NASA Brief

Progress resupply ship to arrive at station September 12

Christopher Tew
Sci/Tech Editor

Chandra X-ray Observatory

The Chandra X-ray Observatory has detected a galactic collision with has activated a radio "halo" around the colliding galaxies.

Kepler

The planet-hunting Kepler telescope has detected a solar system with two planets. This the first observed multi-planet solar system in which both planets "transit" the star. Kepler looks for planets by watching stars for small drops in brightness as a planet "transits" in front of it.

Fermi Space Telescope

The Fermi space telescope recently observed gamma rays emanating from a nova in the constellation Cygnus. This came as a surprise to many astronomers, who did not believe that novas produced enough energy to generate gamma rays. The nova was first observed in March by amateur astronomers in Japan, and the news was relayed to astronomers around the world. A paper describing the observations was published in the journal Science on August 13.

IBEX

The Interstellar Boundary Explorer has discovered a source of energetic neutral atoms coming from around Earth's magnetosphere. The IBEX spacecraft was intended to study the boundary between the Sun's magnetosphere and interstellar space, but has been making observations of the Earth's magnetic field as well. These observations were made jointly with the European Space Agency's Cluster 3 spacecraft.

Lunar Reconnaissance Orbiter

The LRO spacecraft has observed evidence the Moon has shrunk in the recent past, and may still be shrinking. Scientists originally believed that the Moon shrunk early in its history, as it cooled after its formation. Now, certain kinds of cliffs, called lobare scarps, have been detected across the lunar surface. Earlier missions had detected the same kind of cliffs, but were limited to near-equatorial region. Kepler has discovered the cliffs at many different latitudes, making a global shrinking the likely explanation.

Mars Exploration Rovers

The Mars rover Opportunity continues to drive toward Endeavor Crater.

Mars Odyssey

The Mars Odyssey spacecraft put itself into safe mode on July 14. Operators believe the problem stemmed from an electronic encoder that controls the motion of the spacecraft's solar panel. Odyssey switched to a backup encoder and went into safe mode. Science activities resumed July 23. The Opportunity rover was out of contact with ground controllers while Odyssey was in safe mode.

MESSENGER

MESSENGER has made observations of Mercury's thin atmosphere, which is composed of materials like sodium, potassium, magnesium, and calcium. These elements are liberated from the surface of Mercury by the intense solar radiation. Sodium is released through a process called photon-stimulated desorption (PSD).

MESSENGER will enter Mercury orbit on March 18, 2011.

Spitzer Space Telescope

The Spitzer Space Telescope is now on a campaign to observe 700 near-Earth objects. It has already observed 100 and has surprising results. The near-Earth object population is very diverse, and may be continually changing.

Space Shuttle and International Space Station

Space Shuttle Discovery is expected to roll out of the Orbiter Processing Facility and into the Vehicle Assembly Building on September 9. There, it will be mated to the already-stacked External Tank and Solid Rocket Boosters.

The International Space Station is preparing for the arrival of a Progress automated resupply vehicle that will dock to the aft port of Zvezda on September 12. The last resupply ship undocked on August 31.

The station residents have also been photographing hurricanes from orbit.

Flight Engineer Calwell Dyson observed a leaking fluid line aboard the European laboratory module Columbus. She collaborated with the Columbus Control Facility in Munich, Germany to repair the leak.

Station crew members Alexander Skvortsov, and Flight Engineers Mikhail Kornienko and Tracy Caldwell Dyson are preparing to end their stay aboard the station. They will undock aboard Soyuz TMA-18 on September 23. New crew members, Flight Engineers Scott Kelly, Alexander Kaleri, and Oleg Skripochka will launch aboard an improved Soyuz vehicle, Soyuz TMA-01M. They will join Commander Doug Wheelock, and Flight Engineers Shannon Walker and Fyodor Yurchikhin for Expedition 25.

