



## Understanding killer electrons in space

by Nancy Ambrosiano

Settling a long-standing scientific debate, Los Alamos scientists have demonstrated conclusively how electromagnetic waves accelerate ordinary electrons in the belts of radiation outside Earth's atmosphere to a state in which they become "killer electrons," particles that are hazardous to satellites, spacecraft, and astronauts.

Using data from several satellites, including NASA's Polar spacecraft, Los Alamos scientists published in the July issue of *Nature Physics* a paper showing how interactions between electromagnetic waves and electrons are responsible for accelerating radiation-belt particles in the Van Allen radiation belts to the point they become "killers."

The Van Allen radiation belts are doughnut-shaped regions encircling Earth that contain high-energy electrons and ions trapped in Earth's magnetic field (see illustration below).

The paper, "The Energization of Relativistic Electrons in the Outer Van Allen Radiation Belt," was written by Yue Chen, Geoffrey Reeves, and Reiner Friedel of Space Science and Applications (ISR-1). "We're not the first people to look at these space-based density gradients, but the essential achievement was coming up with the definitive test," said Reeves.

Competing models had proposed various effects involving diffusion, each roughly analogous to the ways piles of sand will spread out on a board that is shaken. The Los Alamos team's paper provides the first analysis that internal wave-particle acceleration is the only mechanism consistent with observations for the majority of radiation belt enhancement events (a surge of electrons up to 1,000 times more dense than they are in storm-free conditions).

"Debates on the source of the acceleration have lasted for at least a decade,

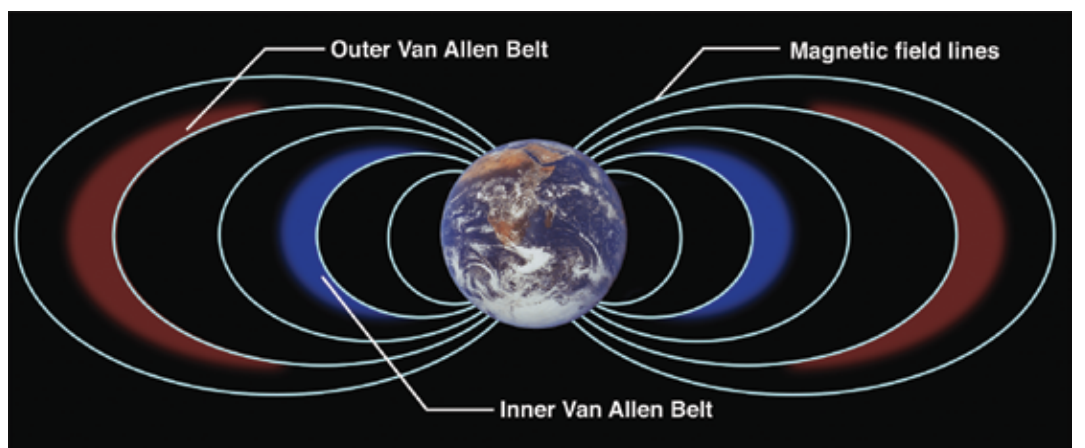
and this paper finally settles the argument based on observations. The result should be very useful for further radiation-belt research work," Chen said.

The Los Alamos model involved measuring fluxes of electrons, counting how many per second hit a satellite-borne detector, and converting the physical measurements to magnetic coordinates. The results showed localized peaks in intensity that could only be caused by acceleration of those electrons by electromagnetic waves. "We know it's some kind of interaction between the electromagnetic waves and the particles, but not the exact mechanism. So it's a big step, but certainly not the only one in understanding radiation belts," said Reeves.

The Los Alamos teams obtained differential electron flux data from the Los Alamos energetic particle sensor (a burst-detector dosimeter) aboard a Global Positioning System satellite, the Los Alamos Synchronous Orbit Particle Analyzer aboard a geosynchronous orbit satellite, and the Comprehensive Energetic Particle and Pitch Angle Distribution experiment aboard NASA's Polar satellite.

The next big step in this field will be the planned 2012 launch of NASA's two Radiation Belt Storm probes, part of the agency's "Living With a Star" program to quantify the physical processes that generate the radiation belts and cause them to decay. Observations from the two spacecraft will enable the development of empirical and physics-based models for the radiation belts. The empirical models will be used by engineers to design radiation-hardened spacecraft, while the physics-based models will be used by forecasters to predict geomagnetic storms and alert both astronauts and spacecraft operators to potential hazards.

The paper is available online at <http://www.nature.com/nphys/journal/vaop/ncurrent/full/nphys655.html>.



