LA-UR-16-27953
Approved for public release; distribution is unlimited.

Title: ADEPS All-hands Introductory Slideshow

Author(s): Kippen, Karen Elizabeth

Intended for: ADEPS All Hands, 2016-10-13 (Los Alamos, New Mexico, United States)

Issued: 2016-10-17

ADEPS All-hands Introductory Slideshow

Quantum criticality in a low-carrier system

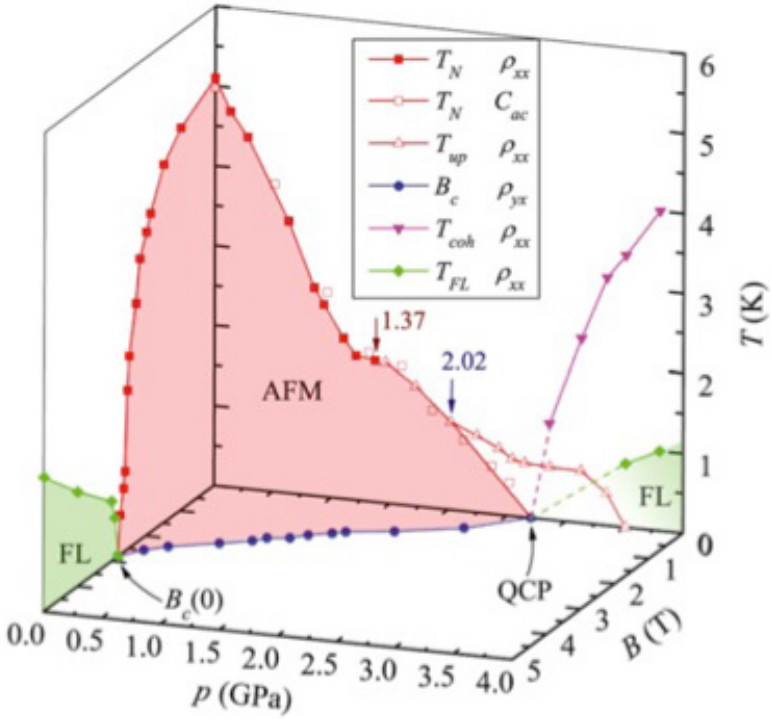
MPA

Scientific achievement

- LANL researchers and collaborators report that pressure and field-induced zero-temperature magnetic phase transitions in $CeNi_{2-d}As_2$ emphasize previously unappreciated importance of a low-carrier density on the nature of quantum-phase transitions and signatures of quantum criticality.
- Conditions leading to a local type of quantum criticality have remained uncertain since evidence for it was discovered nearly 20 years ago.

Significance and impact

- Easily tuned balance among competing interactions in Kondo lattice metals allows access to a zero-temperature, continuous transition between magnetically ordered and disordered phases, a quantum-critical point.
- These highly correlated electron materials are prototypes for discovering and exploring quantum critical states.



For additional details, see *MPA Materials Matter* July 2016 or contact Yongkang Luo.

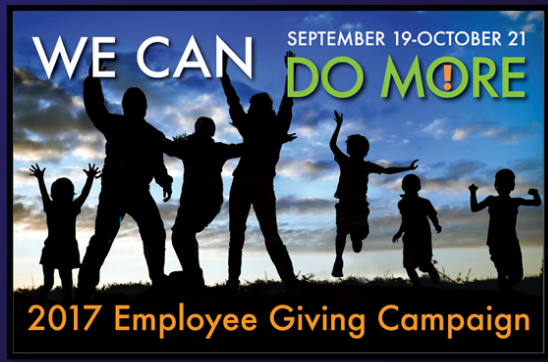
Research details

- Work, funded by DOE Division of Materials Sciences and a Director's postdoctoral fellowship supported through Los Alamos's Laboratory Research and Development program, supports Lab's Energy Security mission and Materials for the Future science pillar.

Moving Arts Española

Moving Arts Española nurtures the children and youth of the Española Valley through education in the performing, visual, and agricultural arts to enhance health, creative expression, and connection to cultures and traditions.

Española arts, dance program helps children discover their passions.

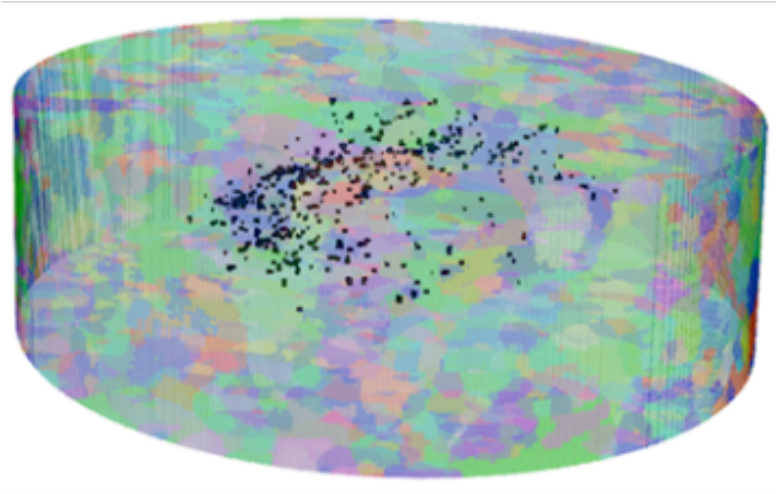


Unraveling microstructural effects on damage evolution in shocked polycrystalline materials

MST

Scientific achievement

- LANL researchers and collaborators used emerging 3D characterization techniques and micromechanical modeling to study microstructure effects on damage evolution in a shocked copper sample.



For additional details contact Ricardo Lebensohn.

