AOT & LANSCE The Pulse

April z` 2008

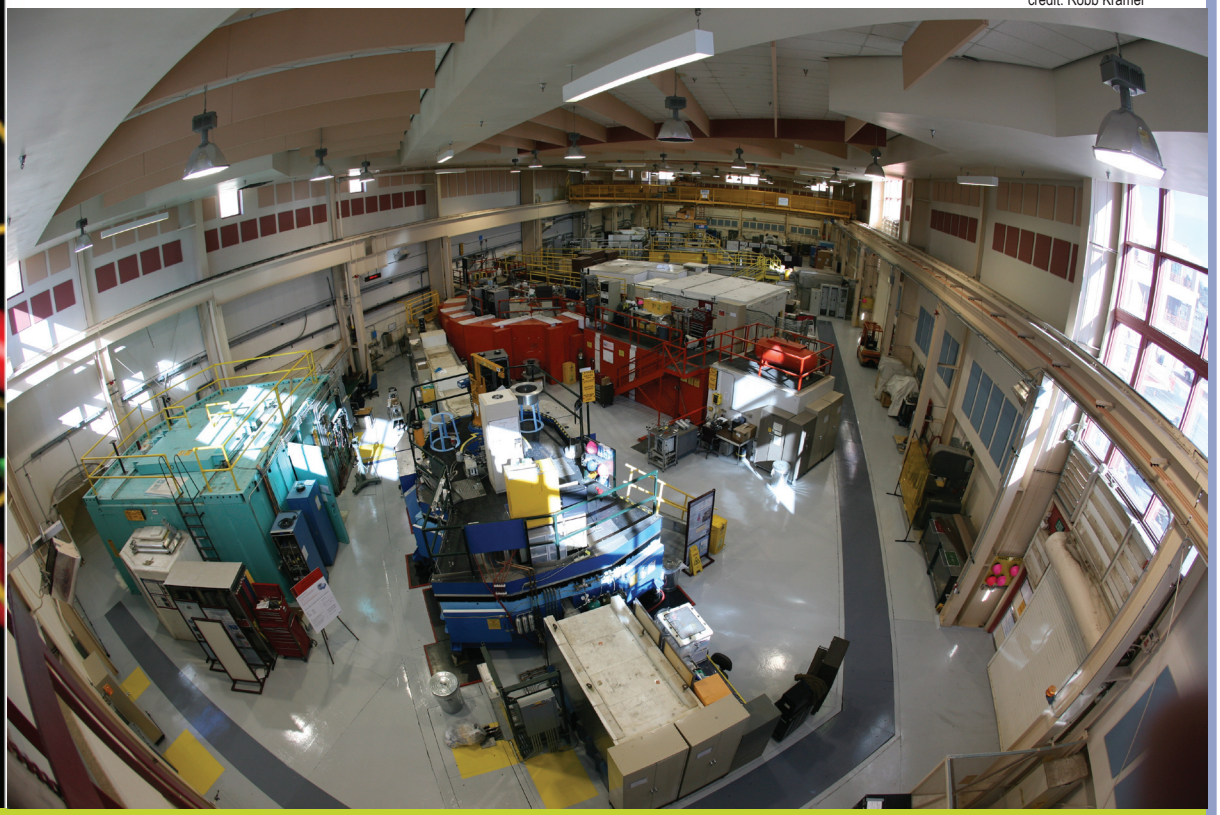
INSIDE

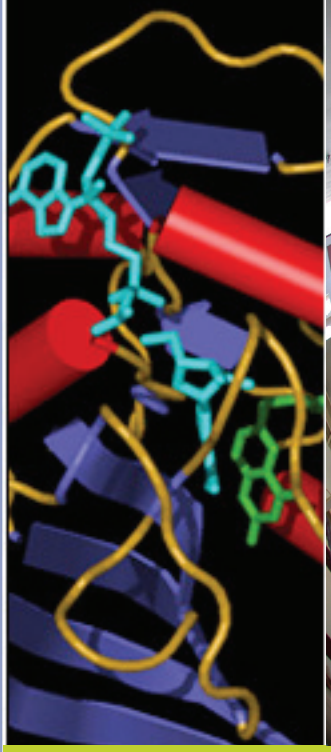
DOE Basic Energy Sciences three-year review of the Lujan Center

The three-year review of the Lujan Center occurred February 9-12 with a panel of eight eminent scientists from the U.S. and Europe. Pedro Montano of DOE BES lauded the scientific presentations by Lujan Center users, remarking that these talks were among the best he has seen. Mike Anastasio (DIR), Terry Wallace (PADSTE), and Susan Seestrom (ADEPS) gave video presentations and Rich Marquez (DIR), Alan Bishop (ADTSC), Kurt Schoenberg (ADEPS), and Kevin Jones (AOT-DO) gave introductory presentations. Highlighted talks include the following: "Magnetic Films" - Steve May (Argonne National Laboratory); "Spin Waves" - Rob McQueeney (Ames Laboratory and Iowa State University); "Local Structure Investigation of Bulk and Nanophase Materials" - Katharine Page (Lujan Center, recently UCSB); "Wrinkling in Physics and Biology" - Ka Yee C. Lee (University of Chicago); "Bridge Cable Failures" - Cev Noyan (Columbia University); "Pyramid Cement and Concrete" - Michel Barsoum (LANL Wheatley Scholar, Drexel University)