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## Exposure and cleanup of human blood

In a recent incident at the Laboratory, a man suffered a bloody nose while trying to reach a high shelf. He was treated and received a small bandage for his nose.

The incident prompted the Laboratory to remind employees about proper procedures for handling exposure to human blood. Employees who are exposed to human blood as a result of an accident or injury should follow these steps:

- Treat all human blood as if it were infectious for blood-borne diseases such as hepatitis or HIV.

- If exposed to your own blood from a minor injury for which medical assistance is not required, clean up the blood and dispose of any tissues or paper towels in a plastic bag and place in a waste receptacle.

- For injuries requiring medical attention, call 911 or escort the individual to Occupational Medicine for evaluation (whichever is appropriate).

- If exposed to blood from another person, go to Occupational Medicine no later than 24 hours after the exposure.

- If exposed to blood during off-duty hours, go to the Los Alamos Medical Center emergency room (or other nearby medical facility/hospital as warranted).

- In most cases, the clean up of blood will have to involve trained and properly equipped individuals or groups who utilize universal precautions. Call 7-6211 to report the incident and request cleanup and decontamination.

- Employees also should notify their line management and ensure that an Injury/Illness Notification Form along with a notification to the Principal Associate Directorate for Operations are completed.

For more information, contact Randy Sandoval of the Environment, Safety, Health, and Quality Directorate (ADESHQ) at 7-8424 or [rsandoval@lanl.gov](mailto:rsandoval@lanl.gov) by e-mail.



## Math and Science Academy Laboratory recognizes key stakeholders

Teachers Lupe Griego, left, of San Juan Elementary School, George Maes and Michael Cavolina, right, of Española Valley High School and Carlos Vigil Middle School, respectively, work on a group project during a Math and Science Academy Summer Institute workshop at Española Middle School East. Several teachers are participating in this summer's academy. The Laboratory hosted a reception to recognize area legislators and other key stakeholders who have provided financial assistance to the Math and Science Academy. The academy was created in 2000 to provide comprehensive and ongoing professional development programs to teachers in middle and high schools in Española, Chama, Mora and Pojoaque. Since the academy began, more than 150 teachers have completed the three-year program and 3,500 students are now being taught by those teachers.

Left: Former Laboratory Deputy Director Don Cobb talks with Math and Science Academy teacher Cathy Berryhill at Española Middle School East at the reception. Cobb is a member of the Laboratory Foundation's board of directors and its scholarship fund advisory committee.

Photos by Sandra Valdez, Records Management, Media Services and Operations

## Baskets help prevent cell phones in secure areas

Cell phones have become a regular part of our lives. Their small size and light weight allows users to carry them inside a pocket, purse, or belt clip. Their portability also means that Laboratory employees have to remember to remove phones from their person before entering a secure area in order to prevent a security infraction.

The Department of Energy designates a cell phone as a controlled article, which is not permitted in a Laboratory security area.

Pamela (PJ) Timmerman of Audits (EA-Audits) found a fun and creative way to help prevent cell phone-related security incidents within her group. Timmerman purchased small wicker baskets large enough to hold the average cell phone. Attached to each basket is the following message:

*Don't be a "Basket Case!"  
Leave your cell phone  
HERE  
when you go on site!*

Every employee in Audits has one of these baskets next to his or her computer set up. Timmerman said this is a humorous way to present a visual reminder for group members to remove cell phones before entering secure areas. The baskets are, she said, a handy place to store cell phones before employees leave their work areas to go to secure ones. A year later, the baskets still are in place and have helped the group have zero security incidents involving cell phones in a secure area.



## Los Alamos National Laboratory NewsLetter

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Los Alamos National Laboratory is a multidisciplinary research institution engaged in strategic science on behalf of national security. The Laboratory is operated by a team composed of Bechtel National, the University of California, BWX Technologies and Washington Group International for the Department of Energy's National Nuclear Security Administration.

Los Alamos enhances national security by ensuring the safety and reliability of the U.S. nuclear stockpile, developing technologies to reduce threats from weapons of mass destruction, and solving problems related to energy, environment, infrastructure, health and global security concerns.



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## Five DHS students at the Lab this summer

The Laboratory is hosting five students in the Department of Homeland Security Scholarship and Fellowship Program. One of the requirements is a ten-week internship to accomplish the program's objectives and to understand the mission and goals of the Department of Homeland Security. Each research experience is directly related to the mission of DHS.

**Fawn Hornsby** of North Carolina State University is working with mentor Michael Brown of Systems Engineering and Integration (D-3). Her research project is on an evaluation study of Quick Urban and Industrial Complex, an urban dispersion model developed at the Laboratory. The model is needed to support many aspects of response in case of a terrorist incident. The model calculates 3D wind-field codes around building complexes. Through experimental data she has found some deficiencies and is now trying to improve the codes.