Significance and impact

- Understanding and controlling mechanisms of dynamic failure of polycrystalline structural materials is an important and mission-critical scientific challenge facing the Lab.
- Analysis revealed most significant correlation between damage and microstructure corresponds to grain boundaries adjacent to crystals having very different plastic response.
- Accounting for correlations discovered will help design more damage-tolerate materials via microstructure manipulation.

Research details

- Funded by LDRD program, “Mesoscale Materials Science of Ductile Damage in 4 Dimensions” and Joint DoD/DOE Munitions Technology Program.
- Supports Lab’s Stockpile Stewardship mission and Materials for the Future science pillar.

Crisis Center of New Mexico

CCNM provides advocacy to people in dangerous situations, helping victims with orders of protection and other legal issues.

CCNM's mission is to educate men, women, and children how to build and sustain healthy families and violence-free environments. The compassionate staff is trained to deal with crisis situations and understands the dynamics of domestic violence.

Los Alamos-developed technology a hit at international cybersecurity conference

P

Scientific achievement

- Quantum random number generator featured at RSA Conference 2016; largest annual gathering of people and companies working on computer security.
- Ray Newell (P-21): “The week was a great success; our booth was busy for the entire time–four days!–and quite a few folks told us it was the most interesting thing they’d seen at the conference.”

For additional details, see *Physics Flash* May 2016 or contact Ray Newell.

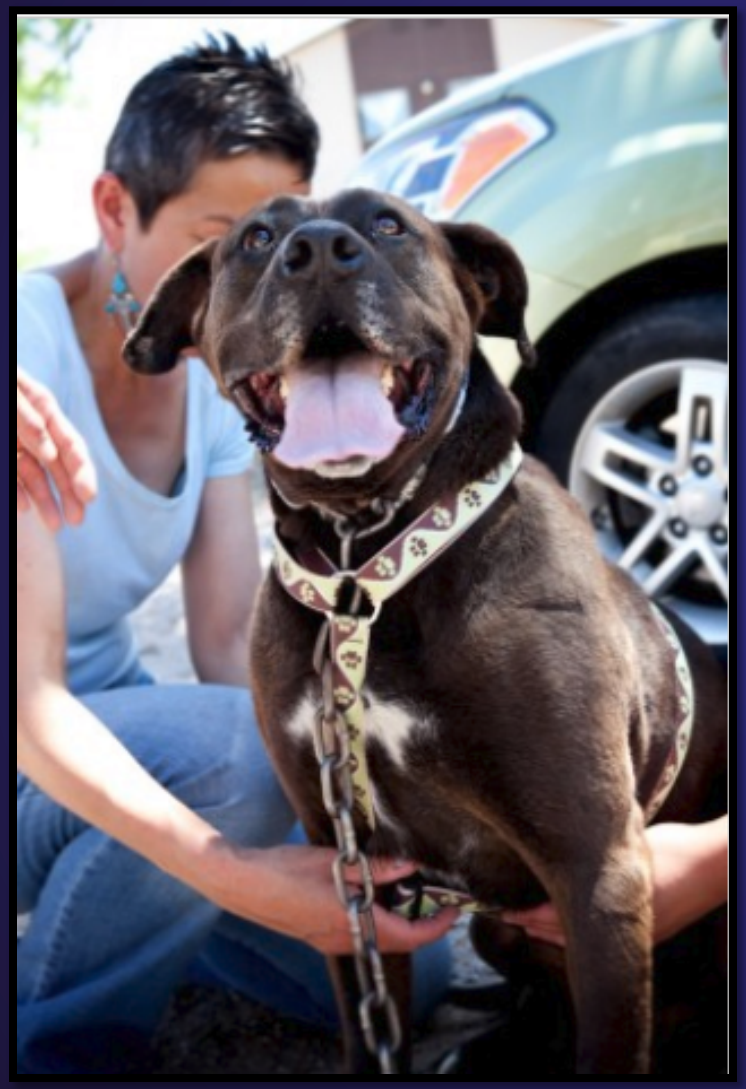
Significance and impact

- Technology, commercialized by Whitewood under the name Entropy Engine, is a plug-and-play computer card that fits most network servers.
- Produces random bits with the strongest security assurances, and at the highest rates, of any hardware random number generator on the market today.

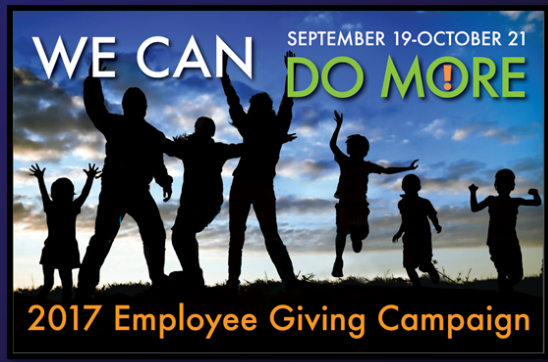
Research details

- In 2015 Los Alamos partnered with Whitewood to commercialize the quantum random number generator.
- Work initially funded through LDRD, with later funding by DARPA for applied demonstration for quantum encryption technology.
- DHS’s Transition to Practice program within department’s science and technology directorate helped bring technology to market.

Española Valley Humane Society



EVHS takes in about 4,000 stray or surrendered animals annually and provides free spay/neuter surgeries to animals from Rio Arriba County plus discounted vaccinations.



Hydrotest component fabrication key to Lab's weapons deliverables

Sigma

Scientific achievement

- Sigma Division continues to be vital to Laboratory weapons mission by fabricating experimental hardware for Lab's Hydrotest program.

Significance and impact

- Forming/Machining and Welding teams have played a key role in manufacturing this experimental hardware.
- Numerous components formed and heat treated; high-quality and reproducible welds and brazes produced.

