AD ASTRA KANSAS NEWS

Spring 2010 To the stars through high-tech / space-tech R&D Volume 9, No. 1

NanoScale Corporation working on space projects and more

"Science at a very small scale has a lot more power than on a bulk scale," says Dr. Frank Kroh, senior scientist at NanoScale Corporation, one of the leaders in Kansas nano technology.

Kroh is talking about science's ability to engineer products, materials or processes on the atomic or molecular scale. That means manipulation in nanometers, which is a billionth of a meter, to produce at least one superior property. One finds the results in every facet of life from golf clubs to stain-resistant materials to nano-electronics. To space.

According to Kroh, a chemist, "with the International Space Station, it's practical to bring water every few months as it is less than 300 miles above the Earth. For the long term, like a trip to Mars, where supplies might be brought only every few years, the cost of bringing every cup of water would be very expensive." Reclamation of water would be one solution.

Currently on the ISS, though water is recycled from the humidity in the air, it is not recovered from food or waste material. A number of teams are working with NASA on the overall system for water reclamation for spacecraft and lunar or Mars bases. NanoScale's assignment is development of materials for the elimination of foul odors produced in a system that can recover water from food, feces or brine wastes. Founded in 1995, NanoScale is very experienced in the synthesis and manufacturing of nanocrystalline metal oxides that adsorb and /or destroy hazardous compounds or serve environmental purposes. Since 2005, the company has received a dozen recognition awards for their innovation, including the National Small Business Technology Council's prestigious Tibbets Award in 2006.

This is a field with booming commercial applications in work, industrial or consumer settings like recreational vehicles or airplanes, any area where people spend long periods of time in small places. According to the NanoScale's NASA proposal this field, which encompasses the air filtration market, currently exceeds $5 billion annually and is growing.

Another NanoScale project with NASA ties and commercial applications is energy related. NASA space applications require highly efficient and reliable energy storage systems. The need for systems that can last for years or even decades indicates supercapacitors would be better than batteries. Capacitors are devices that store (rather than generate) energy temporarily until needed. Existing carbon-based supercapacitors can't hold enough energy and current state-of-the-art ones

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Ad Astra Kansas Day 2010

Governor's Proclamation
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Governor's Proclamation

Whereas April 24, 2010, is the 20th anniversary of the launch of the Hubble Space Telescope which was deployed by Kansas Astronaut Steve Hawley; and

Whereas, Kansas has a long history of leadership in aeronautics and aerospace innovation; and

Whereas, Kansas' future economic renaissance encourages development of opportunities in manufacturing, aerospace, scientific and technical services, energy bioscience and technological innovation; and

Whereas, Kansas' legacy to science and technology includes two Nobel Prize winners and three astronauts as well as cutting-edge research in astrophysics, information technology, bioscience and nanotechnology; and

Whereas, all these accomplishments are dependent on excellence in science, technology, engineering and mathematics; and

Whereas, Kansans have chosen "Ad Astra per Aspera," or "To the Stars Through Difficulties" as the state motto:

NOW THEREFORE I, Mark Parkinson, governor of the State of Kansas, do hereby proclaim April 24, 2010, as

Ad Astra Kansas Day

and encourage all citizens, university, business and government leaders to look to the stars and celebrate, encourage and promote the scientific achievements of our state and its citizens.

Washburn doing NASA study on gamma ray effects

Physics in space and biology on Earth. Seemingly two extreme scientific disciplines. But connected in a three-year study being done by Washburn University for NASA.

The project's purpose is to improve understanding of the effects on marine phytoplankton if and when the Earth receives a blast of radiation from astrophysical events such as supernovae and gamma-ray bursts. More specifically, how might such an event affect us here on Earth? The $500,000 grant is part of NASA's Exobiology and Evolutionary Biology Program.

Led by Brian Thomas, assistant professor of physics and astronomy at Washburn, collaborators are Adrian Melott, professor of physics and astronomy, University of Kansas, and Patrick Neale, senior scientist, Smithsonian Environmental Research Center in Edgewater, Md.

When a massive star collapses upon itself into a black hole, violent explosions of electromagnetic radiation called gamma ray bursts are produced, concentrating along in a jet along the rotation axis of the star. "I tell people this is the biggest explosion in the universe since the Big Bang," says Thomas. Most of these are seen outside of our galaxy.