**Charles Poston** of the The University of Missouri, Columbia is working with mentor James Doyle of Energy and Infrastructure Analysis (D-4). His research project relates to the electrical-power system. The Laboratory has developed a computer program that



simulates the system. Poston examines aerial photographs and locates all the substations and power plants in an area. The process will reduce time and money and will make it easier to respond to a natural disaster, accident, or terrorist attack.

**Srikanth Aravamudan** of Michigan State University is working with Murray Wolinsky of Advanced Measurement Science (B-9). His research project is analyzing data on human cells infected with a pathogenic flu virus. Through the data he is determining which biological pathways show the greatest change after exposure to the virus in case of a threat.

**Daniel Wilhelm** from the California Institute of Technology also is working with Wolinsky. His project is researching how deoxyribonucleic acid (DNA) changes across bacterial strains. Wilhelm is computationally modeling bacterial evolution and investigating if bacterial signatures may serve biological functions. DHS uses DNA signatures to detect bacteria that cause anthrax, plague, and similar threats. These bacteria often mutate making it difficult to detect. Through this study he could provide predictions of the number of unique signatures in the bacterial DNA and how it can mutate over time.

**Mark Croce** of the University of California is working with Edward McKigney of Safeguards Science and Technology (N-1). He is working on a DHS Domestic Nuclear Detection Office project to develop advanced materials for radiation-detection applications. Radiation-detecting materials are necessary in modern technology including homeland security.



**Q:** The Laboratory is rolling out a new performance and salary management system for the fiscal year 2008 performance review cycle. How do you feel about the value of annual performance reviews? Do you think they provide any useful information for improving productivity? If not, why not?



**Nicole Johnson of the Research Library (STBPO-RL)**

Performance reviews are important for tracking the accomplishments of employees, however, the process seems to be tedious. I wouldn't doubt that some people take short-cuts to simply finish the process.



**Randy Morgan of Field Services Weapons (HR-Weapons)**

Performance reviews are invaluable both to the employee and leadership team. Depending on the individual manager, very useful information can be provided.



**Margaret Reeves of the Office of Counterintelligence (OCI-OFF)**

When done right, I believe they do. A new system definitely is in order.



**Danny Abeyta of Weapons Product Definition (W-11)**

Before now, it didn't work too well. I think the new system will categorize people better, and therefore, rate their performance better.



**Yvonne Salaz of the Prime Contract Management Office (PCM-DO)**

Performance reviews are important if done properly. The tool currently used by the Laboratory needs to be more concise. I feel that six pages of written text is unnecessary and time consuming, especially for those in supervisory positions who have to complete the form for each employee.

They provide useful information for improving productivity if done properly and employees are given an opportunity to work with their supervisors to develop an accurate assessment of their performance. The rating scale could become more useful if it reflected the true performance of the employee as assessed by the supervisor.



**Rob O'Day of Personnel and Financial Applications (IST-APPS1)**

Performance reviews are good, [but] they don't increase productivity.



## Lab sponsored school-supply drive under way

**Vangie Trujillo of the Community Programs Office gets creative while decorating the collection boxes that were set up across the Laboratory for employees to donate school supplies. The third annual school supply drive will benefit the New Mexico Children Youth and Family Department's foster kids, the Santa Fe Public Schools Adelante homeless student program, Española Military Academy, and San Ildefonso Pueblo and Santa Clara Pueblo day schools. Donations can be dropped off through August 10 at collection boxes in the Otowi Building, LANSCE at Technical Area 53, TA-55, Central Park Square, S-Site, Materials Science Laboratory, Pajarito School Complex, National Security Sciences Building, and the Community Programs Office located at 1619 Central Avenue downtown. For more information or to arrange for supplies to be picked up, contact Tim Martinez of the Community Programs Office at 7-2390 or timothy@lanl.gov by e-mail.** Photo by Ed Vigil



# Education Counts

*An investment in our mission and continued success*



## Laboratory unites institutes to form consortium

by Todd Hanson

The Laboratory has long had an impact on American science education through its student and postdoctoral programs. In 2003, the Laboratory worked with the University of California, San Diego, to create an institute dedicated to engineering education and to assuring a future supply of world-class engineers to work on the challenges of national security. With that first institute now among five, Los Alamos is about to take another step toward increasing its impact on science and engineering education.

In the future, the five Laboratory's Institutes—the Engineering Institute, Materials Design Institute, Institute for Multiscale Materials Studies, Information Science and Technology Institute, and Institute for Advanced Studies—will be known collectively as the National Security Education Center—A Consortium of LANL Institutes.