For additional details contact Paul Dunn.

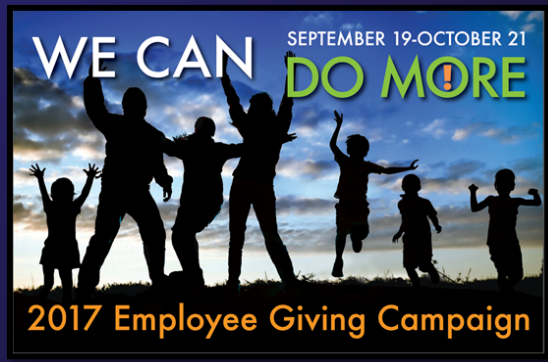
Research details

- Capability includes 500-ton hydraulic press to form components, a heat treatment furnace, a brazing furnace, electron beam welding and gas metal arc welding equipment.

Family Strengths Network

FSN provides education, support groups, and activities to all types of families, parents, teens, and young children. FSN currently hosts an autism support group, foreign language classes, teen programs, a stress-reduction course, and legal- and financial-advice sessions.

Many newcomers are temporary students, postdocs, or visiting scientists with families.



Light-activated photocurrent degradation and self-healing in perovskite solar cells

MPA

Scientific achievement

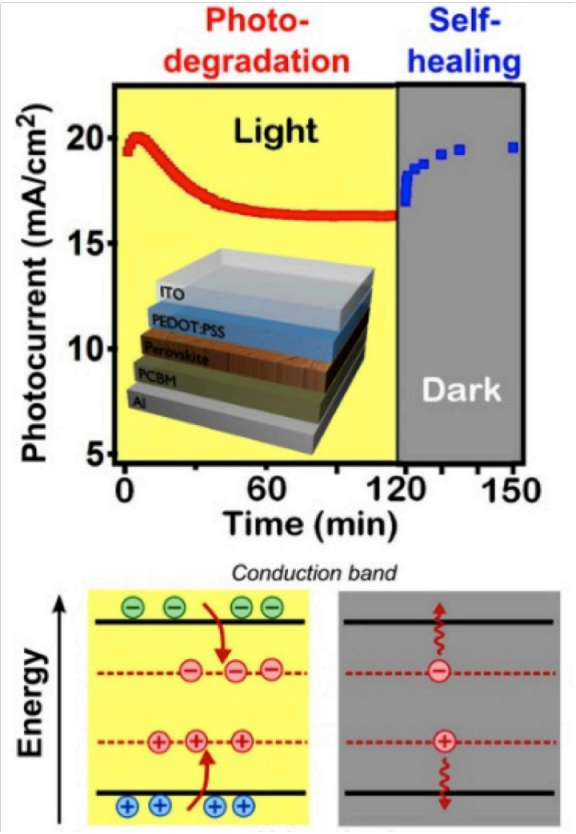
- New study by LANL researchers and collaborators found both cause and solution for the tendency of perovskite solar cells to degrade in sunlight, a breakthrough potentially removing one roadblock to commercialization for this promising technology.

Significance and impact

- Researchers determined photo-degradation is a purely electronic process caused by charge accumulation without chemical damage to the crystal structure, and therefore can be circumvented, while cells' self-healing properties allow them to rebound in the dark.

Research details

- Research is underway toward improvements and long-term technological viability of perovskite-based photovoltaics.
- Los Alamos portion of the work, done in part at CINT, a DOE Office of Science User Facility, was supported by DOE Office of Basic Energy Sciences and LDRD program.
- Computational and DFT calculations used resources provided by Los Alamos Institutional Computing Program, supported by U.S. DOE NNSA.



For additional details, see *MPA Materials Matter* October 2016 or contact Aditya Mohite.

- Work supports Lab's Energy Security mission areas and Materials for the Future science pillar.

Habitat for Humanity
Española & Los Alamos

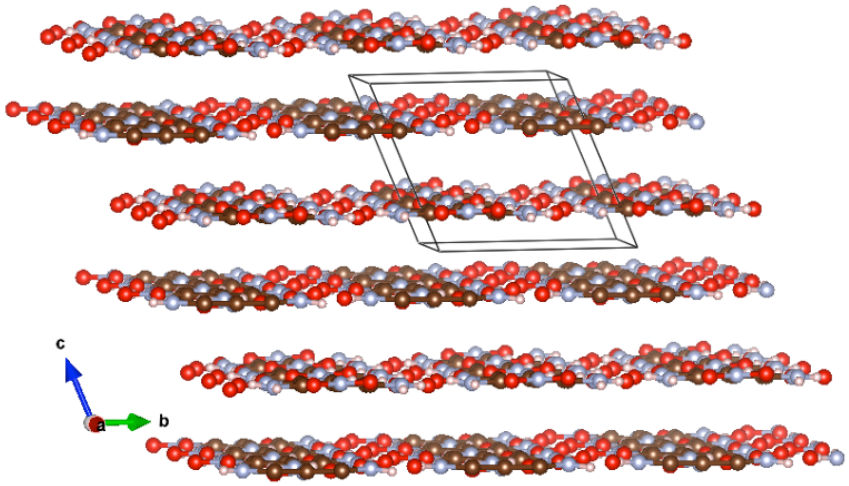
A safe, healthy place to live. A distant dream for many, EVLA volunteers and donors work hard to make this a reality for the less fortunate. EVLA depends on donations and volunteers to get homes built for those in need.

Largest ever temperature range achieved while measuring TATB crystal structure

MST/LANSCE/MaRIE

Scientific achievement

- Lab researchers measured crystal structure of TATB, an insensitive high explosive, from 30–300 K—the largest ever temperature range for this material.
- Measuring effect of large temperature ranges on TATB crystal structure could provide insight into mechanisms governing ratcheting growth, an undesirable phenomenon in the material resulting from heating and cooling.