Space Shuttle Discovery. Discovery will deliver the Permanent Multipurpose Module to the Station. *(Image courtesy of www.nasa.gov)*

Campus Research Report: Dr. Marcus Hohlmann, Part 1 of 2

Dr. Marcus Hohlmann is using muons to search for hidden threats

Christopher Tew
Sci/Tech Editor

Dr. Hohlmann of the Physics and Space Science Department is using technology developed at the the European Organization for Nuclear Research (CERN) for upgrades of the Large Hadron Collider for practical purposes. He hopes to use muon scanning to detect dangerous substances like uranium and plutonium.

Muons are negatively charged sub-atomic particles that are in the lepton family, which includes electrons, however they are about 200 times as massive as an electron. They fall to Earth as by-products of cosmic ray interactions with the upper atmosphere. They can be detected using a variety of methods.

The process Dr. Hohlmann is using, muon tomography, is not a new process. This process of using muons to scan through materials is a fairly simple process. Since muons are always raining down onto the surface of the Earth, have very high energy, and can penetrate through materials, they are ideal candidates for tomography. For an example array, consider two detectors, on above another, and an object in between. The top detector detects all the muons that are raining down. As the muons pass through the object, they can be deflected by the atoms of the material. The lower detector sees what muons made it through unperturbed and what muons had been scattered. Using computers, it is possible to use that data to assemble a model of what was inside the detector.

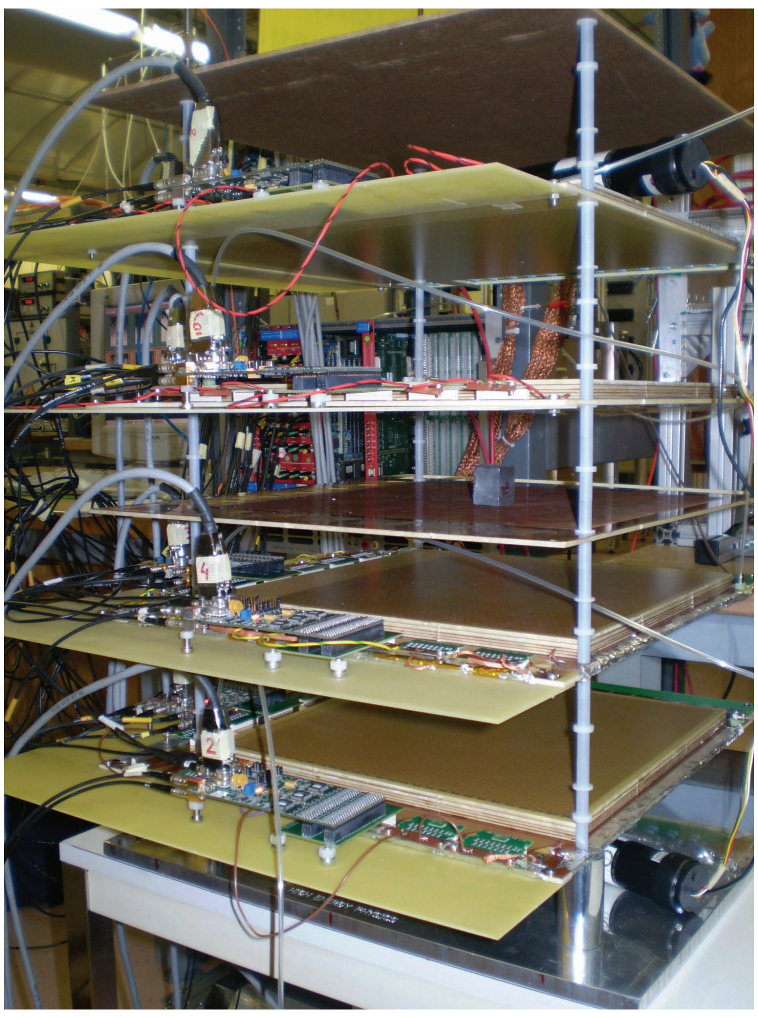
Muon tomography has been used in practical applications before. In the 1960's, Dr. Luis Walter Alvarez, a Nobel laureate of the University of California, used muon sensors to scan an Egyptian pyramid for hidden chambers (he found none in the parts he surveyed). A team at the National Autonomous University of Mexico used muons to scan a Mayan pyramid. Geologists have used muons to scan volcanoes for activity. The Los Alamos National Laboratory used muons for the same purpose Dr. Hohlmann uses them: detecting hidden uranium and plutonium.

