Mathematician’s quantum gravity research may have interstellar applications

To Louis Crane, who remembers a science fiction story from his childhood which contained the motto Ad Astra Per Aspera, it seems strange that his current work connects with it.

The Kansas State University mathematician has just received a $135,247 grant from The Foundational Questions Institute to tackle one of the big unsolved problems in theoretical physics—a theory of quantum gravity. This research will be used to study gravity, black holes, black hole power sources and their applications to propulsion for interstellar space travel, as well as to study the origins of our universe.

Three of the four forces of nature—electromagnetic, strong nuclear and weak nuclear forces—which operate inside the atom, are covered in quantum mechanics. Currently, the fourth, gravity, has Einstein’s theory of relativity with its time and space continuum. The theory of relativity predicts black holes and even the Big Bang. Relativity says that as a star collapses into itself creating a black hole, time and space curve into themselves to a point called a singularity. And that our universe is so precise, with minute changes in the existence or non-existence of stars or other fields in the universe, is so probable, with less than a four-dimensional tube which opens into a new region of space and time which is the source of new universes.

In the evolutionary theory, those universes with the ingredients for producing stars and black holes would be more prolific in producing baby universes than those that lack those ingredients—a sort of a survival-of-the-fittest theory. A quantum theory of gravity would be a “capstone” which would unify the laws or forces of nature. And should explain mysteries like dark matter or dark energy that are known to exist because of empirical evidence in the cluster galaxies. And we may learn of new laws or forces we don’t know about yet, according to Crane.

Crane’s grant was part of The Foundational Questions Institute’s first-round grant awards of $2 million to 30 grant recipients.

The institute is a new, philanthropically funded, scientific grant-awarding agency. This private, independent foundation is run by scientists for the express purpose of furthering research on questions at the foundations of physics and cosmology, particularly new frontiers and innovative ideas unlikely to be supported by conventional funding sources. More information can be found at http://www.fqxi.org

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Pluto, we hardly knew ye...

The ex-planet Pluto, it is smaller by mass than any of the other planets and smaller than seven of the other planets' moons—only one-sixth the mass of the moon. It has only 6 percent of the gravity of earth.

Pluto's thin atmosphere is probably nitrogen, methane and carbon dioxide which varies between being gaseous or frozen depending on where it is on its 248 year orbit around the Sun.

Yet, this icy orb is special to us here in Kansas, having been discovered in 1930 by native Kansan Clyde Tombaugh.

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Science must move on, according to Dr. Pluto to a dwarf or second-class planet.

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ing, Wichita State University--now the KSCGC lead institution. Serving as associate director for both organizations at WSU is Linda Cory, BA Women's Studies / Ethnic Studies.

Stepping down as director and associate director are Dr. David Downing and Prof. Richard Hale of KU, respectively.

The new address of the KSCGC/KNEP office is:

Wichita State University
200 Wallace Hall
1845 Fairmount
Wichita, KS 67260-0044
316-978-3890

For more information, contact fboldridge@ku.edu or call 785-864-3620 or go to the website www.engr.ju.edu/prospective/undergraduate/women

KCAE member to be honored

The late Maurice Witten, past chairman of the Department of Physics at Fort Hays State University and an active member of the Kansas Commission on Aerospace Education (KCAE), will be honored with the Governor's Aviation Honors Award at the 27th annual Wright Brothers Celebration in Wichita on November 18.

Liberty Bell 7 returns to Kansas for good

HUTCHINSON--After a national six-year tour, the fully restored Mercury spacecraft Liberty Bell 7 has landed at its new home at the Kansas Cosmosphere and Space Center.

On Sept. 18, it was lowered into the lower level Hall of Space Museum to become a permanent exhibit in the Cosmosphere's Early Spaceflight Gallery.

Adding Liberty Bell 7 to the Cosmosphere collection makes the museum one of only three places in the world where visitors can see a complete set of flown manned Mercury, Gemini and Apollo spacecraft. The KSCGC also houses the Gemini X and Apollo 13 capsule Odyssey.