For additional details, see *Science Highlights* April 13, 2016 or contact Sven Vogel.

Significance and impact

- TATB is highly anisotropic molecular crystal used in several plastic-bonded explosive formulations.
- Is a prime choice for applications where extreme safety is required because it is difficult to detonate by accident.

Research details

- Researchers used LANSCE's high-pressure/preferred orientation (HIPPO) neutron diffractometer to collect data.
- Is an example of science on the roadmap to MaRIE, Lab's proposed experimental facility for control of time-dependent material performance. MaRIE's combination of x-ray and neutron scattering methods would provide unprecedented, time-resolved access to structural properties of materials from atomic- to meso-scales.
- B61 Life Extension Program and NNSA Science Campaign 1 funded the work, which supports Lab's Nuclear Deterrence mission area and Materials for the Future and Science of Signatures science pillars.

Mountain Canine Corps

Search and rescue: saving lives with super-sleuth canines.

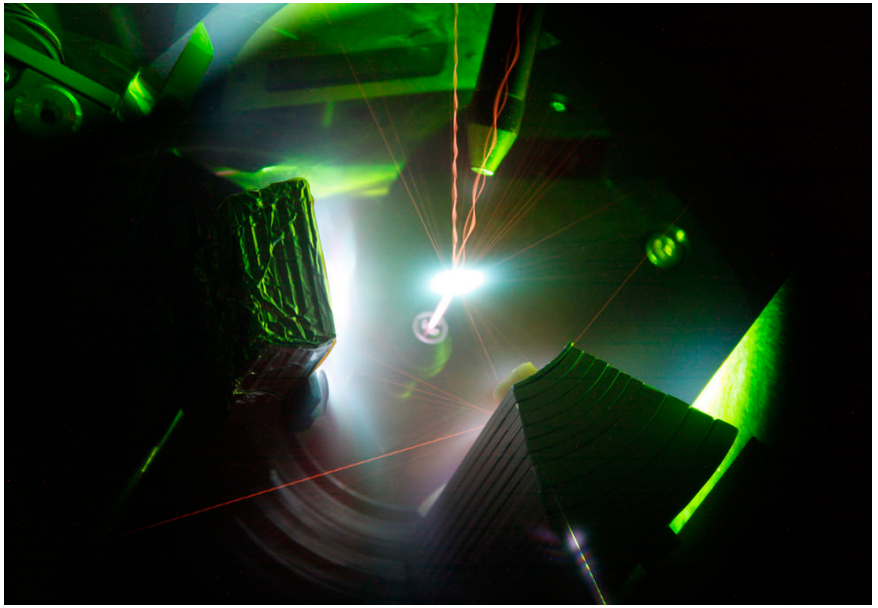
MCC dogs are certified in tracking, air scent and cadaver specialties, and they train twice a week for many hours. Handlers often take the dogs to other regions—even other countries—to train under different conditions. These dogs can pick up a scent over a quarter-mile away.

Recognizing a scientific workhorse

P/MaRIE

Scientific achievement

- **Trident laser retired after 25 years of enabling diverse science in high-energy-density physics and fundamental laser-matter interactions.**



For additional details, see *Physics Flash* August 2016 or contact Juan Fernandez.

Significance and impact

- **Versatile Trident system enabled a broad range of experimental science, including experiments in laser-plasma instabilities, material dynamics, diagnostic development, and relativistic laser-matter interaction.**
- **During its decades of use, more than 16,000 laser target shots were conducted by hundreds of Los Alamos and visiting scientists; more than 150 peer-reviewed journal articles (in 39 different journals) have been published using Trident experimental data; and more than 230 talks have been presented at national and international conferences.**

Research details

- **Research has supported Los Alamos Inertial Confinement Fusion and Weapons research programs and advanced technologies and techniques that hold promise for Los Alamos initiatives, such as MaRIE, Laboratory's proposed experimental facility for the study of matter-radiation interactions in extremes.**

Boys and Girls Club

With your pledge to the Pueblo of Pojoaque Boys & Girls Club through this year's Giving Campaign, club members can learn how to make choices that will improve their lives and be productive, responsible, and caring citizens and leaders in their communities.

Boys & Girls Club creates safe place for teens to grow.

Laboratory metallurgists make thorium targets for production of cancer-fighting isotopes

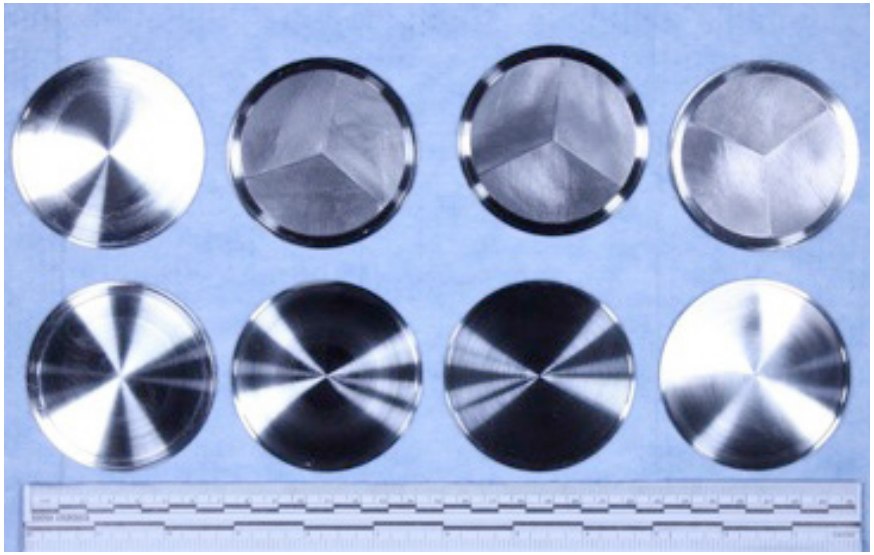
Sigma/LANSCE

Scientific achievement

- Together LANL, BNL, ORNL are developing a large-scale accelerator production capability for Ac-255, a rare radioactive isotope that attacks cancer cells without damaging nearby healthy cells.