On the short term, when this high-energy radiation enters the Earth's atmosphere it splinters apart

cont. page 3 Washburn

Kansas Academy of Math and Science aims at exceptional students

by Ken Moum

The Kansas Academy of Mathematics and Science was established by the Kansas Legislature in 2006 to provide a premier academic high school program for the state's best and brightest high school students.

The program offers college-level instruction by Ph.D. faculty and the opportunity to earn a high school diploma while getting an additional 68 hours of college credit. Students can participate in hands-on research supervised by Ph.D. scientists, leadership, civic, co-curricular and extra-curricular opportunities intended to develop the whole student. All of this is done on a safe campus, in a residential environment.

The first class began at the academy in August 2009 with 26 exceptional juniors from across the state. Prospective students must have completed at least two years of high school with distinction in mathematics or science. Besides academic achievement students are selected based on drive, interest, maturity, stability, and personal and family commitment.

In addition to the value it brings to students, the academy enhances Kansas' intellectual capital and collaborates with Kansas Regents universities to encourage graduates to complete their undergraduate education in-state. It also exposes the state's best and brightest high school students to Kansas business and industry leaders, cultivating relationships that may encourage students to join the Kansas workforce.

The Kansas Academy of Mathematics and Science is holding Spring Information Sessions across Kansas. Locations in Kansas include:

Bonner Springs April 24: Garden City April 25: Colby May 2: Hays May 22: Wichita May 23: Pittsburg June 5: Lawrence June 12: Overland Park . Registration is required and seating is limited. http://www.fhsu.edu/kams/Meetings/

The AD ASTRA KANSAS INITIATIVE in cooperation with Washburn University is sponsoring a

SPACE CELEBRATION

8th annual Ad Astra Kansas Day--
celebrating science in Kansas

- Governor's proclamation
- Planetarium show
- Flight demonstrations
- Real space suit
- 1/25 scale model of Hubble
- Space physics demos
- Telescope displays
- Astro-olympic games
- SKY-Q quiz for all ages
- Robotics demos
- Crane Observatory stargazing
- Solar system presentation
- Ad Astra community outreach
- Activities, take-aways

...and more

FREE--Fun for all ages

Rain or shine

2010—Twentieth anniversary of the Hubble Space Telescope deployed by native Kansan Steve Hawley —a source of pride for Kansans

Participants include:
Washburn University Dept. of Physics / Astronomy
Northeast Kansas Amateur Astronomers League
The Foundation for Aeronautic Education
KSU Dept. of Computer and Information Sciences
The Kansas Cosmosphere and Space Center
NASA Solar System Ambassador Program
NASA High Energy Astrophysics Educator Program
Space Age Publishing Company

6:30 to 10 p.m. Saturday, April 24
Stoffer Science Hall--Washburn University
17th and Washburn, Topeka

Cosmosphere to celebrate Apollo 13 40th anniversary

Hutchinson, Kansas

The Kansas Cosmosphere and Space Center will honor the 40th anniversary of the famed Apollo 13 Spaceflight at a celebration taking place April 16 and 17. "Guests from around the globe will be attending to honor this crew and the mission controllers who helped bring them back safely," says Christopher Orwoll, Cosmosphere president.

Events kick off April 16 with screening of the "Apollo 13" movie at 4 p.m. and the space documentary, "The Wonder of It All" at 7 p.m. in the IMAX theater. Saturday guests can re-live the liftoff of Apollo 13 as they watch the launch of a scale model of the Saturn V and hear the actual audio footage of pre- and post-launching activities. This free event (weather permitting) will be at Gowans Stadium at 9 a.m. directly across from the Cosmosphere and be performed by a group from the New Mexico Museum of Space History.

At the Hutchinson Sports Arena a presentation by ten of the mission controllers who worked on the Apollo 13 mission and will share their memories of the events. Speakers include Flight Directors Gene Kranz, Milton (Milt) Windler, Gerry Griffin as well as Ed Fendell (INST/COMM), Jerry Bostick (FIDO), Sy Liebergot (CSM/EECOM), Astronaut CapComs Jack Lousma and Joe Kerwin, and Guenter Wendt (Pad Leader). Space author Andrew Chaikin will be moderating the discussion.

