



NREL's  
Paul  
Norton



## Research Highlights . . .

### Astronomers discover vast intergalactic plasma cloud

Radio astronomers working at DOE'S [Los Alamos National Laboratory](#), Arecibo Observatory, and the Dominion Radio Astrophysical Observatory (DRAO) have discovered a previously undetected [cloud of intergalactic plasma](#) more than 6 million light years across. The cloud was discovered by using the Arecibo telescope to make a base scan of the sky and the DRAO to enhance the angular resolution of the image from that of a 305-meter telescope (Arecibo) to create the equivalent of a 1000-meter radio telescope. The diffuse, magnetized zone of high-energy electrons may be evidence for galaxy-sized black holes as energizers of the cosmic rays that zip through the universe.

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### One machine for detecting explosive, chem, and bio agents

Air passengers and baggage might one day be screened by a machine under development at [Lawrence Livermore National Laboratory](#) that can detect explosive, chemical and biological agents all at the same time. A team of LLNL researchers has conceptually proven that a three-in-one machine, or "universal point detection system," can be achieved, said George Farquar, a physical chemist at the Lab's Glenn T. Seaborg Institute. Using a system called Single-Particle Aerosol Mass Spectrometry, or SPAMS, the Livermore scientists have developed and tested the technology for detecting chemical and biological agents. The new research expands SPAMS' capabilities to include several types of explosives that have been used worldwide in improvised explosive devices.

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### Sorbents remove trace elements from fuel gas

Gasification is an important strategy for increasing the utilization of abundant domestic coal reserves. High-temperature capture of mercury, arsenic, and selenium helps preserve the high thermal efficiency of integrated gasification combined cycle (IGCC) plants versus low-temperature capture by activated carbons. Searching for a low-cost mercury removal technique that can be applied to IGCC and coal-burning power plants, two scientists at DOE'S [National Energy Technology Laboratory](#) invented palladium-based sorbents for high-temperature capture of mercury, arsenic, and selenium from fuel gas. NETL has licensed the sorbents to Johnson Matthey, a leader in advanced materials technology, for commercial development of the sorbents for IGCC and chemicals from syngas.

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### Quantum secrets of photosynthesis

The mystery of how nature, through photosynthesis, is able to transfer solar energy through molecular systems with nearly 100-percent efficiency appears to have been solved. Researchers with DOE'S [Lawrence Berkeley National Laboratory \(Berkeley Lab\)](#) have identified a quantum mechanical effect as the answer. Using a technique called 2-D electronic spectroscopy, the Berkeley Lab researchers obtained the first direct evidence of wavelike motions of excitation energy that can explore all potential energy pathways simultaneously and choose the most efficient one.

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## NETL scientists assist U.S. military

The U.S. military have called upon the expertise of the **National Energy Technology Laboratory's** Office of Research and Development to develop armor that will improve the safety of tanks and other armored vehicles used in the War on Terror. Scientists at NETL, DOE's primary laboratory for materials research, have used their knowledge of materials performance and process development to assist the Army Research Laboratory in Aberdeen, Md., in a number of projects.

The materials science research focus area at NETL specializes in formulating, characterizing, and melting of most metals, alloys and ceramics; casting and fabrication, prototype development; and the recycle and remediation of waste streams associated with these processes. NETL is one of the few places in the world where alloy development, melting, casting, fabrication, physical and chemical analyses and performance testing (wear, erosion, and various forms of corrosion) can be performed in one place.

NETL has successfully transferred the NETL-developed loose bonded sand, lost foam technology for making steel castings to the Rock Island Army Arsenal, Rock Island, Ill. RIAA requested assistance from NETL at the direction of ARL because of NETL's 20-year history in making cast steel and other prototype armor for the U.S. Army. Since RIAA had no facilities for making cast steel armor plate, NETL provided RIAA with process guidelines, parameters, expertise and actual patterns to set up its casting facility. The novel armor holds great promise for protecting heavy convoy vehicles and personnel that are being destroyed or disabled by improvised explosive devices (IEDs) and other roadside bombs. NETL scientists continue to assist RIAA personnel with design and gate patterns for casting armor plate and other process-related information.

Under a full cost recovery Military Interagency Payment Request (MIPR), NETL scientists will produce ballistic penetrators for the ARL's Armor Mechanics Branch in Aberdeen, Md. Unable to have the penetrators produced elsewhere, ARL sought the assistance of ORD because of ORD's unique materials capabilities.

NETL will also be involved in the development of a process to reduce the weight of the turrets on HUMVEES so that the vehicles will not overturn during combat maneuvering. The goal is to reduce the turret weight from more than 1,200 lbs to less than 600 lbs by replacing the steel-based armor with a combination of titanium alloy and transparent alumina. This would both lighten the turret and increase the protection for the top gunner, but even more importantly, would offer protection from IEDs.

**Submitted by DOE's National Energy Technology Laboratory**

## NREL RESEARCHER SEARCHES FOR THE SPICE OF LIFE

Senior Engineer Paul Norton of DOE's **National Renewable Energy Laboratory** is a variety junkie. He's researched alternative fuels for heavy vehicles, worked on two notable Habitat for Humanity houses and supported DOE's Building America Program. All of this while studying sculpture at the **University of Colorado at Boulder**.



Paul Norton

"I'm a mechanical engineer by profession and a kinetic sculptor by avocation," Norton said.

Norton began work at NREL as a visiting professional in 1984 and returned as a full-time employee in 1995. He spent several years in the Transportation Technologies and Systems Center before making the transition to the buildings research team.

It was at this time Norton began work on a special project that has held his attention for more than five years—working with Habitat for Humanity of Metro Denver on energy efficient, affordable housing.

In 2002, Norton worked with Habitat to tweak existing building designs to include additional energy efficient features such as a radiant wall heating system, solar thermal collectors for hot water and increased attic ventilation. "With our first Habitat project, we piggybacked on Habitat's already energy efficient designs," Norton said. "But based on the success of that house, we were able to propose plans for a Zero Energy House." Reaching zero energy in a **cold climate** was a challenge, so the home was carefully designed to combine the efficiency of the building envelope (insulation, windows, etc.) with efficient heating and cooling equipment, appliances, lighting, passive solar heat and light, solar-electricity, and solar water heating features. So far, the home is exceeding expectations and is has produced more energy that it has used.

When not working with Habitat, Norton evaluates the performance of homes in Building America communities and will serve once again on the Instrumentation team for DOE's collegiate building competition, the Solar Decathlon. The creativity each Solar Decathlon team uses in their building design is something Norton appreciates on many levels, as an engineer and as an artist. Norton expresses his creative by making large-scale, steel sculptures. Norton has studied sculpture for a number of years and has had several pieces shown in art galleries in Denver, Colo.

**Submitted by DOE's National Renewable Energy Laboratory**