AOT & LANSCE The Pulse

December 2012

INSIDE

Gary Holladay

Taking action in working safely

By Diana Del Mauro
ADEPS Communications

Gary Holladay monitors beam status in the Central Control Room of the Los Alamos Neutron Science Center. (Photos by Ethan Frogett)

Gary Holladay of Accelerator Operations & Technology (AOT-OPS) had just started the Friday night shift when the letters "DPW" turned red on a status screen in the Central Control Room of the Los Alamos Neutron Science Center, indicating an equipment problem.

Two neutron detectors had faulted electronically. Holladay, the operations shift supervisor who runs the beam for the half-mile long linear accelerator, jumped up to fix the problem. He drove across La Mesita Road and descended the steps to Lujan Center Experimental Room 1 (ER-1).

While plugging in a surge protector and checking connections, Holladay was unaware that his right knee, his right elbow, and his feet were brushing against a thin film of powder. On his way out, he ran his hands along the stair railings.

> "I felt it was very important, especially in the immediate aftermath of the event, to 'catch someone in the act of doing something right.' Had Gary not done what he did—in fact, what he always does—the contamination would have spread even further."
>
> *Laboratory Director Charlie McMillan*

At that point, Holladay's task in ER-1 was complete. He could have headed straight back to his workstation, but Holladay's sound work practices are deeply ingrained.

On August 24, he stepped into the Blue Room's radiation portal monitor, adjacent to ER-1, and the beeps rang out. Over the years, Holladay had never triggered a positive reading. Promptly, and properly he reported the issue. He also instructed the other accelerator operators to stay out of ER-1. "I was more concerned about my crew than the beam at that point," he said.

Before routine radiation surveys in ER-1 were scheduled to take place, Holladay's diligence and sound safety practices alerted Los Alamos National Laboratory to the inadvertent spread of technetium-99. The substance is a source of beta radiation—low-power, fast-moving electrons that can travel through several feet of air, but are generally stopped by clothing and skin. The on-site and off-site contamination

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From Alex's Desk

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'Overall . . . LANSCE had a very productive year . . .'

Colleagues,

Let me start by wishing all a great winter break. For all the good and interesting reasons, I believe we will all remember 2012 for a long, long time. Overall, even taking into consideration the Lujan Center technetium spread event, LANSCE had a very productive year, from continuing progress with the Linac Risk Mitigation to new WNR capabilities, including the new building.

Hope you will enjoy this month's featured profile on Gary Holladay. Gary's conduct of operation practices proved to be paramount as far as early detection and further contamination control.

I also would like to bring to your attention the call for nominations for the 2013 Rosen Scholar. This is a great opportunity to bring very high level scientific leaders to LANSCE facilities and start new collaborations. For additional details, please visit lansce.lanl.gov.

Last, but not least, please join me in congratulating Paul Lewis as the selected candidate for the LANSCE FOD position. His experience and knowledge of LANSCE facilities is a plus for this complex job and we are all looking forward to working with Paul in this new capacity.

Enjoy the break folks!

LANSCE Deputy Division Leader
Alex Lacerda

Holladay . . .

posed no danger to the public, but the event shut down the Lujan Neutron Scattering Center for a considerable amount of time as the contamination was cleaned up.

In recognition of his conscientiousness, he received a handwritten note from NNSA Administrator Thomas D'Agostino thanking him for his "excellent work and safety practices," plaudits from Laboratory Director Charlie McMillan during a meeting in his office, and a Laboratory Spot Award.

"I felt it was very important, especially in the immediate aftermath of the event, to 'catch someone in the act of doing something right,' " said McMillan. "Had Gary not done what he did—in fact, what he always does—the contamination would have spread even further."

The Laboratory is addressing the root causes of the event. Additionally, as part of the resumption process several radiological foot and hand monitors are now installed in ER-2, to be shared by both experimental halls.

