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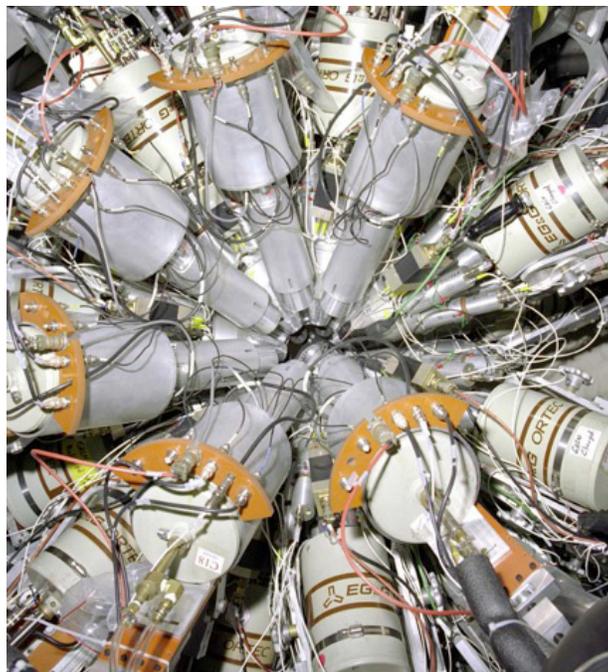
Recent results on nuclear structure of tin isotopes from GEANIE

A team of scientists, including researchers from Nuclear Science (LANSCEN-S) have recently completed a series of studies on the nuclear structure of tin isotopes, observing for the first time transitions above the previously known 10+ isomers.

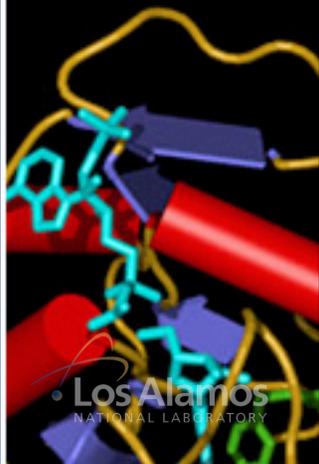
In nuclear technology tin is important because it is used in cladding of fuel rods in nuclear reactors and the heavier tin isotopes are produced as fragments in the fissioning of actinides. Hence, knowledge of rates of neutron induced reactions on tin isotopes is needed. Nuclear models in which nucleons occupy orbitals, much like the orbitals in atomic physics, have been successful in explaining nuclear energy levels. Similar to atomic electron shells, nuclear theory predicts "magic numbers" of closed nuclear shells for both protons and neutrons. The tin isotopes have been a testing ground for such models and methods for many decades. The closed proton shell in tin isotopes makes them amenable to shell model calculations.

The researchers performed measurements of nuclear reaction rates by observing gamma rays emitted in neutron induced reactions on the heaviest stable tin isotope ^{124}Sn (50 protons and 74 neutrons), specifically, reactions where 1 to 8 neutrons are ejected from the recoiling nucleus. They used the GEANIE spectrometer, comprised of high-resolution germanium detectors to detect gamma rays, and the pulsed neutron source of the Los Alamos Neutron Science Center's Weapons Neutron Research (WNR) facility that provides neutrons over a wide energy range. Measuring these reaction rates and comparing with model predictions helps improve understanding of nuclear reactions and the structure of the nucleus, sustaining nuclear science in support of Los Alamos's scientific and defense missions.

In the process of analyzing the data from this experiment the researchers observed for the first time γ -rays feeding the previously known long-lived states in $^{118,120,122}\text{Sn}$ (2.5-, 6.26- and 62- μs isomeric half lives, respectively). These experimental results, which appeared in *Physical Review C*, are in excellent



The GEANIE spectrometer with its germanium detectors viewed from above.





'LANSCCE was one of the participants of NUFO's most important outreach activities for 2011, the April User Science Exhibition at the U.S. House of Representatives.'

Colleagues,

I would like to bring to your attention the National User Facility Organization (NUFO) of which LANSCE is an integral part. NUFO represents the interests of about 30,000 users who conduct research at 39 U.S. national scientific user facilities, as well as scientists from U.S. universities, laboratories, and industry. LANSCE is an active member and a participant of NUFO sponsored events.

NUFO facilitates communication among users, user organizations, facility administrators, and other stakeholders. It seeks to provide a unified message at the national level on issues of resources for science, economic competitiveness, and education for the next-generation scientific workforce.

