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MPA Materials Matter

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Photo by Richard Robinson, IRM-CAS

Mary Elizabeth Phipps

*Intrepidly exploring new research frontiers
through nature-inspired nanoscience*

By Diana Del Mauro, ADEPS Communications

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*We look at how nature
makes materials. Us-
ing biological building
blocks and premises
from nature, we try to
get nature to make
materials for us in a
certain way.*

”

“I’m going to have a lab like this some day,” Mary Elizabeth Phipps said she remembers telling herself around the age of 5 after visiting her father’s chemistry laboratory at Boston College. She recalls drawing pictures of the mysterious bottles she had seen covered with skulls and crossbones.

Now a research technologist at the Center for Integrated Nanotechnologies (MPA-CINT), Phipps, whom colleagues know as Lisa, feels at home in its Gateway to Los Alamos Facility’s Bio-Suite. The lab is lined with flasks minus the hazardous chemical warning labels—containers filled with saline buffers and salts.

Phipps is the only cell biology technologist at the national user facility, which provides a wealth of tools for studying nanoscience integration. In the Bio-Suite’s mammalian cell culture section—a rarity in a materials-based lab—she helps chemists, materials scientists, and physicists design and execute experiments. “Our focus is how to meld biology with materials,” said Phipps, noting how the Center’s Soft Biological and Composite

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Congratulations to all of these awardees. I especially want to thanks those who prepared the nominations for these awards and encourage others to do so for their deserving colleagues. It is a time-consuming, but very rewarding process.

”

Toni

From Toni's desk...

As we approach the end of 2014, I want to update you on news in MPA and attempt to summarize the highlights of the year.

Manuelita Martinez-Brito, a longtime admin for MPA-11, has moved down the hall to P-21. Vanessa Gonzales has moved from CINT to work in MPA-11 and CINT is now searching for a new admin. We thank Manuelita for her dedicated service to MPA and wish her well in her new position. We have two new deputy group leaders in MPA-11. Jeff Willis, who has served MPA and EPS exceptionally well in several acting management roles, is now the permanent DGL for MPA-11. George Goff, whose expertise is in actinide chemistry, is also a new DGL in MPA-11, having moved to MPA-11 from C-CDE. We welcome George to MPA.

Following the departures of David Watkins, MPA deputy division leader (now retired), and David Morris MPA-CINT group leader (now C Division Leader), we have two ongoing searches for these positions. The MPA DDL search is chaired by Jose Oliveras and I co-chair the CINT GL/co-Director search with Grant Heffelfinger, my counterpart at Sandia. Both committees have been active and interviews are either underway or will be in the near future.

We also have had many MPA folks recognized with awards.