Neutron scattering instruments in the Lujan Center beam room.

credit: Robb Kramer





From Alan's desk

Enhancement of the Lujan Neutron Scattering Center at LANSCE

It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair, we had everything before us, we had nothing before us, we were all going direct to heaven, we were all going direct the other way…

—Charles Dickens, A Tale of Two Cities

I remind you of this famous moody quote by Charles Dickens to point out that hope springs from the chaos of good and bad circumstances. Many are losing jobs, scientists are anticipating a Sputnik-like resurgence, a recession threatens depression, scientists rejoice at the choice of policy-level leadership, the energy problem looms, even the public is suddenly paying attention to education, the NNSA labs face cuts, the science labs are being funded to take an increasing role in society.

The precipitating crisis for these historic circumstances has been brewing. Major parts of the scientific enterprise of the United States are finally taking a dramatic upswing in federal investments toward the vision laid out four years ago in the National Academies' report *Rising Above the Gathering Storm*, which enunciated the case for investment in science and education to regain innovation-created competitiveness. Regrettably, politically misalignments have delayed action on this agenda. Now, while much of the global economy teeters on collapse, I feel a tinge of "survivor guilt" as funding possibilities open up.

Sprouting from the enthusiasm for a refurbished accelerator at Los Alamos, we at the Lujan Center are in a steady climb toward a vision we call "full utilization." The Enhanced Lujan Program (ELP) objectives are to increase user support and instrument quality to world-competitive levels with all available flight paths utilized fully. ELP is an $80M program designed to transform Lujan Center over five years under primary sponsorship of the Office of Science.

My main message is that you can be involved in exciting, new instrumentation concepts for your own research. The process for planning instrumentation enhancements began with community outreach workshops in 2005-2007 but also extending to cost studies, reviews, and workshops since 2001. From this planning and a call for letters of intent last year, instrument advisory teams (IATs) have been self-identifying and meeting in mini-workshops. Reports from IATs will lead to formal proposals to BES (or, in some cases, National Science Foundation). We want to know your needs in materials research.

You don't have to be an expert in neutron scattering to be a member of an IAT. We have the expertise to turn your ideas into instrumentation concepts. An exciting direction for neutron instrumentation is to incorporate a benchtop measurement into a scattering instrument, often in a "pump-probe" set up. Because neutron scattering information is in some sense orthogonal to that of other techniques, the combined experiment provides a "cross product" that fills a volume of phase space information in one sweep. An example of a pump-probe apparatus is the new shear cell we recently developed for small-angle scattering and reflectometry. The cell can be programmed to shear a complex fluid in sync with the 20-Hz neutron beam, which enables snapshots of mesoscale structure as a function of the phase of a periodic stress with simultaneous rheometry.

Three IAT meetings have occurred so far this year, for diffractometers SMARTS and HIPPO and for a proposed new inelastic neutron scattering spectrometer. Four more meetings will be held at Oak Ridge in May, and up to three meetings are planned on University of California campuses this summer. There is plenty of time to join an IAT by sending me an email

continued on page 3

or calling. (We thank sponsors John Sarrao of the Los Alamos National Laboratory Office of Science and Nan Sauer of the Los Alamos institutes. Prof. Michel Barsoum, the Wheatley Scholar at the Lujan Center funded by PADSTE, has been invaluable and tireless in leading planning teams.)

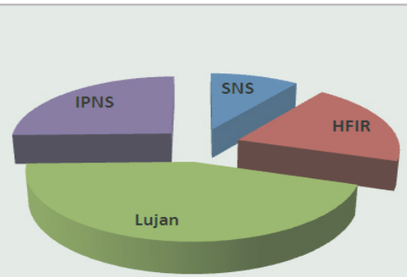
Among the new instruments being discussed, inelastic neutron scattering (INS) has perhaps the strongest and longest community push. A new spectrometer, powered by Lujan Center's world-leading intensity per pulse, promises to illuminate the mechanisms underlying correlated electron phenomena, hydrogen storage in materials, magnetism, and fundamental excitations in stockpile metals. Diffraction, already strong at Lujan Center, is a favorite for understanding new energy materials through the rapidly developing science of local structure analysis; we expect to see users apply neutron pair distribution functions to radiation-damaged materials created in the Fission Fusion Material Facility of MaRIE. We plan to build on a project recently funded by the University of California in high pressure materials behavior to enhance "dot-product" between energy research and weapons research. Using new polarized neutron techniques, an IAT for Asterix has been invited to submit a full proposal to BES. Finally, because sample environments are the staff of life for innovative experiments, we encourage teams to submit ideas for extreme conditions under which in-situ scattering would provide valuable information.