LANSCCE was one of the participants of NUFO's most important outreach activities for 2011, which was the April User Science Exhibition at the U. S. House of Representatives. Held in the

Rayburn Foyer of the Rayburn House Office Building, the exhibit was organized to highlight the significant role that user facilities play in science, fundamental knowledge, and economic competitiveness. Additional information about NUFO can be found at: www.nufo.org. LANSCE will take part organizing the 2012 NUFO Annual Meeting.

Let me also take this opportunity to thank all involved in organizing the 2012 LANSCE Topical Users Meeting. The meeting took place January 9-10 here at TA-53 focusing on three main themes: neutron radiography (organizers: Michal Mocko and Ron Nelson), nuclear sciences (organizers: Fredrik Tovesson and Steve Wender), and new directions in local structure (organizers: Kate Page and Anna Llobet). It was a very successful meeting with strong external participation engaging with LANSCE facilities defining and/or expanding new science endeavors.

LANSCCE Deputy Division Leader Alex Lacerda

GEANIE... agreement with predictions from shell model calculations.

This work combined data taken with the Gammasphere spectrometer at Lawrence Berkeley National Laboratory using heavy-ion reactions that complement the GEANIE data.

The combination of the GEANIE spectrometer with the neutron source of LANSCE/WNR facility has been extensively used to measure reaction rates and contributed significantly to knowledge of level schemes of isotopes in the past. The researchers are confident that it will continue doing so in the future. One of the most notable accomplishments of the GEANIE spectrometer at LANSCE was the measurement of the $^{239}\text{Pu}(n,2n)^{238}\text{Pu}$ reaction rate that is an important diagnostic for defense program needs. The GEANIE project is supported by funding from the U.S. Department of Energy Office of Science and NNSA defense programs.

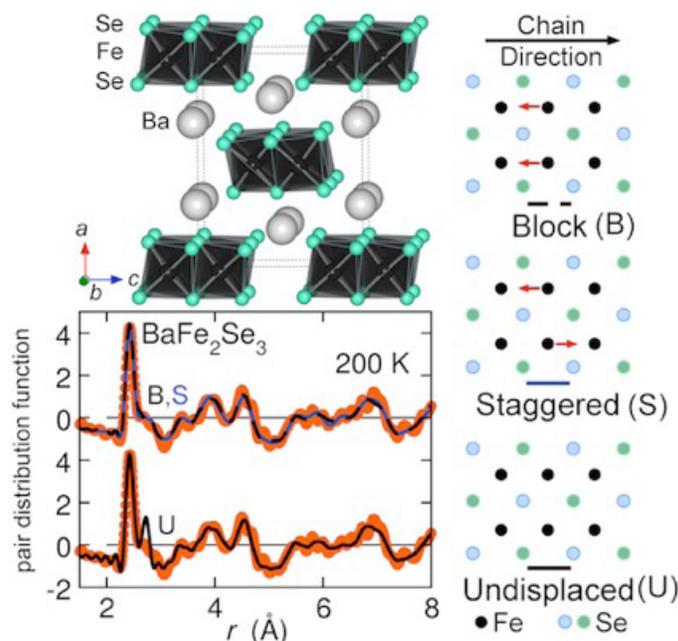
Reference: "States built on the 10+ isomers in $^{118,120,122}\text{Sn}$," by N. Fotiadis, M. Devlin, R. O. Nelson, (LANSCE-NS) J. A. Cizewski (Rutgers University), R. Krucken, (Technische Universitat Munchen and TRIUMF), R. M. Clark, P. Fallon, I. Y. Lee, and A. O. Macchiavelli (Lawrence Berkeley National Laboratory), and W. Younes (Lawrence Livermore National Laboratory).

Technical contact: N. Fotiadis

Local iron displacements and magnetoelastic coupling in the antiferromagnetic spin-ladder compound BaFe_2Se_3

In research appearing in *Phys. Rev. B. Rapid Comm*, scientists from John Hopkins University in collaboration with Anna Llobet (Lujan Neutron Scattering Center, LANSCE-LC) reveal the existence of highly correlated local Fe displacements in the spin-ladder iron chalcogenide BaFe_2Se_3 . Their results confirm significant magnetoelastic coupling in $[\text{FeX}_4]$ -based materials, an ingredient hypothesized to be important in the emergence of superconductivity and confirm that knowledge of these local displacements is essential for properly understanding the electronic structure of these systems