Tickets are still available. Admission is $5 for adults and $2 for children under 13. Tickets will be sold at the door or call the Cosmosphere at 662.2305 or 800.397.0330. For more information on the Apollo 13 events visit the Cosmosphere website at ww.cosmo.org or call 800.397.0330.

cont. Nano

are too expensive. The project goal is to develop new nanocomposites using various types of metal oxides that can be combined with current carbon-based supercapacitors to boost performance and be economical. Solving this need to store high levels of energy, deliver the energy quickly with long-term lifetime and low cost would be a major breakthrough in the private sector as well with hybrid cars or many electronics also having the same high energy requirements.

"Think of nanotechnology as more ways to use science to solve problems," says Kroh. For example, the company is also working in the area of cancer research.

'"NanoScale can make metal nano particles with a radius of about ten nanometers; a human cell

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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.

ASTRONOMY / PHYSICS

"Molecular Ion Dissociation in Swift Strong Laser Field," $16, 400, Brett Esry, Itzhak Ben-Itzhak, KSU Dept. of Physics. U.S.-Israel Binational Science Foundation award 12-09

KU's Monarch Space Watch Includes Kansas students

Students from over 35 schools in Kansas watched as three monarch butterflies took their species' first trip into space last fall. Actually, they not only watched, but were part of the project in cooperation with KU's Monarch Watch program.

The Monarch Watch has been a continuous program at the University of Kansas for the last 18 years under the leadership of Dr. Chip Taylor, Department of Ecology and Evolutionary Biology. For this first space project they assisted BioServe Space Technologies at the University of Colorado in Boulder. BioServe does biologically-based science experiments for NASA. Monarch Watch developed the artificial diet used for the monarchs.

Studying how space and weightlessness affects an organism and comparing it to that on earth can lead to discoveries about how biological systems work.

In November 2009 three Monarch larvae were sent up on the space shuttle Atlantis to the International Space Station to go through their development cycles, returning in February. All stages of monarch development specifically depend on gravity. Questions included: Would they be able to cling to the surface of their container? Make a chrysalis? Be able to split their skins and come out? Hook on to the chrysalis? Emerge as an normal adult butterfly?

Patty Gnau's second grade at Morse Elementary in Overland Park was one of the 450 schools and home schools east of the Rockie Mountains which received control kits. The class had the same size plastic shoebox-looking container and the same food paste as on the space shuttle.

Following online and in the classrooms, they found their butterflies were slower than the ones in space. "Our class came to the conclusion that the larvae probably had a more constant temperature and light 12 hours on and 12 hours off in the ISS," says Gnau. When the butterflies emerged, it was projected on the smart board so all 60 second graders could see. "We watched online up in space as they hung for about an hour and let their wings dry out and pump with blood," says Gnau.

Students raised the monarchs in the classroom. Played with what to feed them. The recommended Gatorade did not work well; honey did and they thrived, living about their three week lifespan. "They are mounted in a Plexiglass frame for posterity," says Gnau. "This experience really impressed upon the kids that science was real and that they were a part of it," says Gnau.

The monarchs did a lot better than expected in space, according to Taylor. "We thought they would have problems pupating, but they did. We thought they wouldn't come out of the pupae and would get stuck. But they did. Two emerged so successfully that they could have been put together for mating," says Taylor. "How they expanded their wings in the absence of gravity is not clear and that's what's important to see. We expected them all to be crippled and two weren't."

"The Monarchs appear to be very gravity-oriented, and yet even without it they were able to compensate and perform most of normal activities," says Taylor.

Kathy Egbert did the project with her 120 freshman biology students at Ottawa High School to meet two state standards: scientific method and animal behavior. She downloaded slides and videos on the project to make a powerpoint presentation. She presented students with information beforehand and had them do scientific investigations using a journal, and assess what preparations were needed before the launch.

"Throughout the project, I asked them for a hypothesis about what's going to happen and why. Then afterwards, what did happen? What went wrong? What are the options? What is our new hypothesis?" says Egbert.