- Joe Thompson of MPA-CMMS was awarded the 2014 Frank H. Spedding Award “for outstanding contributions to the physics of f-element materials, especially their magnetism and unconventional superconductivity.”
- Piotr Zelenay of MPA-11 was selected as a 2014 Fellow of the Electrochemical Society.
- Michael Fitzsimmons of MPA-CINT was selected as a 2014 Neutron Scattering Society of America Fellow “for many important contributions to the study of interfacial and thin-film magnetism using polarized neutron reflectometry.”
- Quanxi Jia of MPA-CINT was selected as a 2014 Fellow of the Materials Research Society for his “pioneering contributions to the development of high-temperature superconducting-coated conductors and for advancing the processing and application of multifunctional metal-oxide materials.”
- Dipen Sinha of MPA-11 and the team of researchers Anirban Chaudhuri, Cristian Pantea, Blake Sturtevant, Alp Findikoglu, and Craig Chavez, received the 2014 Richard P. Feynman Innovation Prize for their development of Swept Frequency Acoustic Interferometry, the base technology behind the Safire™ oil field sensor technology. In partnership with Chevron, they were also awarded an R&D 100 Award for this technology.
- Rod Borup of MPA-11 is the recipient of the 2015 Research Award from the Energy Technology Division of the Electrochemical Society. He is recognized for “his seminal contributions to the fundamental understanding of the durability of polymer electrolyte fuel cells.”
- Jon Rau, Eve Bauer, Ben Davis of MPA-11, along with others, were awarded a Los Alamos Distinguished Performance Award for a materials project that will enhance the safety of the existing stockpile.
- Tommy Rockward of MPA-11 received a DOE Hydrogen and Fuel Cells Program R&D Award “in recognition of outstanding technical contributions to the development of hydrogen fuel quality standards.”
- Marc Janoschek of MPA-CMMS received the 2014 Wolfram-Prandl Prize for “his pioneering studies of the spin dynamics in chiral helimagnets and the development of a cryogen-free apparatus for spherical neutron polarimetry.”
- Jennifer Hollingsworth of MPA-CINT was awarded the Los Alamos Fellows Prize for “the discovery and elaboration of the synthesis and optical properties of ‘giant’ nanocrystalline quantum dots that overcome fundamental photophysical limitations, such as blinking, of conventional semiconductor quantum dot formulations.”
- Jacqueline Kiplinger, formerly of MPA-11 and currently residing in C-IIAC, received the American Chemical Society’s F. Albert Cotton Award for her work in establishing synthetic routes to novel uranium and thorium compounds.
- John Sarrao, former MPA division leader, was the recipient of the U.S. Department of Energy’s 2013 Ernest O. Lawrence Award in Condensed Matter and Materials Sciences.

Congratulations to all of these awardees. I especially want to thanks those who prepared the nominations for these awards and encourage others to do so for their deserving colleagues. It

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I see a great opportunity to utilize our exceptional existing expertise and intellectual resources to create a synergy for wider multidisciplinary research and applications through meaningful collaborations among ourselves and with the outside research community.

”

From Quanxi's desk . . .

Hi, greetings to you all! I am sure many of you have seen me around for years—first as an STC and then as a CINT scientist. I was a team leader at MPA-STC from 1997 to 2009 and the Nanoscale Electronics and Mechanics Thrust Leader at CINT from 2009 to 2014. Since June, I have had the honor of serving as the Acting Co-Director of CINT when David Morris, the former CINT Director, became the Laboratory's Chemistry Division Leader. I treasure this opportunity to work with and learn from everyone in the Center, and will try my best to assist Neal Shinn (the Director) to maintain and—better still—elevate CINT's important role in leading nanoscale science and technology research.

I received my B.S. and M.S. in electrical engineering from Xian Jiaotong University, China, and PhD in the same field from the State University of New York at Buffalo before joining the Laboratory in 1993. My research areas include synthesis and study of the structure-property relationships of nanostructured materials, multifunctional materials, and thin films; development of novel deposition techniques for the growth of electronic materials; as well as development and fabrication of high-temperature superconducting films, novel solid-state microelectronic/electro-optic devices, and semiconductor/energy materials and devices. I am very proud of my contribution to the fundamental understanding of supercurrent distribution in thick superconducting films and my technical approaches to solving complex technological issues in the development of high performance coated conductors. I am especially proud of the critical part I played in the innovation and development of a polymer assisted deposition technique—the PAD—to grow high-quality thin films from a wide range of materials, as it has provided a versatile, eco-friendly, and cost-effective technique to synthesize materials and to grow thin films and coatings with properties tailored to the requirements of a specific product, component, or application.

CINT has been playing a leadership role in integrating science through its function as a Department of Energy/Office of Nanoscale Science Research Center (NSRC) national user facility. We have excellent scientists, including postdocs and graduate students, doing interesting and significant research in a number of areas in our four thrusts to create, characterize, understand, and integrate nanostructured materials into the microscopic and macroscopic worlds. I see a great opportunity to utilize our exceptional existing expertise and intellectual resources to create a synergy for wider multidisciplinary research and applications through meaningful collaborations among ourselves and with the outside research community. I plan on discussing such potential collaborations with many of you in the next few months.