So, why did Holladay use the whole body monitor when he was in the middle of solving a problem?

It was simply part of his routine and his tendency to err on the side of caution. Flip through the log book and you'll see Holladay is one of only a few people who continued to "portal out" of ER-1 when exiting through the Blue Room, even though the requirement was lifted years ago. This sense of caution was instilled in Holladay in part by (now retired) crew chief Chuck Burns, who encouraged Holladay to self-monitor before heading back to his workstation.

"I'm religious about it," Holladay said. "I look forward to the future, and I don't want to make a mess anywhere." Besides, he noted, the time it takes to prevent a mess is less than the time it takes to clean up one.

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Gary,

Thank you for your excellent work and safety practices last week. Your diligence has allowed us to get in front of and address a serious contamination event. I personally thank you for your work at the lab and in how you do your work. You have made a real and positive difference.

Thomas Paul D'Agostino

Holladay's note from NNSA Administrator Thomas D'Agostino.

Holladay with the sandwich grill he chose as his Laboratory Spot Award gift. He's bequethed it to his teammates for their use.

Design and manipulation of macroscopic quantum states in materials

Researchers from DOE's Institute for Quantum Matter at Johns Hopkins University collaborated with Anna Llobet (Lujan Neutron Scattering Center, LANSCE-LC) to discover a new driving force for the emergence of highly entangled quantum states of matter: a mixed-valence-driven heavy fermion state in KNi_2Se_2. The finding is relevant to a class of materials called "heavy-fermions," metals in which the conduction electrons behave as though they have a mass 10-1000 times that of a normal electron. This happens in systems where individual magnetic electrons become indistinguishable as a result of strong interactions with a bath of non-magnetic conduction electrons. The result is an overall non-magnetic state that is coherent across the material, causing deviations from traditional solid-state theory and behavior. The journal *Physical Review B* published the research.

The paper presents the discovery of a new class of heavy-fermion materials in which the fundamental interaction that gives rise to the emergent electronic state is electrostatically driven, rather than magnetically. The scientists used pair distribution function analysis of neutron total scattering data from the LANSCE Lujan

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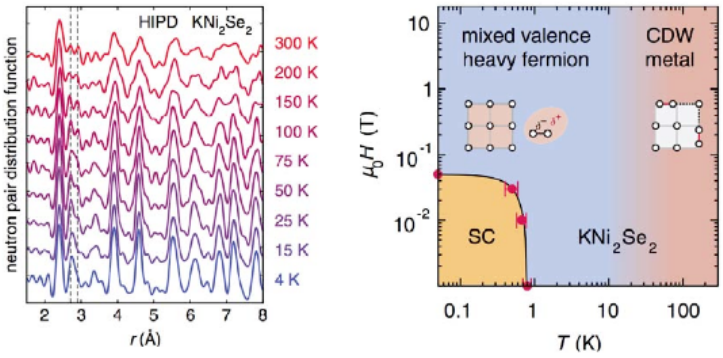

Left: Temperature-dependent pair distribution function analysis of KNi_2Se_2 reveals multiple Ni-Ni distances at T=300K (dashed lines at r ~2.7Å and 2.9Å), yet only one Ni-Ni distance at T=4K. The loss of multiple Ni-Ni distances occurs between T=25 K and T=15 K. Right: The temperature/field phase diagram shows the superconducting, field-independent mixed-valence heavy fermion and incipient charge-density wave metal states of KNi_2Se_2.

Design . . .

Center. The researchers first observed a local distortion in KNi_2Se_2 that disappeared on cooling the sample, a highly unusual and rare structural trend. This distortion, an aperiodic charge density wave (CDW) reflects the fluctuations of nearly localized charges. The disappearance is accompanied by the formation of a "heavy" electronic mass state, which indicates a quantum mechanical hybridization of the electronic states. Superconductivity emerges from the heavy-mass state at a temperature of 0.80(1) K. This discovery is important in the quest for new exotic states of matter because it demonstrates a new strategy for the design and manipulation of large-scale quantum states and energy harvest and conservation.