Their classroom butterflies were about also two weeks behind the ones in space. Every unexpected occurrence made for good discussion. "The more that went wrong the more we could talk about. The more we could speculate about what went right and what went wrong. Or I could say, 'oh this is what happens in nature," says Egbert.

cont. Nano

has about a thousand times larger diameter. Applying a certain type of harmless magnetic field enables these nanoparticles to get very hot: a sort of nanosized torch that can be turned on and off by touching a switch. Professor Bossmann of KSU and his students have developed ways to attach the metal nanoparticles to molecules that are attracted to cancer cells. Once the cancer cells have taken in enough nanoparticles the magnetic field is turn on. This burns the cancer cells, while keeping the patient comfortable," says Kroh. This looks promising, according to Kroh, though clinical testing is about two years away.

NanoScale has a contract with the National Cancer Institute, funding from the National Science Foundation and the Kansas BioScience Authority. The company is working with K-State professors Dr. Stefan Bossmann, chemistry, and Prof. Deryl Troyer, anatomy and physiology. They will be working with the KU Medical Center soon.

AEROSPACE

"**Aeroelastic Modeling Effects and Flight Test Demonstration of Resilient Adaptive Flight Controls on a General Aviation Testbed--Dynamic Inverse and Adaptive Critic Methods,"** Thomas Karcz and Kenneth Barnard, KSU Aviation, Salina. NASA funding awarded 3-10.

INFORMATION TECHNOLOGY

"Microtransceiver Development and Support," William Kuhn, KSU Dept. of Electrical and Computer Engineering and Timothy Sobering, vice president of Electronics Design Laboratory. Ball Aerospace and Technologies Corporation award 12-09.

ENERGY

"Nano technology for renewable energy," $210,285, Jun Li, KSU Dept. of Chemistry. National Science Foundation award 12-09.

"**High Temperature Membrane Reactors,**" $225,000, Mary Rezac. KSU Dept. of Chemical Engineering. U.S. Dept. of Energy awards 2-10.

MANUFACTURING and ADVANCED MATERIALS

"Micro-Geometry of 3-D Woven SiC and Carbon Fiber Preforms," $76,487, Youqi Wang, KSU Dept. of Mechanical and Nuclear Engineering. NASA funding 3-10.

"Structure-Optical Properties of Noble Metal Particles," $49, 357, Christine Aikens,KSU Dept. of Chemistry. U.S. Dept. of Defense funding 2-10.

Source: KSU Office of Research and Sponsored Programs award listing.

Washburn cont.

apart the nitrogen and oxygen molecules which change into nitric oxide, a compound which breaks up the ozone layer. This could result in an average 35 percent depletion rate in the ozone layer versus the 3 to 5 percent we have now, allowing in dangerous levels of ultraviolet light from the sun. This effect could last for years, according to Thomas.

Pico phytoplankton are microscopic algae that float in the upper part of the oceans around the world. They produce nearly half of the world's oxygen and are the basis of the food chain in the oceans.

The study, which will use data from the Swift satellite and the Fermi Gamma Ray telescope now in orbit, will do a census in two areas, according to Thomas. From an astrophysical perspective what kinds of events occur, the number of events and how energetic are these? Melott will be studying all the different varieties of events that could produce effects. From the biology perspective, the goal is to quantify the biological effect. During the study researchers will irradiate different types of plankton to see the effect on their production.

Most gamma ray bursts come from outside our solar system and would have to travel 6,000 or more light years to reach Earth. Also with the narrow path the light travels, it would have to be directly headed for Earth to affect us, according to Thomas.

Though the odds of this happening are one in every few hundred million years, past work done by Melott and Thomas indicates that, in a similar fashion, gamma ray bursts may have been responsible for a mass extinction of marine creatures on Earth during the Ordovician period some 450 million years ago.

Interstellar R&D

Ad Astra Kansas News

This "Interstellar R&D" feature in this ***Ad Astra Kansas News*** *seventeenth 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

Optical SETI Complements Radio and Microwave Search Technologies

New advances in laser technology by the start of the 21st century have enabled searches for extra-terrestrial life ETI to be conducted in the optical, visible wavelengths of the electro-magnetic spectrum, adding to radio and microwave SETI capabilities operational since the early 1960s. A high-energy nanosecond pulse optical laser transmitting with a 10-meter focus mirror on Earth would appear as an interstellar beacon thousands of times brighter than the Sun to a distant civilization in the narrow beam's line of fire. Possible detection of powerful optical laser nanosecond pulses have led to several search initiatives to receive optical communications through interstellar distances.