Liberty Bell 7, piloted by astronaut Gus Grissom, sank shortly after splashdown in 1961. In 1999, a special team from the Discovery Channel retrieved it from the bottom of the Atlantic Ocean. The Cosmosphere painstakingly restored every detail.

Besides having been displayed in major museums across the country during its national tour, the Liberty Bell 7’s most recent stop was the Kennedy Space Center in Florida.

Kiowa County---meteorite capital?

Finding meteorites has been an avocation around Haviland since the 1880s—one not likely to cease anytime soon.

In October of 2005, native Kansas and professional meteorite hunter Steve Arnold unearthed what is the largest oriented pallaseite meteorite in the United States in a farm near Kiowa County. Sizewise, this 1430 lb. boulder edged out another local specimen, the 1,001 lb. Space Wanderer, that has been on display at Greensburg’s Big Well museum since the 1940s. This past April, Don Stimpson of Haviland located another 1500 lbs. worth of meteorites in another Kiowa County field thought to be empty of the rocks.

These Brenham meteorites, named for Brenham Township in Kiowa County, are extremely rare pallaseite meteorites. This means they are made up of iron and a form of the gemstone peridot. Only about one percent of meteorites are pallaseite.

They are believed to have fallen to Earth from the asteroid belt between Mars and Jupiter about 20,000 years ago. According to W. Randall Van Schmus, professor of geology at KU, the impact area of this meteorite field is roughly three miles by one mile.

The record-holding 1430 lb. meteorite, which was unearthed about seven feet underground, is also an oriented meteorite, meaning that unlike about 99 percent of other meteorites, it did not tumble to earth, but shot straight to earth more like a bullet, morphing into a conical shape as it reached the heat of the atmosphere.

In July, the town of Haviland held a first annual Haviland Meteorite Festival with the theme “The Rock Stops Here.” Also being considered is a meteorite museum and the promotion of Haviland as the “Meteorite Capital of America.”

Another area in Kansas noted for meteorites is Ness County.

For more information, go to www.meteoritestudies.com/protected_BRENHAM.HTM According to Prof. Van Schmus, a good (though obscure) reference is “Spa Rock and Buffalo Grass” by Ellis Peck (one-time owner of Brenham land) published in 1979.

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Editor and Publisher: Steve Durst 650-324-3705 news@spaceagepub.com
Managing Editor: Jeanette Steinert 620-669-8558 steinj@ourtownusa.net
Contributing Editors: Randall M. Chambers, Ph.D., Distinguished Professor Emeritus, Wichita State University College of Engineering; President, NSS Wichita Chapter 316-684-2814 randall.chambers@wichita.edu
Michelle Gena, Space Age Publishing Co. 650-324-3705
Topeka display marks Ad Astra Kansas Day

From April 23-29, 2006, a static display in the first floor rotunda at the state capitol building illustrated Kansas' scientific prowess with the theme "Kansans reaching for the stars through space-tech education, research and commerce."

Included in the over twenty entities supplying display material were WSU's National Institute for Aviation Research, Emporia State University, the KU ULTRA Telescope project, Kansas Applied Remote Sensing Center, the Kansas BEST Robotics Competition, the Wellington Challenger Center, the Kansas Science Olympiad, Kansas Space Grant Consortium, and Wichita Jardine Middle School—an official Kansas NASA Explorer School.

Ad Astra Day is a recognition of the importance of science and technology to Kansas' future. The next participation by the Ad Astra Kansas News in its ongoing attempt to publicize science in Kansas will be participation in Kansas Day activities in January, 2007, in Topeka.
The quest to the Stars, and to the Moon, increasingly lies through Earth’s South Pole ice / rock “science” continent of Antarctica. Now host to activities from some 50 nations — about 30 with permanent staffed science research stations, Antarctica will observe International Polar Year 2007, fifty years after the birth of Antarctica astrophysics (AA) during the IGY International Geophysical Year of 1957.