Reference: "Mixed-valence-driven Heavy-fermion Behavior and Superconductivity in KNi_2Se_2," *Physical Review B* **86**, 054512 (2012). Researchers include James R. Neilson, Andreas V. Stier, Liang Wu, Jiajia Wen, Zlatko B. Tesanovic, N. P. Armitage, and Tyrel M. McQueen (Johns Hopkins University); Anna Llobet (Lujan Center, LANSCE-LC); Jing Tao and Yimei Zhu (Brookhaven National Laboratory).

The DOE Office of Basic Energy Sciences, Division of Materials Science and Engineering funded the LANL work, which benefited from the use of the high-intensity powder diffractometer (HIPD) and the neutron powder diffractometer (NPDF) at LANL's Lujan Neutron Scattering Center. Scientists performed a portion of this research at the National High Magnetic Field Laboratory (Tallahassee, FL), which the National Science Foundation, the State of Florida, and the DOE sponsor. The work supports the Laboratory's Energy Security mission area and the Materials for the Future science pillar.

Technical contact: Anna Llobet Megias

New insight into uranium oxide surfaces

The complexity of uranium oxide–arguably the most important technological form of uranium–exhibits some of the most intriguing and challenging chemistry known. Indeed, the compositions of uranium oxides are numerically variable, and susceptible under various environmental conditions. Even the deceptively simple cubic structure of UO_2 masks incredibly complex speciation following exposure to air. The scientific challenge is to identify, measure, and understand those aspects of actinide speciation that carry information about the changes within these materials as a function of aging conditions without disturbing their microstructures.

In recent work accepted to be published in *Analytical Chemistry* Lujan Center scientists Peng Wang and Jarek Majewski, in collaboration with Heming He, Marianne Wilkerson and Kirk Rector from LANL Chemistry Division and David Allred from Brigham Young University's Department of Physics and Astronomy, used a combination of surface enhanced Raman spectroscopy (*SERS*) and neutron reflectometry (*NR*) to nondestructively characterize with angstrom level resolution the chemical speciation in an

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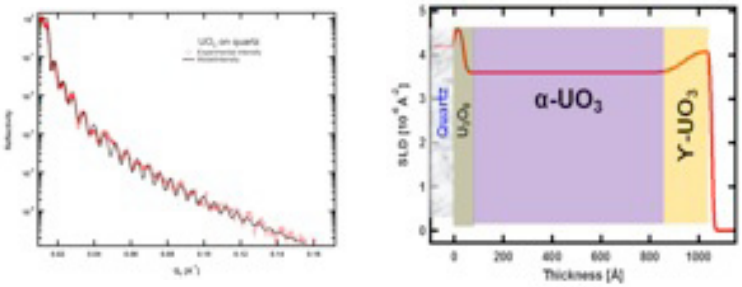
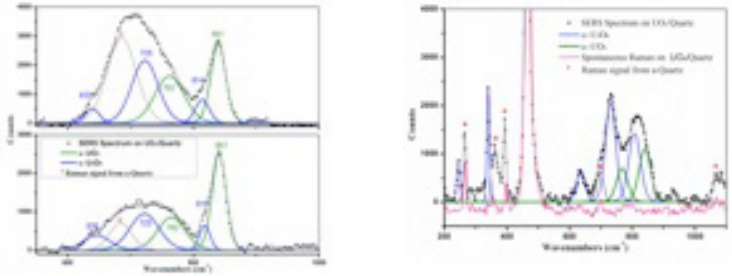


Above: Left: NR spectrum in the form of R vs. Q_z from UO_x coated mono-crystalline α-quartz. The data is represented by open circle with error bars indicating one standard deviation. The solid lines through the data points are the best-fit corresponding to the scattering length distribution (SLD) profiles shown in right.