Indeed, through the analysis of the neutron diffraction experiments performed at LANSCE (HIPD and NPDF instruments), the researchers discovered that short-range magnetic correlations ($\xi \sim 35 \text{ \AA}$), present at room temperature, develop into long-range antiferromagnetic order below $T_N = 256 \text{ K}$, with no superconductivity down to 1.8 K. Built of ferromagnetic Fe_4 plaquettes, the magnetic ground state correlates with local displacements of the Fe atoms as determined from neutron pair-distribution function analysis of



The spin-ladder BaFe_2Se_3 exhibits local Fe-Fe displacements along the chain direction; the magnitude of the displacements are magnetoelastically coupled.

the same data. This finding was uniquely enabled by the extremely broad Q range of HIPD: while the experiment was originally performed to determine the nature of magnetism in the double-chains, analysis of the total scattering profile revealed these Fe displacements. An additional experiment performed on NPDF confirmed the presence and magnitude of these displacements.

As with the copper oxide superconductors two decades ago, their results highlight not only the importance of reduced dimensionality in spin-ladder compounds, but also show that local metal atom displacements are ubiquitous in $[\text{FeX}_4]$ -based materials and must be included when trying to understanding the resulting magnetism and superconductivity. Similar local offsets have been observed in FeSe and $\text{FeSe}_{1-x}\text{Te}_x$, (see Science Highlights, 9/21/2011) with the presence or absence of superconductivity being very sensitive to their pattern.

The research was supported by the US Department of Energy, Office of Basic Energy Sciences, Division of Materials Sciences and Engineering. This work has benefited from the use of HIPD and NPDF at the Lujan Center at Los Alamos Neutron Science Center, funded by DOE Office of Basic Energy Sciences.

Reference: "Iron displacements and magnetoelastic coupling in the antiferromagnetic spin-ladder compound BaFe_2Se_3 ," *Phys. Rev. B* **84**, 180409(R)(2011) by J. M. Caron, J. R. Neilson, D. C. Miller, and T. M. McQueen (The Johns Hopkins University, Maryland) and Anna Llobet (LANSCE-LC).

Technical contact: Anna Llobet

Emergent magnetism at LaAlO₃/SrTiO₃ interfaces: Fact or fiction?

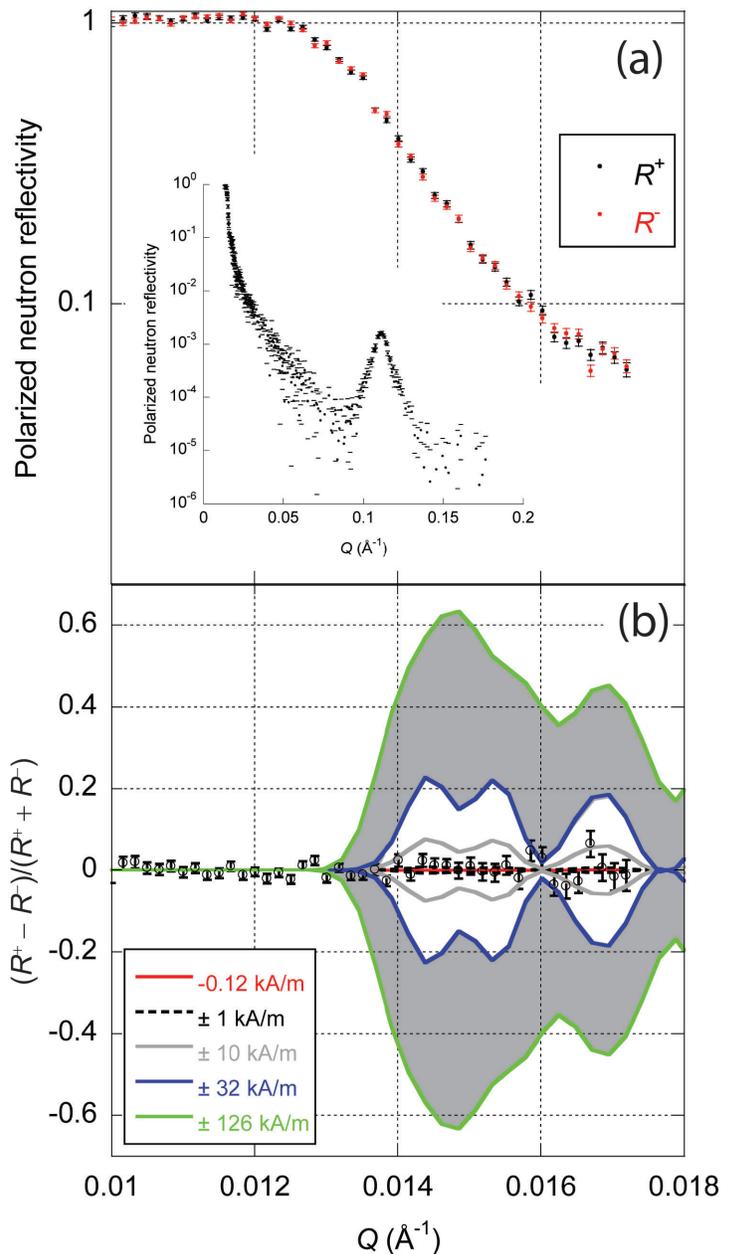
Using polarized neutron reflectometry (PNR), Los Alamos researchers and collaborators have measured the neutron spin-dependent reflectivity from four LaAlO₃/SrTiO₃ superlattices, observing important restrictions on theories that imply a strongly enhanced magnetism at the interface between LaAlO₃ and SrTiO₃ [M.R. Fitzsimmons et al., *Phys. Rev. Lett.* **107**, 217201 (2011)].