Thank you for the opportunity to work with you all to strengthen CINT's scientific endeavors and realize CINT's scientific mission.

Acting CINT Co-Director Quanxi Jia

Phipps cont.

Nanomaterials thrust area uses DNA technology, biochemistry, and cell biology as starting points to address global security challenges in health, energy, and the environment. “We look at how nature makes materials. Using biological building blocks and premises from nature, we try to get nature to make materials for us in a certain way.”

Phipps said she likes being a jack-of-all-trades, constantly learning through the experiments brought to her bench. She grows a variety of cells for CINT users. Human stem cells, she said, are the most “exciting” and the “trickiest” to develop because she must provide the right chemical signals to make them manifest bone, cartilage, fat, and/or vasculature architectures. “Stem cell work is really important in terms of regenerative medicine, tissue engineering, and discovering the biomechanics of how stem cells actually work,” she said.

She prepares genomic DNA-functionalized substrates in such a way as to expose the telomeres, the ends of chromosomes involved in human aging, for a study using super-resolution spectroscopy. “If you understand telomeric function you can start to understand the aging process, not only of specific cells but of humans as a whole,” she said. For DNA self-assembly with carbon nanotubes, Phipps provides all the right elements for DNA to bring nanotubes together so they become materials, such as nanoelectronics. She helps achieve materials with new functionality by manipulating DNA and proteins to create biosensors that could possibly detect cancer, tuberculosis, and virulent strains of influenza.

“Lisa is very fearless about entering new fields,” said Jennifer Martinez (MPA-CINT), her mentor for the past nine years and Bio-Suite lead scientist. “Trained as a biologist and artist, Lisa started in CINT doing chemistry for materials functionalization—very different from what she had ever done before—and now solidly mingles biology with materials and chemistry . . . Above all, Lisa conducts her research the way she conducts her life, which is with great thought, care, and honesty.”

Phipps credits her “Renaissance man” father for encouraging her to follow her passions. She began college as an art major, but switched to biology because she was interested in the molecular mechanisms of the body. By the time she joined Los Alamos National Laboratory in 2003, Phipps had worked in large academic labs, including the Massachusetts Institute of Technology and Tufts University, on infectious diseases, cancer, and gene therapy, as well as in biotech labs in California, mainly focusing on proteomics, the study of protein structures and functions. She had also earned a master of fine arts from the San Francisco Art Institute while continuing her scientific pursuits.

On Friday nights Phipps can be found in her Santa Fe garage studio, painting “strange animal creatures in weird situations,” she said. She operates in spontaneity mode, the opposite of the analytical bent required in the lab.

Lisa Phipps's favorite experiment

What: Exploring how terahertz radiation can affect gene expression in stem cells and subsequent differentiation.

Why: Stem cells have the potential to regenerate and repair damaged tissues that thus far have limited therapeutic regimens or involve dangerous regimes. For example, it would be great to avoid a potentially fatal bone marrow transplant, which involves whole-body irradiation and renders the patient terribly immune-compromised, and instead use differentiated stem cells as therapeutic agents.

When: 2010-present.

Where: Los Alamos National Laboratory's Center for Integrated Nanotechnologies (CINT) and Laboratory for Ultrafast Materials and Optical Science (LUMOS), and Harvard University.

Who: A CINT user from Harvard Medical School, LANL Theoretical Division collaborators, and the CINT/LUMOS team.

How: Stem cells are pluripotent: that means they can become various kinds of cells in our bodies. The path to becoming one cell type versus another depends on the chemical signals they get in vivo. In our project, I grow and then chemically direct human stem cells to differentiate into a specific tissue type. Next, the cells are subjected to terahertz irradiation. In another set of experiments, I chemically directed mouse mesenchymal stem cells to differentiate into adipose cells. We then subjected these cells to various conditions of terahertz radiation, and analyzed messenger ribonucleic acid from both the irradiated cells and the non-irradiated control cells by reverse transcription polymerase chain reaction and microarray (Affymetrix gene chip arrays).