Systems to detect nanosecond optical pulses from extraterrestrial civilizations are now operational at UC Berkeley, home of SERENDIP and SETI@home, with collaboration from Geoffery Marcy, and at the Leuschner Observatory, with direction from Dan Wertheimer. UCB scientists, along with those from UC Santa Cruz and the SETI Institute, also have coupled Lick Observatory's 101-cm Nickel Telescope with a new nanosecond pulse detection system capable of finding laser beacons from civilizations many lightyears distant. This system, unlike other optical SETI searches, is largely immune to false alarms (cosmic rays, muon showers, radioactive decays) due to a new approach using three light detectors / photomultipliers — "perhaps the most sensitive optical SETI search yet undertaken," notes SETI pioneer Frank Drake.

Optical SETI searches also are being conducted at the Harvard-Smithsonian Observatory 155-cm telescope, with direction from Paul Horowitz, and in collaboration with Princeton University and its 91-cm instrument; also at Columbus, Ohio, and Sydney, Australia. More recently, the world's first 180-cm All-Sky OSETI telescope was unveiled by the Planetary Society, made operational by Harvard University, and is dedicated to finding that one high-energy pulse of unidirectional light that might be a communication.

COMMUNICATION

FOCAL – New And Novel Equipment In The Search For ET

In its early incarnation, the Search for Extra Terrestrial Intelligence was made with a single 26 meter radio dish. Over the following half century, more sensitive and numerous dishes have been employed. Now, the FOCAL Mission seeks to utilize the largest object in this solar system, our Sun, as part of the apparatus that may bring the messages of other life-forms to our ears.

Italian physicist and visionary, Claudio Maccone, memorialized this groundbreaking concept in his 1997 book *The Sun As A Gravitational Lens: Proposed Space Missions*. Maccone points out that "each civilization has been given a single great gift: a lens of such power that no reasonable technology could ever duplicate or surpass its power. This lens is the civilization's star."

Predicted by Einstein's Theory of Relativity, gravitational lensing refers to very distant light being bent around a massive object that exists between the light and the viewer. As the massive object's gravity bends the light, a line of focus is created on the viewer's side of the object. Dr. Maccone cites the distance of this focus at 550 AU and beyond.

Utilizing gravitational lensing would require significant innovation, namely a deep space mission involving sending a spacecraft to 550 AU from the Sun. The resulting magnification, however, is about 10^8. The benefits could be applied to radio astronomy observations, as well as communications.

Numbers have been examined for interstellar scenarios including Alpha Centauri, Barnard's Star and Sirius A. Even if life forms outside of our solar system are not broadcasting any detectable communications, FOCAL opens the door to interstellar exploration by making reasonable communications with the exploration crew or probe possible.

TRANSPORTATION

Fill 'Er Up With Less Than Nothing!

The natural desire to explore interstellar space remains frustrated by the vast distances involved. Our nearest star, Proxima Centauri, is the equivalent of 50 million round trips to the Moon and our fastest moving probe, Voyager 1, would take 74,000 years to make the trip.

This is why interstellar pioneers must turn to the cutting edge of physics theory to identify a power source, or fuel, which can propel a starship at the speed of light. Only a fuel which does not weigh down the vehicle will allow such speeds. Only a fuel which available along the route can be trusted to make such a voyage.

New York University physicist Jia Liu may have identified a source for such energy: Dark Matter. It is believed that dark matter is about six times more prevalent than visible matter in the universe and, inspired by Robert Bussard's 1960 "ramjet" design, Liu may have found the key to utilizing it for interstellar travel.

One of the leading theories about the nature of dark matter is that it is comprised of "neutralinos"… particles with no electric charge that are their own antimatter. Theoretically, when two meet, they annihilate each other and the subsequent energy released is equal to the total mass of the particles.

Liu has envisioned a simple 100 square meter chamber which can open at either end and also compress its contents. Simply, with the front of the chamber open, the starship would collect dark matter in its path. Then the chamber would close and compress the contents, naturally increasing the speed of reactions within. When the back of the chamber opens, the energy rockets out, propelling the ship forward.

Liu has put some numbers on this scenario. If the starship weighs in at 100 tonnes, Liu believes the starship could easily reach the speed of light in just a few days. These speeds place Proxima Centauri within just a few years' travel.

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