



LBNL's Saul Perlmutter

Research Highlights . . .



In a whirl over spin origins

A recent experiment at DOE's [Jefferson Lab](#) has found it's possible to measure a suspected contributor to the spins of both the proton and neutron. Measurements in the late 1980s revealed that the spins of the individual building blocks of the proton don't add up to its actual spin. Since then, scientists have learned that the spin of protons and neutrons come not only from their quarks, but also from how the quarks move, their so-called orbital angular momentum. The new result, which appeared in *Physical Review Letters*, reveals that experimental data can be detailed enough to begin the task of extracting the quarks' orbital angular momentum.

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New condenser enables different rates for experimentation

The [Savannah River National Laboratory's](#) Glass Development Laboratory, which designs and fabricates unique scientific glass apparatus, has a long history of helping SRNL's researchers develop more effective tools for experimental work. Among their innovations is the newly patented Two Part Condenser for Varying the Rate of Condensing, invented by Gary Dobos of the Glass Development Lab. This condenser design enables the unit to effect different rates of condensing during experiments. It was designed as a way to increase condensing rates as experiments were in progress. The design offers a second condenser that can be inserted into the primary condenser to increase efficiency without disassembling the original set-up or interrupting the test.

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Sandia's Sunshine to Petrol project seeks fuel from thin air

Using concentrated solar energy to reverse combustion, a [Sandia National Laboratories](#) team is building a device intended to chemically "reenergize" carbon dioxide into carbon monoxide using concentrated solar power. The carbon monoxide could then be used to make hydrogen or serve as a building block to synthesize a liquid combustible fuel, such as methanol, gasoline, diesel or jet fuel. The prototype device will break a carbon-oxygen bond in the carbon dioxide to form carbon monoxide and oxygen in two distinct steps. It is a major piece of an [approach](#)—which the researchers have dubbed "Sunshine to Petrol"—to converting carbon dioxide into fuel from sunlight.

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Pantex and Livermore partner for complex transformation

Representatives from Pantex convened recently at DOE's [Lawrence Livermore National Laboratory](#) for to advance joint efforts in complex transformation. LLNL will partner with colleagues in Amarillo, Texas, for the transition of critical test capabilities to Pantex when facilities at LLNL are closed. LLNL and Pantex joint efforts have ensured the success of several initiatives that improved production throughput at Pantex, while maintaining a rigorous safety environment. The partnership with Pantex also seeks to bring on new diagnostics for evaluating the condition of warheads using non-destructive techniques at Pantex. This approach avoids both excessive shipments of components around the Nuclear Weapons Complex, as well as costly destructive testing.

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Superconducting cable tech takes step toward marketplace

DOE's [Oak Ridge National Laboratory](#) and SuperPower Inc., a Schenectady, N.Y., superconducting wire manufacturer, recently [signed](#) a license agreement to use an ORNL-developed technology that can lower the cost of producing superconducting wires for more efficient transmission of electricity.

The licensing agreement is part of a national effort led by DOE to research, develop and ultimately transfer energy technologies from DOE national laboratories to the global marketplace. Incorporating these high temperature superconducting wires and power equipment into the nation's electric grid will help meet rapidly growing demand for energy in an energy-efficient, cost-effective manner.

"This licensing agreement continues the long history of successes moving DOE technology from its labs to the marketplace," Patricia Hoffman, DOE principal deputy assistant secretary for Electricity Delivery and Energy Reliability, said. "High temperature superconductivity is a revolutionary and cross-cutting technology that can further the Administration's long-term effort to transform our nation's electricity infrastructure and provide a safe, reliable and affordable stream of electricity to all Americans."

Superconductors are special materials with no electrical resistance at extremely low temperatures. High temperature superconductors (HTS), discovered in 1986, lose resistance at warmer (though still very cold) temperatures than conventional superconductors.

Cooled by cheap and abundant liquid nitrogen, high temperature superconductors can be used to make lighter, smaller, more efficient, higher capacity power devices; relieve congested power line networks; and increase power transmission capacity.

Second generation, or 2G, wires made by depositing high temperature superconducting materials onto inexpensive metal templates coated with ceramic buffer layers will make high temperature superconducting wires less expensive to produce.

ORNL's pioneering research on 2G wires includes discovery of lanthanum-manganese-oxide as a buffer material that can be formed rapidly using commercial film-deposition processes.

"This agreement with SuperPower is a great example of ORNL working with industry and delivering the science and technology to help address the nation's energy challenges," ORNL Director Thom Mason said.

Submitted by DOE's [Oak Ridge National Laboratory](#)

A HISTORIC MOMENT FOR BERKELEY LAB'S SAUL PERLMUTTER



Saul Perlmutter

Barely 10 years ago, at the annual meeting of the American Astronomical Society on January 8, 1998, Saul Perlmutter made the first public announcement of something that, in the words of cosmologist Michael Turner, "changed the course of astronomy and physics."

The San Francisco Chronicle carried the front-page news next morning: "Call it the runaway universe, and we are on board. A new, detailed study of exploding stars and immense galaxy clusters billions of light years away seems to indicate that the universe not only will expand forever, contrary to some theories, but that its outward expansion is starting to speed up..."

Perlmutter, an astrophysicist in DOE's [Lawrence Berkeley National Laboratory](#) and head of the international [Supernova Cosmology Project \(SCP\)](#), presented evidence for a cosmological constant, soon to be called [dark energy](#), the mysterious something that constitutes 70 percent of the universe and forces its accelerating expansion.

Perlmutter graduated from Harvard magna cum laud in physics with the goal of finding "a research project with real data—not just theory—that would address a deep philosophical question."

He and Carl Pennypacker, both postdocs in Berkeley Lab physicist Rich Muller's group, founded the SCP in 1988 to measure the expansion of the universe using Type Ia supernovae, something astronomers had tried to do but had mostly given up as hopeless.

After years of scrounging for telescope time they proved it could be done. Immediately a rival group formed, hoping to beat them to the prize measurement: the rate at which the expansion of the universe was slowing down.

Except it wasn't slowing down.

Both groups soon convinced their peers that dark energy was real. The new challenge became to find out what dark energy is, using satellites like the proposed [Supernova/Acceleration Probe, SNAP](#), inspiration for the DOE/NASA Joint Dark Energy Mission.

Submitted by DOE's [Lawrence Berkeley National Laboratory](#)