The “a-ha moment”: With the human stem cells, we found that terahertz irradiated stem cells showed marked changes in the expression of certain genes and importantly, demonstrated an accelerated differentiation. With the mouse stem cells, our data demonstrated that terahertz radiation, at specific conditions, results in changes in directed gene expression and accelerates stem cell differentiation.

Janoschek receives Wolfram-Prandl Prize for neutron scattering research

Marc Janoschek (Condensed Matter and Magnet Science, MPA-CMMS) received the 2014 Wolfram-Prandl Prize during the German Conference for Research with Synchrotron Radiation, Neutrons and Ion Beams at Large Facilities in Bonn. He was honored for “his pioneering studies of the spin dynamics in chiral helimagnets and the development of a cryogen-free apparatus for spherical neutron polarimetry.”

Courtesy photo by Volker Lannert, KFN

Janoschek received the Wolfram-Prandl Prize in the Bundestag, the equivalent to the German House of Congress in the former capital of Bonn. The building now serves as an international conference center.

The award is named after the German neutron scattering pioneer Professor Wolfram Prandl, who developed modern neutron scattering methods and high-level numerical data analysis. The German Committee for Research with Neutrons presents this award, which includes a cash prize, every two years to outstanding early-career scientists. The award typically emphasizes research enabled by innovative neutron scattering method developments.

Janoschek received the award for his pioneering neutron scattering experiments on the microscopic magnetic interactions that determine the functional properties of helical magnets. Part of this research was performed using a novel device called MuPAD (Mu-Metal Polarization Analysis Device) that Janoschek designed and built during his thesis. MuPAD enables the study of magnetic structures and interactions in unprecedented detail. A total of three MuPADs are currently employed at two European neutron scattering centers (Paul Scherrer Institut, Switzerland and the Heinz Maier-Leibnitz Zentrum, Germany), and their successful use to answer outstanding scientific questions has been reported in 15 peer-reviewed publications.

Janoschek's work on helical magnets is timely because of their potential for novel memory, computing, and sensing applications that have recently attracted increasing scientific

interest. He will continue his research on this topic as the principal investigator of a Laboratory Directed Research and Development project at Los Alamos that began in FY15. This project will focus on optimizing these materials for applications of designed and controlled functionality to support the Lab's materials strategy.

Janoschek performed his doctoral studies in solid-state physics at the Paul Scherrer Institut in Switzerland and the Technische Universität München (TUM) in Germany, where he graduated summa cum laude in 2008. He was a Feodor-Lynen postdoctoral fellow of the prestigious German Alexander von Humboldt Foundation at the University of California, San Diego in the group of Brian Maple, where he also acquired experience in high-quality single crystal synthesis. Since 2011, Janoschek has been the capability leader for neutron scattering in MPA-CMMS.

Technical contact: Marc Janoschek

Electrical contacts to the metallic phase of MoS₂ enhances performance of ultrathin electronics

While a new super material, ultrathin molybdenum disulfide (MoS₂), has emerged as a highly desirable layered semiconductor for electronics, contact resistance caused by metals deposited on the semiconducting phase has been a limitation for device performance.

In a study published advanced online in *Nature Materials*, Rutgers University and Los Alamos researchers show how “phase engineering” of electrodes is an effective strategy for removing this barrier and improving the performance of MoS₂ transistors. The result is devices fabricated with metallic electrodes; such ultrathin transistors are highly reproducible and independent of the type of contact metal pads used.