In a ceremony planned for August 7 at the Los Alamos Research Park, Director Michael Anastasio, Principal Associate Director for Science, Technology, and Engineering Terry Wallace Jr., and Los Alamos Institutes Director Nan Sauer will formally dedicate the third floor of the existing Institute building as the NSEC's new home.

“Although the intent of each and every Los Alamos Institute always has been to enhance science and technology education, this coalition of intellectual and educational

endeavors is aimed at making national security science education and practice a core concern of the Laboratory,” said Wallace.

The National Security Education Center is an educational partnership unique in North America, and perhaps the world, for its national security focus. The NSEC will concentrate its efforts on developing and enhancing the scientific bases for national security.

National security science at Los Alamos has evolved over the past several decades to encompass the elements of defense, homeland security, and infrastructure and energy security, as well as the science missions required for stockpile stewardship. The Laboratory pursues these broad, multi-disciplinary programs in order to anticipate America's national security needs in a dramatically and rapidly changing world.

According to Sauer, the dedication of the Center is only one milestone along what has been conceived as a far-reaching path toward increased academic cooperation, enhanced scientific collaboration and scholarship, and technical work force development.

“The mission of the NSEC is to help Los Alamos and the nation train and recruit the next generation of national security scientists and engineers, while revitalizing and retaining the Laboratory's current world-class technical staff,” says Sauer.

Sauer emphasizes that this notion of maintaining and reinvigorating the current

technical work force is an important element of the NSCE's strategic plans. “There will be an increasing role for the institutes—through the NSEC—in helping keep Los Alamos National Laboratory a compelling and intellectually stimulating place to work,” she said.

A number of special guests have been invited to next week's dedication, including the Los Alamos National Security Board of Governors, Senior Vice President Bruce B. Darling from the University of California's Office of the President, and Terry L. Yates, chairman of the New Mexico Consortium Board.

Following the dedication, guests will attend a reception and then be given the opportunity to visit a student poster session and tour the newly renamed Institute spaces.

### Student Symposium this week at UNM, LA *Championing scientific careers*

by Jaclyn J. Valdez

Nearly 200 Laboratory students are presenting their research Wednesday and Thursday at this year's Symposium 2007 at the University of New Mexico, Los Alamos. The theme for this year's Symposium is Championing Scientific Careers.

Symposium 2007 includes presentations by keynote speakers Nan Sauer and Jake Meadows. Sauer is office director of the Lab Institute's Office, and Meadows of Water Quality and RCRA (ENV-RCRA) is chairman of the Students' Association.

In addition, Laboratory Director Michael Anastasio will speak to participants Thursday evening at the awards banquet.

Laboratory employees are encouraged to attend the poster viewing session of the symposium Thursday morning.

Sauer received her bachelor's degree in chemistry from the University of Idaho and her doctoral degree in inorganic chemistry from Iowa State University.

Meadows came to the Laboratory as a student intern in 2004 after completing his bachelor's degree in soil science at Montana State University.

The agenda for this year's symposium is at <http://www.lanl.gov/education/symposium/> online.

For more information, contact Brenda Montoya at 7-4866 or [bmontoya@lanl.gov](mailto:bmontoya@lanl.gov) by e-mail.

### Bradbury helps visitors break the code

by Ed Vigil

Which five letters of the alphabet are used to begin more than half of all English words?

The answer to this and other secrets related to codes and ciphers can be found at TechLab this summer at the Bradbury Science Museum.

Codes and ciphers is a new TechLab activity that allows participants to explore and investigate the secret world of coded messages. Visitors can search for answers and solutions as they explore the history, mystery, and future of hidden communication. They also will learn how to write in invisible ink, crack codes, and become a cipher sleuth.

Interactive activities include braille, DNA codes, pigpen ciphers, scytals, bar codes, Navajo Code Talkers, and much more.

TechLab offers several hands-on activities for visitors throughout the year and is one part of the museum's educational outreach effort, including the Science On Wheels program. Science On Wheels takes science education out to the area schools to teach students about science and complements area schools' science education curriculum.

By the way, the answer to the introductory question is T,A,O,S, and W. These letters help cryptanalysts crack codes and ciphers, or secret messages.

The Bradbury Science Museum is open seven days a week except for Thanksgiving, Christmas and New Year's Day. Museum hours are 10 a.m. to 5 p.m. Tuesday-Saturday and 1 to 5 p.m. Sunday and Monday. Admission is free.

For more information or to contact the museum, call 7-4444.

The Bradbury Science Museum is part of the Community Programs Office (CPO).