21st century AA projects, such as Caltech’s BICEP in 2005 and the National Science Foundation’s IceCube, follow 1990s advances by Center for Astrophysical Research in Antarctica (CARA, using infrared, submillimeter and radio wavelengths) and Antarctic Muon and Neutrino Detector Array (AMANDA), both operating from the “Dark Sector” near the Amundsen-Scott South Pole Station.

BICEP (Background Imaging of Cosmic Extragalactic Polarization) will operate at 100 - 150 GHz at angular resolution 1.0 - 0.7 degrees, and is designed to measure the polarization of the Cosmic Microwave Background, to provide answers about the beginnings of the Universe. IceCube, NSF’s $272M multi-national cosmic neutrino telescope, is complete in 2011.

Also advancing in the 21st century, VLF Antarctica research on Earth’s electromagnetosphere continues under direction of Stanford Professor Umran Inan with the HAIL (Holographic Array for Ionospheric Lightning) study of sprites, blue jets, elves and other geomagnetic phenomena.

Internationally, increasing research activity in numerous scientific domains by many nations is highlighted by China preparations for its 3rd Antarctic permanent station (after coastal Great Wall and Zhongshan Stations) in the continent’s unexplored hinterland and pristine crystal-clear air, atop highest ice cap zone Dome A.

**OBSERVATION**

**Antarctica Astrophysics**

**COMMUNICATION**

**Laser Communication Tech Advances Lead the Way for Interstellar Use**

NASA’s measured focus on sustainable exploration advances in support of the Vision for Space Exploration will create an infrastructure for communications within the solar system which can be extended to the stars and beyond. Increased need for reliable transmission of large amounts of data on a continuous basis from the Moon and Mars has brought a new focus on laser communications.

Laser communications can accommodate transmission rates that are 10 to 1,000 times higher than radio waves. The small size of the equipment takes up less payload space on a spacecraft and the narrow beam of the laser enhances security, also allowing for reduced antenna area and less power.

SETI involving laser communications is known as optical SETI and received the support of Arthur C. Clarke. Laser transmissions can reach across the galaxies with almost no interference and the equipment for transmission is inexpensive. Optical SETI is not hampered by terrestrial interference and it is highly distinctive from natural processes which produce noise which is picked up in the search for radio waves.

As laser communications come into common use within the solar system, the refined technology will set the groundwork for communications which will be needed for interstellar exploration and travel in the future.

**TRANSPORTATION**

**Tau Zero Foundation and EnergyUSA Seek Interstellar Propulsion Possibilities**

*The Tau Zero Foundation will establish itself as the dependable venue through which the visionary goals of interstellar flight can be advanced through imagination coupled with intellectual rigor,* states Marc Millis, one of the founders of the organization. The Foundation calls for philanthropic support, modeled on the SETI Institute and Biosphere 2. Millis, an employee at Glenn Research Center, keeps the quest for revolutionary modes of interstellar travel entirely separate from his work at NASA. His Breakthrough Propulsion Physics Project lost funding in 2002, but NASA covers his time to maintain awareness and publish assessments of ideas for interstellar travel.

Millis reviews papers focused on antigravity, which he does not believe is a viable option, “a transient inertia effect” called the Woodward effect, and a gravitomagnetic effect which exceeds the bounds of general relativity. “The bottom line,” says Millis, “is that there are no breakthroughs that appear imminent, but there are definitely small steps that can be taken to continue to look into these things.” Norm Hansen, President of EnergyUSA, hopes to begin using “Mirror Energy,” utilizing matter/antimatter, to bring flights to the Moon by 2016. Long considered a candidate for interstellar propulsion, five grams of the fuel would power 1,000 round trips to the Earth’s nearest neighbor.

“Mirror Energy” is based on positrons, which are costly to create and difficult to store. Nonetheless, EnergyUSA anticipates technological advances bringing costs down dramatically. The same improvements in production and control of positrons open the door to use in interstellar travel.

Dr. Louis Crane, a researcher at Kansas State University, is working to compute quantum effects in experiments involving gravity. He hopes to apply this to small, artificial black holes and test the feasibility of using them as energy sources for interstellar travel.

*The Tau Zero Foundation will establish itself as*