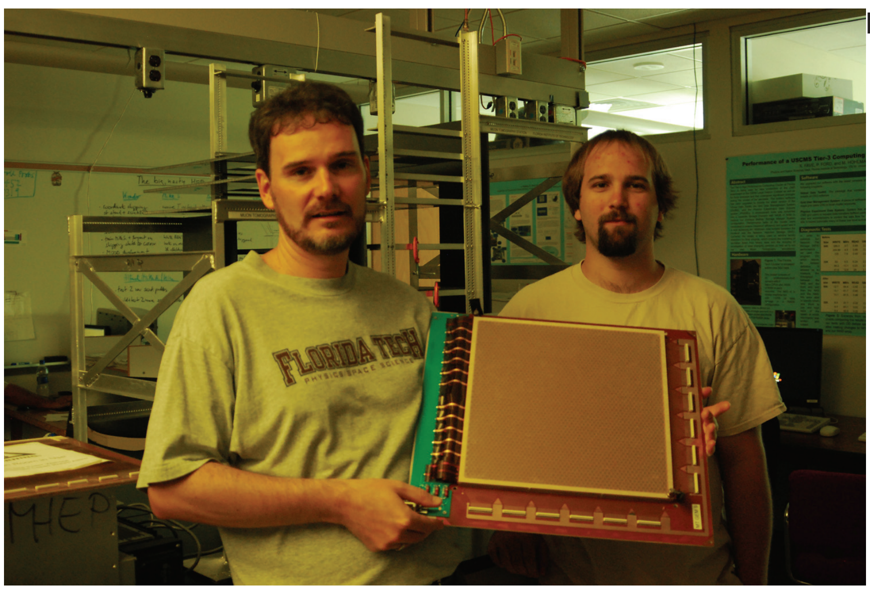
The key difference between Dr. Hohlmann's and all everyone else's is the detector technology. The others used old, bulky equipment that makes deployment of this technology to places like airports (to scan luggage) or seaports (to scan incoming cargo containers) difficult. Dr. Hohlmann uses a brand new technology called a Gas Electron Multiplier, or GEM. GEMs use a special copper-plated foil that has tiny holes, about 70 microns wide, etched into it chemically. A voltage is applied across the foil that creates powerful electric fields inside the holes, which are also filled with gasses like argon and carbon dioxide. When a muon passes through the detector, it ionizes some of the gas atoms. The loose electron, accelerated by the electric field, goes on to ionize other atoms and creates a kind of avalanche. Once the "avalanche" reaches a threshold intensity, it can be detected and read out. GEM detectors are thin, only about 1 centimeter in height, but can have any width. Dr. Hohlmann's GEM detectors were assembled by his team at CERN in Switzerland, but they are now preparing to assemble detectors here at Florida Tech in the future.

Dr. Hohlmann's current prototype array is about 30 cm by 30 cm. This prototype was already able to tell the difference in shape and density between an iron cube and a cylinder of tantalum (a denser metal). Dr. Hohlmann says his next step is the construction of what he calls the "cubic foot station." It will enclose a volume of one cubic foot with detectors on four sides. This will increase the abilities of the detector, making it easier to see its targets of uranium and plutonium. The next step after that is the construction of a "cubic meter station," which will be large enough to put packages and luggage through.

Dr. Hohlmann would also like to bring others working on similar projects here to Florida Tech for a tomography workshop. He says there are teams at Los Alamos and in Canada working on the same problem with different technologies and approaches.

Dr. Hohlmann is also working on the Compact Muon Solenoid on the Large Hadron collider at CERN. The next Campus Research Report will have more on that topic.





Dr. Hohlmann's prototype array.
Above, Dr. Hohlman's prototype 30cm by 30cm tomography station. An iron target rests inside (Image courtesy of Dr. Hohlmann).
At left, Dr. Hohlmann and student Bryant Benson hold a GEM detector in front of the soon-to-be cubic foot station (Image courtesy of Christopher Tew).