual orbits – that populate the Kuiper Belt, 30-50 times Earth's distance from the Sun. The probe could measure and map particles, study gravitational properties, and begin its journey into interstellar space. When the probe has traveled a distance of 1 light year from our Sun, it may reach the Oort Cloud, an area of space where dormant comets are believed to exist.

This would be true exploration. Speculation based on mathematics would be tested, as would the very laws of physics. New understandings and infinite possibilities await.

Cont. Auger from page 3

4) Incentives for landowners might be needed. A one-time tax credit has been well-received in Colorado.

"I am asked a lot about the economic impact of this project. What does that mean in tangible things? [We're gaining] a fundamental understanding of our universe and what comes out of this research is unpredictable.

Extraordinary scientific advances [in physics] lead to discoveries no one can predict. For example, supercomputers came out of the need to do all the extreme calculations needed by physicists. Web browsers were developed by high energy particle physicists. In nuclear medicine MRIs came out of particle physics," says Thornton.

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