LDRD@SNL

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Sandia National Laboratories
Laboratory Directed Research and Development

We welcome your questions, comments, and ideas for future LDRD projects to feature! Email your feedback to Marie Arrowsmith, mdarrow@sandia.gov

Pulsed Power Accelerator for Material Physics Experiments

Sandia Team: David B. Reisman, Brian S. Stoltzfus, Wiliam A. Stygar, Kevin N. Austin, Eduardo M. Waisman, Randy J. Hickman, Jean-Paul Davis, Tom A. Haill, Marcus D. Knudson, Christopher T. Seagle, John L. Brown

David Goerz (Goerz Engineering), Rick Spielman (Idaho State), Jerry Goldlust (Dialectric Sciences), Ray Cravey (Alpha Omega Power)

A new Sandia National Laboratories accelerator called Thor is expected to be 40 times more efficient than Sandia's Z machine, the world's largest and most powerful pulsed-power accelerator, in generating pressures to study materials under extreme conditions.

Thor's magnetic field will reach about one million atmospheres (compared to Z's five million), about the pressures at Earth's core, will be smaller (2,000 rather than 10,000 square feet), and will be considerably more efficient due to design improvements that use hundreds of small capacitors instead of Z's few large ones.

A major benefit in efficiency is that while Z's elephant-sized capacitors require large switches to shorten the machine's electrical pulse from a microsecond to 100 nanoseconds, with its attendant greater impact, the small switches that service Thor's capacitors discharge current in a 100-nanosecond pulse immediately, obviating energy losses inevitable when compressing a long pulse.

The new architecture also allows finer control of the pulse sent to probe materials, with tailored precise pulses of electrical current. Tailored pulse shapes are needed to avoid shocks that would force materials being investigated to change state. Sandia is building Thor in stages and already has assembled materials. Two intermediate stages are expected in 2016, which will be used for initial experiments and validation.

Two recent papers in the *Physical Review Special Topics – Accelerators and Beams* outlined Sandia's plan for Thor and discussed the possibility of building next-generation linear transformer driver-powered accelerators, such as Thor, to achieve ignition and high-yield fusion.

Thor's theoretical design was supported by Sandia's Laboratory Directed Research and Development program; later engineering details and hardware were supported by the National Nuclear Security Administration's Science Campaign.

Read more: http://tiny.sandia.gov/thor

LDRD Participants Recognized

Decontamination Technology for Chemical and Biological Agents received the Federal Laboratory Consortium's (FLC) 2016 Award for Excellence in Technology Transfer. The technology was developed with funding from the U.S. Department of Energy and the National Nuclear Security Administration (NNSA) Chemical and Biological National Security Program. The Laboratory Directed Research and Development (LDRD) Program supported projects focused on gaining insight to, and enhancing decontamination mechanisms for a variety of scenarios.

Due to his varied accomplishments and extraordinary range of interests, **Conrad James** received the 2016 Black Engineer of the Year (BEYA) Special Recognition award at the annual BEYA STEM conference in Philadelphia, Feb. 18-20.

Jackie Chen, distinguished member of technical staff at the Combustion Research Facility, is scheduled to deliver the keynote address on Tuesday, June 21, at the ISC High Performance conference in Frankfurt, Germany.

Control of coherent information via on-chip photonic–phononic emitter–receivers

Heedeuk Shin, Peter T. Rakich (Yale)
Jonathan A. Cox, Robert Jarecki, Andrew Starbuck (Sandia)
Zheng Wang (UT-Austin)

LDRD-based unique filtering technology that combines light and sound waves on a single chip is expected to better detect radar and communications frequencies.

A powerful signal filtering technology based on radio frequency form the basis for spectrometers that would let users "see" energies placed in various frequency bands across a wide spectral range. The technology has the potential to revolutionize signal-processing systems that rely solely on conventional electronics.

A paper published in Nature Communications describes the work, initiated by Sandia's LDRD program and currently funded for almost $5 million by the Defense Advanced Research Projects Agency (DARPA).

Read More: http://tiny.sandia.gov/phonon

LDRD PROJECTED BUDGET AND STATUS

FY16 Q2 $155 MILLION 348 PROJECTS *FUNDED AT* $146.0 MILLION

Upcoming Events

Mar 1 - Apr 6 - Investment Area review of Ideas
Mar 8 - 10 - Materials Science External Review Board Meeting
April 11 - LDRD proposal submission opens

Sandia National Laboratories

Sandia National Laboratories is a multiprogram laboratory managed and operated by Sandia, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000

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