Given the decreasing size of microelectronics, efficient heat dissipation has emerged as one of the biggest challenges facing the microelectronic industry. This is largely due to high contact resistance in field-effect transistors, which leads to power dissipation as heat since more energy is required to overcome the resistive barrier for device operation. Temperatures can reach as high as 300-500 °C, eventually resulting in degraded performance and short lifetime for devices such as laptops, iPads, etc. Similar arguments hold for optoelectronic devices such as photodetectors, sensors, photovoltaics, and light-emitting diodes, making contact resistance a universal problem.

MPA-11 researchers fabricated and tested hundreds of devices with metallic electrodes and concluded that 80-90% of the devices worked using phase transformation of the contacts. In contrast, the yield of working devices fabri-

continued on next page

Illustration of the 1T and 2H crystal structure phases of MoS₂.

Device structure for the field-effect transistor measurements.

Ultrathin cont.

cated with metals on top of the semiconducting phase was substantially lower and device characteristics were highly variable. The findings suggest that conversion to the pure metallic phase could lead to even greater enhancement in performance.

The key is a methodology they developed to locally pattern the metallic phase on ultrathin semiconducting MoS₂ nanosheets and use them as electrodes. Through this means they observed the lowest contact resistances reported thus far to the best of their knowledge. The low contact resistance is attributed to the atomically sharp interface between the phases and to the work function of the metallic phase and the conduction band energy relative to vacuum level of the semiconducting phase being similar. Both top- and bottom-gated devices with metallic electrodes showed enhanced performance compared to devices in which metal is contacted directly to the semiconducting phase.

The Laboratory Directed Research and Development program funded the work through an exploratory research grant on two-dimensional materials. Researchers in MPA-11 performed part of this work at the Center for Integrated Nanotechnologies, a DOE Office of Science user facility. The effort supports the Lab's Energy Security mission area by making transistors more energy efficient and Materials for the Future science pillar.

Photoluminescence Image

EFM Image

Left: Photoluminescence map of a triangular monolayered MoS₂ nanosheet. The left side of the triangle is the semiconducting phase, whereas the right side was converted to the metallic phase. The semiconducting phase shows noticeably brighter photoluminescence than the metallic phase. Right: Electrostatic force microscopy phase image of a monolayered MoS₂ nanosheet showing the difference between locally patterned superconducting (dark color) and metallic (bright color) phases.

Reference: "Phase-engineered low-resistance contacts for high-performance ultrathin MoS₂ transistors," advance online publication, *Nature Materials* (2014). Authors include Sibel Ebru Yalcin, Brittany Branch, Gautam Gupta, Aditya D. Mohite (Materials Synthesis and Integrated Devices, MPA-11); Rajesh Kappera, Damien Voiry, and Manish Chhowalla (Rutgers University).

Technical contact: Aditya Mohite

Novel noise-based probe demonstrated at the National High Magnetic Field Laboratory

Researchers demonstrated a low-power optical technique, called two-color spin noise spectroscopy, at the National High Magnetic Field Laboratory-Pulsed Field Facility at Los Alamos. The general principle, developed by a Los Alamos-led international team, proves that by measuring the fluctuation properties of a system (rather than conventional response functions), information that is generally regarded as inaccessible to conventional linear optical studies can be obtained. *Nature Communications* published the research.

The team revealed that fluctuation correlations could be used to reveal the underlying homogeneous linewidths of individual constituents within inhomogeneously-broadened systems. The scientists demonstrated the technique using electronic spins that were trapped in semiconductor quantum dots. (Quantum dots are nanometer-scale, "zero-dimensional" materials useful for electronics, photonics, and potential quantum computing applications). The researchers anticipate that the technique could also be applied to other materials and systems in which intrinsic noise fluctuations are measurable.

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Experimental schematic. Narrowband probe lasers 1 and 2 are combined in a single-mode polarization maintaining fiber (F), and subsequently focused through an ensemble of singly-charged InGaAs quantum dots, where spin fluctuations of trapped holes impart fluctuations on the polarization state of the transmitted lasers, which are measured by balanced photodetectors. MS are mechanical shutters, HWP is a half-wave plate, and WBS is a Wollaston beam splitter.