Significance and impact

- Effort driven by pressing need to provide enough Ac-225 to support clinical trials of medicines based on this isotope.
- Tri-lab team is developing chemical processing techniques and production-scale targetry to prepare for Ac-225 manufacturing.



For additional details, see *LANSCE Pulse*, June 2016 or contact Jason Cooley.

Research details

- Encapsulated thorium target assemblies are used to produce Ac-225 via irradiation using high-energy proton beams at accelerator facilities at Brookhaven and Los Alamos/LANSCE. Irradiated targets shipped to Oak Ridge for chemical processing, with distribution of isolated Ac-225 for initial evaluation studies worldwide.
- LANL's Sigma Complex is only place in United States with expertise, equipment, access for melting, forming, machining thorium.
- Work supported by DOE Office of Science via funding from Isotope Development and Production for Research and Applications subprogram in Office of Nuclear Physics.
- New capability at Sigma supports Lab's National Security mission and Materials for the Future science pillar.

Embudo Valley Tutoring Association

Serving the villages surrounding Dixon, EVTA tutors support kids four days per week in class and two days after school at no cost. They also tutor during summer.

EVTA currently has four tutors that serve about 60 children every year.

Water-removal technique boosts performance of carbon nanomaterials for energy applications

MPA/MST

Scientific achievement

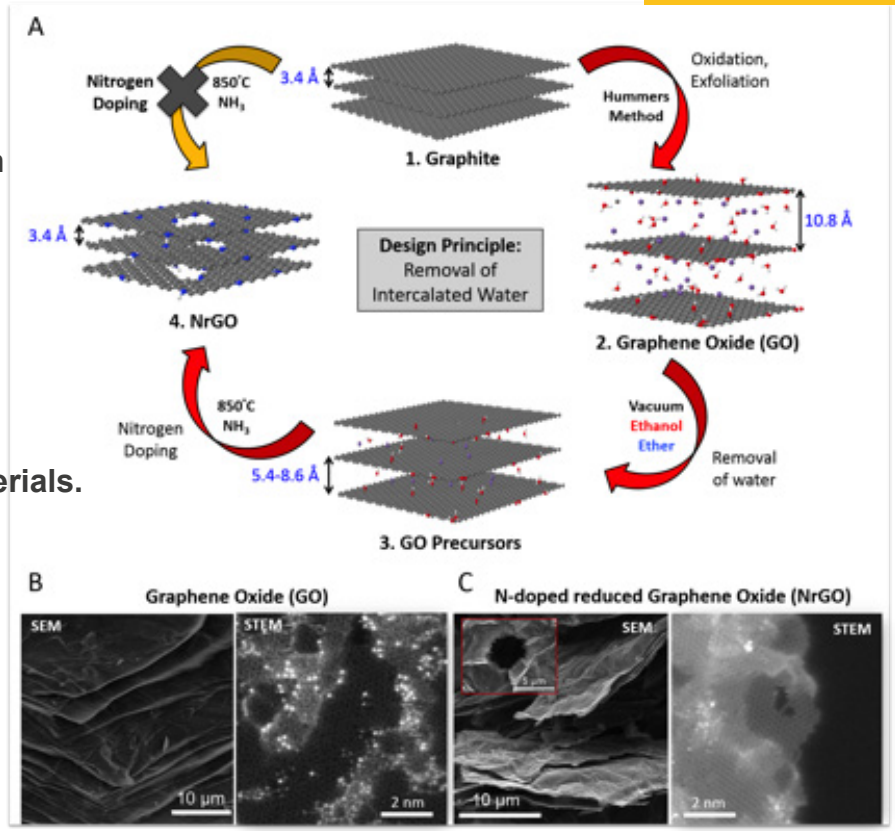
- Taking water out of synthesis process is key to designing next-generation carbon nanomaterials with enhanced performance for fuel cell and battery applications.

Significance and impact

- Findings by a Los Alamos-led team are based on a breakthrough in understanding critical role of water in formation of catalysts for oxygen reduction in materials.
- Research provides first comprehensive understanding of intercalated water's role within graphene oxide nanosheets (GN).

Research details

- Team demonstrated state-of-the-art performance of nitrogen-doped reduced graphene oxide in acidic environments and demonstrated best electrochemical stability reported thus far for GN-based catalysts.



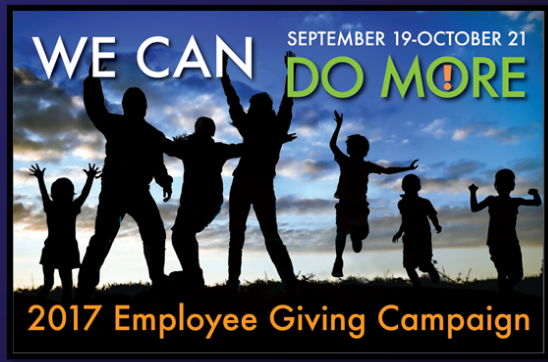
For additional details, see *MPA Materials Matter*, July 2016 or contact Gautam Gupta.

- Los Alamos Directed Research Grant funded work, which supports Lab's Energy Security mission area and Materials for the Future science pillar.
- Work was performed, in part, at CINT, an Office of Science User Facility operated for DOE Office of Science by Los Alamos and Sandia national laboratories.