Below: Left: shell-isolated Au-NPs enhanced SERS spectra obtained on the UO_x thin film showing dominant chemical speciation of γ-UO_3 on these selected locations, respectively. Right: comparison of the SERS and spontaneous Raman spectra (red) recorded on a carefully polished location of the thin film; the former showing a mixed γ-UO_3 and α-U_3O_8 feature, while the later only obtained the quartz signal.



Insight . . .

ultrathin uranium oxide film deposited on quartz substrate. The measurements establish the ability to determine the chemical speciation and depth of both the surface and underlying layers of a film that could lead to a quantitative measure of oxidation kinetics in these and other materials. This fundamental approach provides the ability to characterize the rates of changes in environmental samples. The practical implication of this behavior is the ability to maintain stable forms of nuclear fuel over time, to provide safe mechanisms for storage of spent nuclear fuel, to predict transport and fate, and to assess the forensic properties of nuclear materials.

"*Characterization of Chemical Speciation in Ultra Thin Uranium Oxide Films,*" Heming He, Peng Wang, David D. Allred, Jaroslaw Majewski, Marianne P. Wilkerson, Kirk D. Rector, accepted in *Analytical Chemistry*, November, 2012.

This work benefited from the use of the Lujan Neutron Scattering Center at Los Alamos Neutron Science Center funded by the DOE Office of Basic Energy Sciences and Los Alamos National Laboratory under DOE Contract DE-AC52-06NA25396 and from support of the U.S. Department of Energy through the LANL/LDRD Program.

Technical contacts: Kirk D. Rector and Jaroslaw (Jarek) Majewski

Celebrating service

Congratulations to the following AOT Division employees celebrating service anniversaries recently:

David Henderson, AOT-OPS	35 years
Lawrence Earley, AOT-RFE	25 years
Michael McCormick, AOT-OPS	20 years
Peter Walstrom, AOT-ABS	15 years
Louis Fernandez, AOT-RFE	15 years
Raymond Valicenti, AOT-MDE	15 years
Monica Sanchez, AOT-ABS	10 years
Eduardo Garcia, AOT-OPS	10 years

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

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To read past issues, see lansce.lanl.gov/pulse.shtml

HeadsUP!

Reduce fire hazards around buildings

The below average summer "monsoon" season means that dry conditions remain, which could lead to potential fires on Lab property. There are some things employees can do to help reduce potential fire hazards, according to Manny L'Esperance of Emergency Management (EO-EM).

- Facility operations personnel and other employees are encouraged to conduct walkarounds of their buildings and remove weeds, debris and other materials that could catch fire. These include pine needles, standing grasses and low-hanging tree branches.
- Personnel from Emergency Operations fire staff and Fire Protection (FP) Division are available to assist in walking Laboratory spaces and developing a risk assessment for work areas.
- Smoking in designated smoking areas is allowed at LANL, but cigarette butts should be discarded in receptacles. Smoking along walking and bicycle paths is discouraged. Similar defensible space actions should be used at home.
- Employees who observe smoke or fires should call 911 and then Emergency Operations.

Questions? Call 7-6211.

Recycling at LANL

Don't know what you can recycle at the Lab or who can help? Check out the Recycling at LANL website (int.lanl.gov/environment/p2/recycle/index.shtml) for resources and useful tips. Or check out the associated website (int.lanl.gov/environment/p2/recycle/detail.shtml) with A to Z guidance on recycling. It's jam-packed with info on recycling such things as

- batteries,
- binders,
- books,
- electrical equipment,
- light bulbs,
- paper plates and cups (both used & unused),
- and, of course, the standard stuff like aluminum cans, plastic bottles, and paper.

Need help? Email wastenot@lanl.gov for recycle pickup requests, recycling and sanitary waste reduction, waste and recycle questions, or call the Pollution Prevention (P2) Team at 5-8855.