The degree of correlation between the noise on the two probe lasers, as a function of their mutual detuning. The half-width of this correlator reveals the homogeneous linewidth of the quantum dots, even though this is a low-power measurement on an inhomogeneously-broadened quantum dot ensemble.

Novel cont.

In magnetic systems, fundamental noise can exist in the form of intrinsic and random spin fluctuations. Passively “listening” to these fluctuations using sensitive optical magnetometry forms the basis of spin noise spectroscopy, wherein dynamic properties about the system (such as relaxation and coherence times) are inferred from the noise alone while in thermal equilibrium. The fluctuation-dissipation theorem supports this approach. Until now, all previous spin noise spectroscopy studies have used a single probe laser to detect a system’s intrinsic spin fluctuations.

As the name suggests, two-color spin noise spectroscopy utilizes two different probe lasers to measure spin fluctuations at different wavelengths. Correlations between these two fluctuation signals form the basis for this new methodology. When the two lasers have the same wavelength, they are sensitive to the same quantum dots in the ensemble and their spin fluctuation signals are correlated. In contrast, two lasers that are widely detuned from each other measure different subsets of quantum dots, leading to uncorrelated fluctuations. Measuring the noise correlation versus laser detuning directly reveals the quantum homogeneous linewidth even in the presence of a strong inhomogeneous broadening.

These noise-based techniques also hold promise for studies of correlations in interacting systems, such as coupled quan-

tum dot or nanocrystal systems, spin-exchange interactions in atomic gases, or spin interactions in chemical and biological systems. Advanced optical measurement methods combined with effects of magnetic fields and manipulation of spins in solids could lead toward new physics with potential applications in energy security and information processing technology.

Reference: “Two-colour Spin Noise Spectroscopy: Using Spin Fluctuation Correlations to Reveal Homogeneous Linewidths within Quantum Dot Ensembles,” *Nature Communications* 5, 4949 (2014). Authors include Luyi Yang (Condensed Matter & Magnet Science, MPA-CMMS); P. Glasenapp and A. Greilich (Technische Universität Dortmund, Germany); D.R. Yakovlev (Technische Universität Dortmund and Russian Academy of Sciences); M. Bayer (Technische Universität Dortmund); and Scott Crooker (MPA-CMMS).

The Laboratory Research and Development program funded the Los Alamos work. The research benefited from the use of the NHMFL Pulsed Field Facility at LANL, one of three campuses of the National High Magnetic Field Laboratory, which is sponsored primarily by the National Science Foundation, Division of Materials Research, with additional support from the State of Florida and the DOE. This research supports the Lab’s Energy Security mission area and the Materials for the Future science and Science of Signatures science pillars.

Technical contacts: Luyi Yang and Scott Crooker

Sinha and SFAI team win Feynman Innovation Prize

Finalists honored at ceremony

The Laboratory presented the second annual Richard P. Feynman Innovation Prize to Dipen Sinha (Materials Synthesis and Integrated Devices, MPA-11) and the Swept Frequency Acoustic Interferometry (SFAI) team.

The award celebrates the contribution of an individual or team that has successfully brought an idea to the marketplace through a partnership resulting in measurable improvement to LANL’s mission performance, positive impact to the U.S. economy (i.e., return on investment), and increased public awareness of the Laboratory’s contribution to society. The Innovation Council reviewed and ranked the nominations. The Feynman Center for Innovation Division Leader and the Chief Technology Officer selected the 2014 Innovation Prize winner from the highest-ranking nominations.

Sinha and the SFAI team developed Safire to optimize the recovery of oil from wells. The team and Chevron collaborators, in partnership with General Electric, used SFAI technol-

continued on next page

Prize cont.

ogy to develop and commercialize Safire, considered the world's most cost-effective topside multiphase flow meter. Safire determines the volumetric flow rate for each component of the fluid, continuously revealing the well's proportion of oil, gas, and water. The invention won a 2014 R&D 100 award from *R&D Magazine*. Team members are Anirban Chaudhuri, Cristian Pantea, Blake Sturtevant, Alp Findikoglu, and Dipen Sinha (MPA-11); and Craig Chavez (Applied Engineering Technology, AET-1).