CASA Child Advocates

CASA educates and empowers diverse community volunteers who ensure each child's needs remain a priority in an over-burdened child welfare system. For volunteers, CASA is a life-changing experience that makes our community a better place.

Statewide, there are 22 CASA programs that train, support, and supervise these volunteers.



SMARTS reveals residual stresses in additively manufactured parts

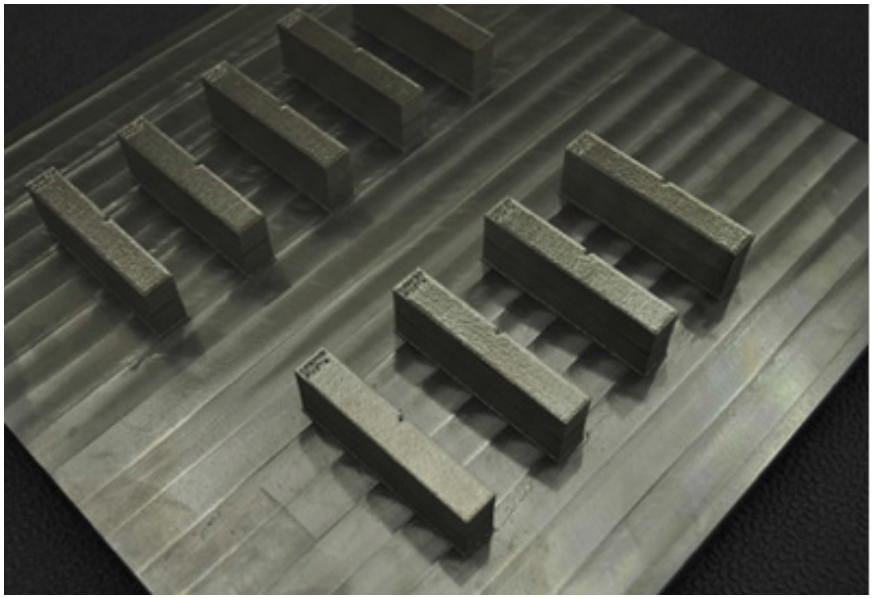
MST/Sigma/LANSCE/MaRIE

Scientific achievement

- **Spectrometer for Materials Research at Temperature and Stress (SMARTS) revealed how build failure affects residual stresses in additively manufactured parts.**

Significance and impact

- **Understanding how residual stress develops during additive manufacturing is critical to qualify parts for critical applications.**



For additional details, see *LANSCE Pulse* June 2016 or contact Don Brown.

Research details

- **Lujan Center at LANSCE provides unique hardware and software capabilities for rapid bulk microstructural characterization to accelerate qualification of additively manufactured materials.**
- **Results are an example of decades of experience with large data-sets that provide foundation for data analysis of MaRIE experiments in material discovery. MaRIE is Laboratory's proposed experimental facility for Matter-Radiation Interactions in Extremes.**
- **Science Campaign 1 and DSW funded the research, which supports Lab's Stockpile Stewardship mission and Materials for the Future science pillar.**

San Martin de Porres Soup Kitchen

Eliminating hunger one plate at a time.

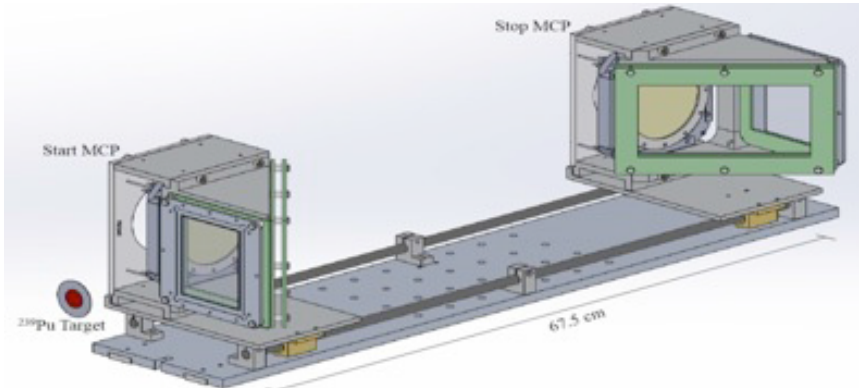
Volunteers from many different churches and organizations prepare and serve all the meals, operating the soup kitchen named after a saint dedicated to work on behalf of the poor.

SPIDER scales up to measure plutonium fission product yields

P/LANSCE

Scientific achievement

- Spectrometer for Ion Determination in Fission Research (SPIDER) has been designed, assembled, and commissioned to measure fission product yields.
- Main goal is to reduce uncertainties in energy dependence of fission product yields.



For additional details, see *Physics Flash* May 2016 or contact Fredrik Tovesson.

Significance and impact

- Accurate nuclear data is central to development of robust theoretical fission models, which guide advances in nuclear weapons and nuclear energy.
- SPIDER upgrade to multi-arm device is under development for studying fission product properties from events induced by fast neutrons, a neutron energy region accessible at Weapons Neutron Research facility.

Research details

- SPIDER provides unambiguous identification of fission product mass by using ultra-fast micro-channel plate detectors and axial ionization chambers to register velocity and kinetic energy, respectively, of coincident fission products. Data on total kinetic energy release and prompt neutron emission per fission event are acquired simultaneously.
- LDRD funded construction of original SPIDER instrument in support of Lab's Nuclear and Particle Physics science pillar for application to basic studies of nuclear fission. NNSA Science Campaign 1 funded spectrometer upgrade and current plutonium measurement program.
- Work supports Lab's Stockpile Stewardship and Energy Security mission areas and Nuclear and Particle Futures science pillar.