Improvements in sample fabrication capabilities have enabled the growth of increasingly complex materials with crystalline quality. This has allowed observation of exotic behavior, such as the electronic confinement of a two-dimensional electron gas at the interface between two nominally insulating materials, LaAlO₃ and SrTiO₃. The conductivity can be strongly affected by magnetic fields—despite neither being magnetically ordered.

Bulk magnetometry measurements of LaAlO₃/SrTiO₃ bilayer samples have reported magnetization exceeding 10 kA/m, if attributed to the interface. Bulk magnetometry, however, cannot identify whether the origin of the magnetic signal is from the interface, substrate, film bulk, or contamination on the sample or in the magnetometer. Given the community's keen interest in emergent magnetism, the researchers used PNR, which is intrinsically sensitive to interfacial magnetism, to look for magnetism at a LaAlO₃/SrTiO₃ interface.

Data of the neutron beam spin asymmetry obtained from two superlattice samples at 11 T and 1.7 K are shown in the figure (symbols). The solid curves and region between them, represent the range over which the data should have been observed, had the magnetization measured by bulk magnetometry been produced by the LaAlO₃/SrTiO₃ interface. The neutron data are inconsistent with this explanation and instead establish an upper limit of < 2 kA/m to magnetism for the LaAlO₃/SrTiO₃ interface.

Los Alamos personnel included M.R. Fitzsimmons, N.W. Hengartner, S. Singh and M. Zhernenkov (LANSCÉ-LC). Samples were grown in Twente by A. Brinkman, M. Huijben, H. Molegraaf and in Madrid by F.Y. Bruno and J. Santamaria. Bulk magnetometry was performed at the University of California, San Diego by J. de la Venta and Ivan K. Schuller. The Los Alamos portion of the work was supported by the Office of Basic Energy Science, U.S. Department of Energy, BES-DMS funded by the Department of Energy's Office of Basic Energy Science, DMR under grant DE FG03-87ER-45332.



(a) Polarized neutron reflectivity from one superlattice sample and (inset) R^+ from a second superlattice sample over a broader range of wavevector transfer Q . (b) Spin asymmetry of the neutron reflectivity (1-sigma errors). Curves show the spin asymmetry anticipated for some values of magnetization.

Celebrating service

Congratulations to the following AOT Division employees celebrating a service anniversary this month:

Victor Vigil, AOT-MDE 35 years
 Brandon Roller, AOT-MDE 15 years
 Eron Kerstiens, AOT-OPS 10 years

Coming soon: Los Alamos's Environmental Recertification Audit

The "ISO 14001 Environmental Recertification Audit" will occur February 13 -17. Most likely it will touch every corner of the Laboratory, including divisions associated with ADEPS. This column is meant to provide you with basic information as to what the audit is all about and what important things you should know. E-mail updates will be forwarded to our divisions as final audit plans and schedules become available.

First and foremost, please consider familiarizing yourself with the LANL EMS webpage off the LANL home page (click on the "Environment" tab at the top of the page); as with most audits, workers are not always expected to know every policy, detail or plan – but- they should know how to find them!

Each worker should be able to:

- Describe their role and function at LANL,
- Discuss how their work may interact with the environment (directly and indirectly), and
- Explore what steps they take or could take to improve environmental performance.