Range of innovations honored at ceremony

During the awards ceremony, the Laboratory recognized the following teams as Feynman Innovation Prize Finalists:

Gary Grider (High Performance Computing, HPC-DO) with John Bent (External ICN Users, EXTICN) created the Parallel Log-structured File System. The open-source, extremely scalable data-management middleware library can be used with everything from small clusters of computers to the largest supercomputer in the world. The industry partner is EMC Corporation.

Materion Brush Team: A Cooperative Research and Development Agreement between industry partner Materion Brush Inc. and Los Alamos led to the development of a technology enabling a shipment of approximately 22,500 pounds of beryllium for recycle. Team members include James C. Foley, Beverly Aikin, and Victor Vargas (Metallurgy, MST-6); Melissa Abeyta (Personnel Security, SAFE-2); Beverly Neal-Clinton (Integrated Services, SEO-4); Loretta Gurule and Cliff Polston (Experimental Device Engineering and Assembly, W-5); Martin Griego and George Valdez (Materials Management, ASM-MM); Steven Gonzales and Cheryl Montoya (Weapons Fabricated Services, PF-WFS); Robert Gonzales and Renee Pacheco (Classified Matter Protection, PS-1); Kenneth Martinez (Vulnerability Analysis, PS-3); and Cynthia Zelic (Environment, Safety, and Health Deployed Services – Science and Technology Operations, DSESH-STO FOD).

Chris Morris and the Muon Tomography team developed a technique that uses the natural flux of muons produced by cosmic ray interactions with the Earth's atmosphere to create three-dimensional images of large objects. The team with industry partner Decision Sciences International Corporation received a 2013 R&D 100 award from *R&D Magazine* for a scanning device to detect contraband. Team members include Chris Morris, Zhehui (Jeff) Wang, Jeff Bacon, John Perry, Elena Guardincerri, J. Matt Durham, Joseph Fabritius, Dan Poulson, Shelby Fellows, Joey Elmlad, and Kenie Plaud-Ramos (Subatomic Physics, P-25).

Tom Terwilliger (Biosecurity and Public Health, B-10), Joel Berendzen and Li-Wei Hung (Applied Modern Physics, P-21) created SOLVE. The software analyzes how x-rays diffract off crystals in a protein molecule and then draws a

At the Innovation Prize Awards Ceremony, from left, Feynman Center Director David Pesiri, Verdesian Life Sciences Vice President of Science and Technology Nigel Grech, MPA-11 Group Leader Andrew Dattelbaum, MPA-11 inventor Dipen Sinha, and LANL Chief Technology Officer Duncan McBranch.

3-D picture of the protein. With 965 licenses, SOLVE is the most licensed LANL technology. The industry partner is PHENIX Industrial Consortium.

Pat Unkefer (retired LANL scientist from Bioscience Division), Thomas J. Knight (deceased), and Rodolfo Martinez (New Mexico Highlands University) developed Take Off, a seed treatment featuring a proprietary mixture of amino and organic acids. The technology has been commercialized in Europe and the United States. Verdesian Life Sciences is the industry partner.

Technical contact: Mariann Johnston

Sandberg to help steer LCLS x-ray laser user program

Richard Sandberg was recently elected a member of the Users' Executive Committee of the Linac Coherent Light Source (LCLS), the world's first hard x-ray laser, located in California, and a tool that allowed Sandberg and collaborators to create the first-ever in situ images of void collapse in explosives using an x-ray free electron laser.

Sandberg (Center for Integrated Nanotechnologies, MPA-CINT) holds a PhD in physics, with a certificate in optics, from the University of Colorado Boulder. He joined LANL in 2009 as a Director's Postdoctoral Fellow and became a staff scientist in 2011.