St. Elizabeth Shelter

Building futures…changing lives

St. Elizabeth Shelter is dedicated to assisting homeless individuals and families by providing emergency shelter, food, case management, counseling, supportive housing, and referrals to partnering human-service agencies.

Los Alamos, Sandia collaborate on controlled measurements of Pu at first-ever explored pressure, temperature, density regimes

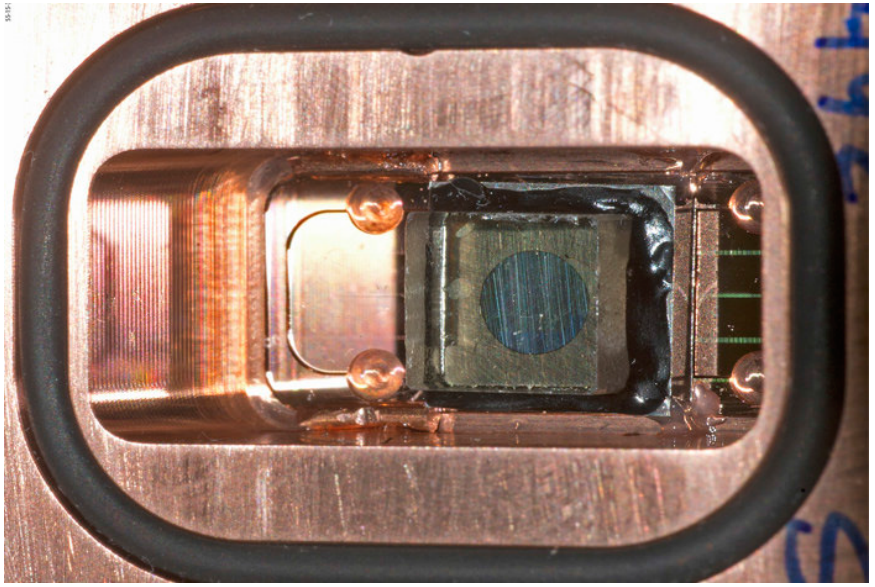
P/MST

Scientific achievement

- **LANL and SNL conducted Pu experiments using Sandia's pulsed power Z Machine that reached regions of pressure, temperature, and density regimes—relevant to those seen during a nuclear weapons detonation—never before explored in the laboratory.**

Significance and impact

- **Experiments improve fundamental understanding of how Pu behaves in a dynamic environment and how that performance might change with age, sometimes looking at new material and comparing it against older material from the stockpile.**



For additional details, see *Physics Flash* May 2016 or contact Russell Olson.

Research details

- **LANL's role included producing Pu samples, fabricated by MST-16 in collaboration with researchers from MST and M divisions and Sandia.**
- **Experiments support Stockpile Stewardship—to ensure safety, security, and effectiveness of U.S. nuclear deterrent without need for full-scale nuclear testing—and extreme environments subcategory of Materials for the Future science pillar.**
- **Los Alamos effort supported through Science Campaign 2.**

La Clinica del Pueblo del Rio Arriba

La Clinica del Pueblo del Rio Arriba initiated a series of community organizations that provided legal aid, cooperative farming, and free or low-cost medical care to residents.

For many in this rural region, making a trek to a hospital takes an hour or two, and they may be debilitated or lacking transportation.

pRad commissions key new capabilities

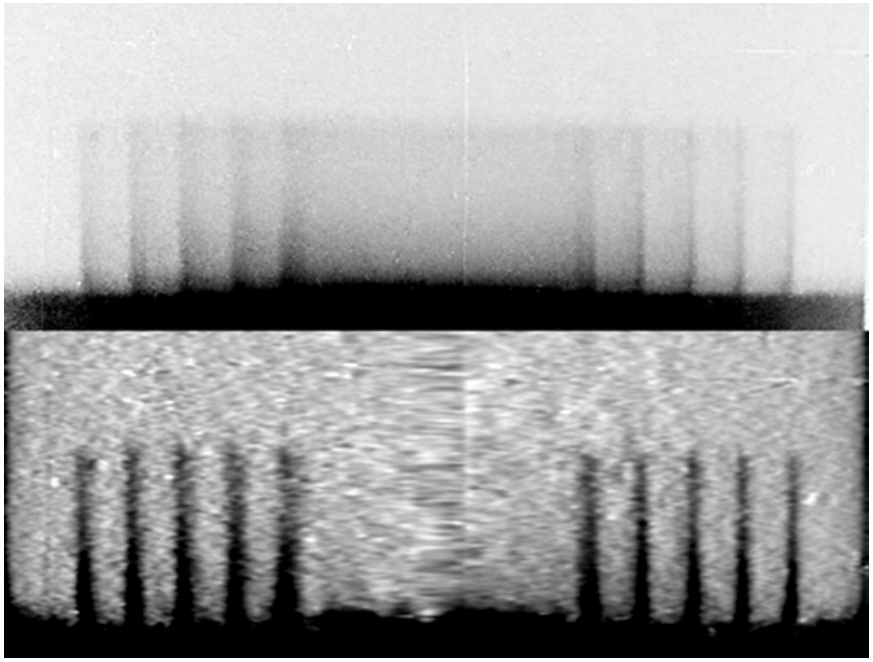
P/LANSCE/MaRIE

Scientific achievement

- Electromagnetic magnifier commissioned and new and improved high-speed imaging system installed, operated at LANSCE's Proton Radiography Facility (pRad).

Significance and impact

- Magnets improve capability's reliability, predictability.
- 10-frame ultrafast camera offers improved spatial and charge resolution, higher quantum efficiency, lower noise, and faster repetition rate over current state of the art, with integration times below 50 ns.



For additional details See *The Pulse*, June 2016.