Each worker should be able to describe/able to find:

• Laboratory Environmental Governing Policy, which states: *"We approach our work as responsible stewards of our environment to achieve our mission. We prevent pollution by identifying and minimizing environmental risk. We set quantifiable objectives, monitor progress and compliance, and minimize consequences to the environment, stemming from our past, present, and future operations. We do not compromise the environment for personal, programmatic, or operational reasons."*

- Their EMS point-of-contact:

ADEPS POCs: MST – Jim Coy; MPA – Cathy Padro; LANSCE – Frances Aull; Physics – Steve Glick

- Their EMS Environmental Action Plan actions (if they have actions):

The FY12 ADEPS EAP and much more can be found within the Lab's EMS Web page at int.lanl.gov/environment/ems/index.shtml.



'Most likely (the audit) will touch every corner of the Laboratory, including divisions associated with ADEPS.'

More information on our FY12 Environmental Action Plan and the various actions certain individuals will need to take will be distributed shortly.

- Their current/up-to-date work procedures
- Any measuring and testing equipment used in activities that may interact with the environment and the associated M&TE calibration records
- Their environmental records:
It is strongly encouraged that all staff have their required Environmental Awareness Training (#32461) completed; annual refresher course (#52121) is also available in UTrain.

Each manager should be able to describe:

- Their organization's activities that may interact with the environment,
- Their management role in activities that may interact with the environment,
- Their commitment to the Laboratory Governing Policy and their EMS EAP,
- Examples of improvements to their organization's environmental performance, and
- Outcomes of the management review of the EMS and previous year's EAP (this can be found at the LANL EMS Web page at int.lanl.gov/environment/ems/index.shtml, under the Directorate Achieves

link, click on ADEPS, then on FY11 TR 5.2 to find the review document).

The EMS program at LANL conforms to the ISO 14001 standard as required within the LANL/NNSA Prime Contract with the DOE. The specific requirement calls for an independent third-party recertification audit of the entire organization once every three years.

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). International Standards covering environmental management are intended to provide organizations with the elements of an effective environmental management system (EMS) that can be integrated with other management requirements and help organizations achieve environmental and economic goals.

Steve Glick, ADEPS EMS point of contact

Meeting planning services available

Got a conference that needs organizing, an event to be planned?

Rose Romero, the ADEPS meeting coordinator, can help.



With 15 years of Los Alamos conference planning experience, Romero has assisted staff members in planning conferences both large and small, from locally held meetings with a dozen participants to international conferences for hundreds of attendees. Knowledgeable in the Laboratory's conference management policies and associated allowable conference costs, she can help in overseeing the details that ensure a smooth, successful event.

Romero can assist with developing and overseeing allocated workshop budgets, obtaining the necessary cost codes for workshop funding, negotiating and overseeing contracted food services, and in planning and executing workshop and conference web sites. Her experience includes arranging for transportation, conference facilities, and accommodation and preparing pre-conference materials such as invitation letters, badges, folders, and participant lists. During the workshop, she can manage the registration desk, help with setting up meeting rooms, and with compiling agendas, abstracts, and related materials into post-conference documents.

"I love the variety and working on things from start to finish," Romero said. "Meeting planning is like putting together a puzzle. Every piece must fit the puzzle for the puzzle to be successfully complete."

Romero can be reached by calling 665-7657 or emailing rbromero@lanl.gov.



"Meeting planning is like putting together a puzzle. Every piece must fit the puzzle for the puzzle to be successfully complete."

HeadsUP!

Call issued for 2012 pollution prevention award nominations

The Lab is now accepting nominations for 2012 pollution prevention awards. P2-related projects and activities that have reduced pollution, enhanced operations, saved money, or reduced environmental impacts are eligible for nomination. Nominations are due by the end of the work day on February 10. Questions? Contact the Pollution Prevention Program Office at 5-8855 or p2awards@lanl.gov.

Driving a government vehicle?

Did you know that LANL workers cannot use cell phones and similar electronic devices or perform other distracting activities while operating government vehicles? Lab policy on Vehicle and Pedestrian Safety, P101-7, states that these activities should only be performed when the vehicle is safely stopped or parked. (Note: This requirement does not apply to Emergency Operations and Security subcontractor personnel responding to an emergency.)

Workers should also avoid distractions while operating privately-owned vehicles on LANL-managed roadways. Such distractions include, but are not limited to,

- wearing headphones or other listening devices that could prevent the recognition of emergency alarms;
- using cellular phones and similar electronic devices;
- reading maps; and
- operating a global positioning device.

Safely stop or park your vehicle before performing these activities.

AOT & The Pulse

Published monthly by the Experimental Physical Sciences Directorate.

To submit news items or for more information, contact Karen Kippen, EPS Communications, at 606-1822, or kkippen@lanl.gov LALP-12-005

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

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