The committee's purpose is to help improve user operations and facility capabilities. Since opening in 2009, LCLS has served 2,040 total researchers, leading to 341 journal

continued on next page

Sandberg cont.

publications. It offers six experimental stations and attracts proposals in a range of disciplines that include biology; soft and hard materials; matter in extreme conditions; chemistry; atomic, molecular and optical; and methods and instrumentation. LCLS is part of the Department of Energy's SLAC National Accelerator Laboratory operated by Stanford University.

Sandberg team's LCLS research demonstrated a crucial diagnostic for studying how voids affect explosives under shock loading. The in situ data constitute the first experimental step toward developing next-generation, physically based mesoscale models with predictive capability for high explosives. Future facilities like Los Alamos's proposed MARIE (Matter-Radiation Interactions in Extremes) will take this research into next generation of Stockpile Stewardship in order to design the advanced materials needed to meet 21st century national security and energy security challenges.

Technical contact: Richard Sandberg

Celebrating service

Congratulations to the following MPA Division employees celebrating a service anniversary recently:

James Coulter, MPA-CMMS	30 years
Alp Findikoglu, MPA-11	20 years
Billy Vigil, MPA-CMMS	20 years
Jerzy Chlistunoff, MPA-11	15 years
Mary Elizabeth Phipps, MPA-CINT	10 years
Vanessa Gonzales, MPA-11	5 years

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To submit news items or for more information, contact Karen Kippen, ADEPS Communications, at 505-606-1822 or kippen@lanl.gov.

To read past issues see www.lanl.gov/orgs/mpa/materialsmatter.shtml.

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From Toni's desk cont.

is a time-consuming, but very rewarding process.

Programmatically, our groups are doing quite well. CINT received the written reviews from the 2013 triennial review from DOE-BES. The review was quite positive, but there are a couple of issues that will require some attention. CINT leadership is working on a formal response to this review. The NHMFL, working with its partners at Florida State University and the University of Florida, is preparing an overall strategic vision for the future of the NHMFL in preparation for an open competition for the magnet lab to be run by the National Science Foundation. The energy programs in MPA-11 are doing well despite the overall budget constraints in the national programs. Finally, we are successfully working to increase MPA's contribution to the weapons program.

On the strategic front, we are going to be "refreshing" two Areas of Leadership within the Materials Pillar: Actinides and Correlated Electron Materials and Energetic Materials. We will hold "Deep Dives" in these areas to get input from the Laboratory's materials community to update our strategy and its implementation. These are the topics that will underpin the 2015 Materials for the Future capability review to be held May 4-6. In partnership with GS and the Institute for Materials Science, we ran a successful workshop on nanomaterials for global security applications. Jennifer Martinez and Nate Mara, MPA-CINT, and Deputy Institute Leaders for the Institute of Materials Science were instrumental in organizing this workshop, which will pay off with programmatic opportunities in GS for the materials community at LANL.

Finally, I would like to wish all of you a safe and happy holiday season, preferably with a lot of snow on the ski slopes!

MPA Division Leader Toni Taylor

HeadsUP!

Laboratory earns
VPP Star status

The Laboratory has attained Voluntary Protection Program Star level recognition from the DOE, the largest site in the DOE complex to do so. VPP Star level recognition means LANL has and continues to implement excellent safety programs that systemically protect employees. It is based on an assessment of management commitment, employee involvement, worksite analysis, hazard prevention and control and safety and health training.

Achieving VPP Star Status follows the Lab attaining VPP Merit level recognition in 2010. At the time, then Director Michael Anastasio committed LANL to pursuing VPP Star Status. During the most recent VPP assessment last spring, DOE assessors focused on the Los Alamos Neutron Science Center at TA-53 and technical areas 54 and 55. Workers and managers were encouraged to participate in the assessment.