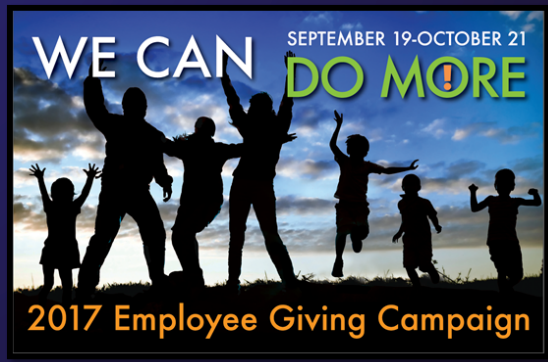
Research details

- Materials experiments at MaRIE will demand unprecedented time-resolved imaging capabilities, and many of the technologies featured in this prototype are promising additions to suite of technologies researchers can employ in conceptual designs. MaRIE is the Laboratory's proposed Matter-Radiation Interactions in Extremes experimental facility for the study of time-dependent mesocale materials science.
- Camera commissioning was supported by Science Campaign 3; Institutional PADSTE G&A Science Investment funded magnet work.
- Improvements support Lab's national security science mission and Materials for the Future and Science of Signatures science pillars.

First Born

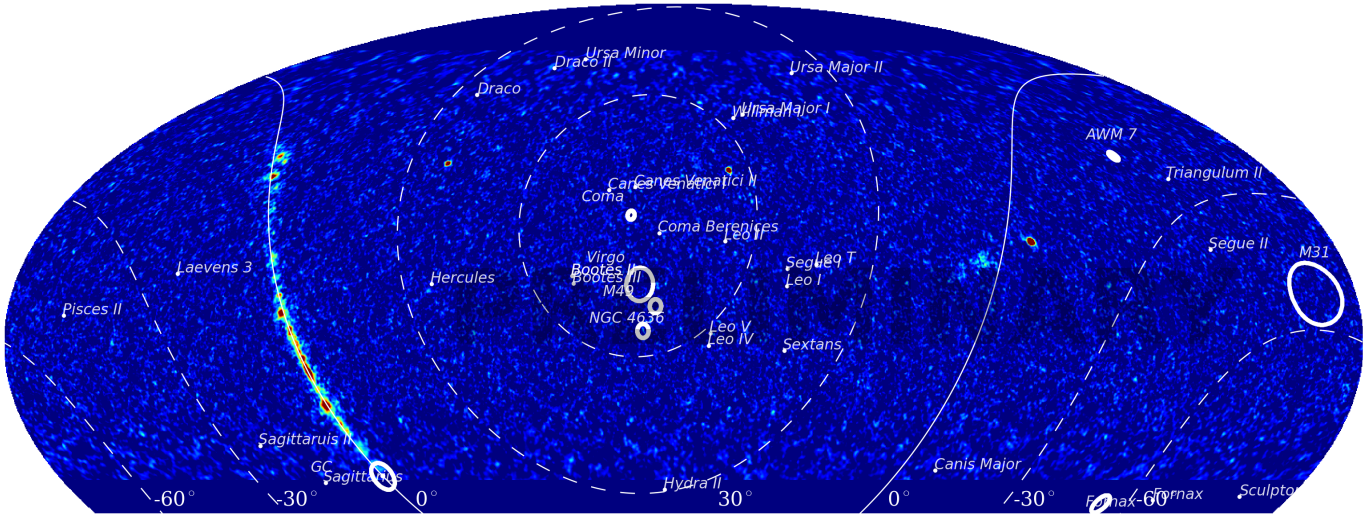
First Born is a unique nonprofit home visiting program designed to meet the needs of New Mexican families. You can pledge funds to United Way of Santa Fe County's First Born Program.

First Born helps inexperienced parents not feel isolated during the daunting task of raising a newborn.

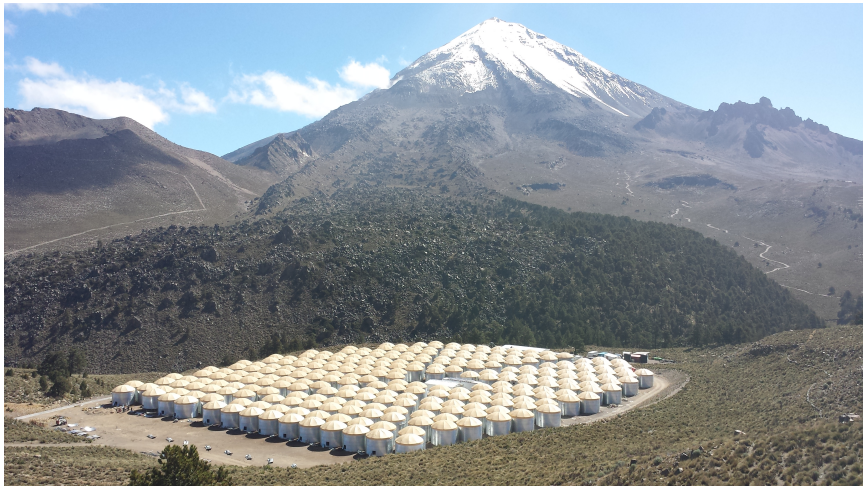


HAWC Gamma-Ray Observatory released results of first year of data collection (skymap) at APS April Meeting

P



- HAWC is sensitive to highest-energy gamma rays ever observed and sees 2/3 of the sky every day.
- Map shows HAWC's detection of many sources along the Galactic plane (color scale) as well as more than 20 known regions of high dark matter density (white circles). No excess gamma-rays observed from these regions constrains some theories of the nature of the dark matter.
- Joint project with universities in United States, Mexico, Poland, Germany; U.S. funding from NSF, DOE Office of Science and LANL (through LDRD)



Technical contact: Pat Harding, P-23