The timing for getting ELP funded is auspicious. There has never been a time in which the product of funding prospects and Lujan Center performance has been as high. The two figures below from our triennial review in February show that the Lujan Center—since 2004 the largest Department of Energy (DOE) neutron scattering program—has hosted 45% of all users at DOE neutron facilities with only 5% of the neutron facility budget! BES has blessed the ELP plan and now has the resources to fund it. Our job is to submit good proposals and we need your help.

This country is placing a huge, somewhat desperate bet on the future. In the physical sciences, massive new funding is being channeled into energy research owing to the urgency to reach global thermodynamic sustainability. We in the scientific enterprise should be sobered by the responsibility we have been assigned in this goal with its attendant risk of failure. I for one wish to accept that risk.

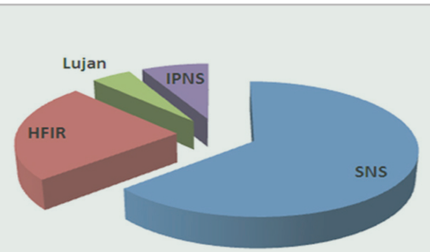
Accidents will occur in the best regulated families.
Charles Dickens

—Alan Hurd, Lujan Center Director



Users (1864)
DOE Neutron Centers 2006-2008

Lujan Center has hosted 45% of users at DOE neutron facilities over the last three years.

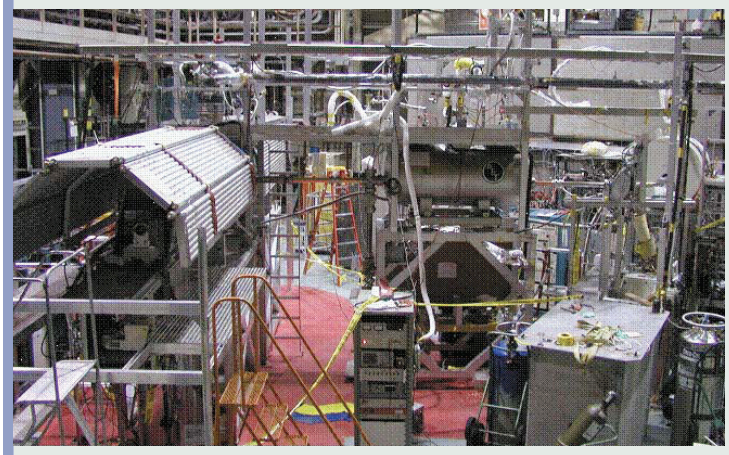


Budget ($680M)
DOE Neutron Centers 2006-2008

Operating budgets of DOE neutron facilities. (Construction costs not shown.) Lujan Center has 5% of the budget.

LANSCE UCNA experiment publishes first ultra-cold neutron results

Ultra-cold neutrons are neutrons that move so slowly, near human running speed, that they can be trapped in material bottles for hundreds of seconds. This property enables their use in precision measurements of nuclear physics properties, with smaller systematic uncertainties than standard methods using cold neutron beams. The Ultra-Cold Neutron Asymmetry (UCNA) experiment at LANSCE was designed to measure the correlation in neutron decay between the polarization of the neutron and the momentum of the emitted electron from the decay, known as A. The A coefficient helps determines the value of the weak coupling coefficients, which describe the behavior of the weak nuclear force. The UCNA experiment released its first results, a measurement of the A coefficient with 4% uncertainty. This, the first measurement in the world of the A coefficient based on ultra-cold neutrons, was the culmination of a 10-year research and development effort in P, LANSCE, and AOT divisions, and university collaborators. LANL researchers include J. Anaya, J. G. Boissevain, T. J. Bowles, D. J. Clark, S. Currie, R. Hill, G. E. Hogan, T. M. Ito, K. Kirch, S. K. Lamoreaux, M. Makela, C. L.Morris, R. Mortensen, A. Pichlmaier, J. C. Ramsey, R. Rios, A. Saunders, S. Seestrom, W. E. Sondheim, and W. Teasdale. Reference: "First Measurement of the Neutron β Asymmetry with Ultracold Neutrons", *Physical Review Letters 102*, 012301 (2009).

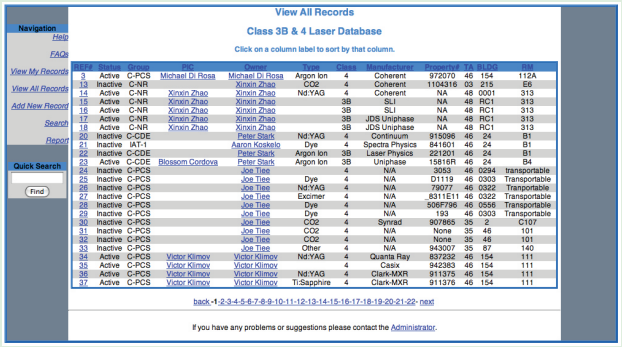


uCN experiment in operation at LANSCE

HeadsUP!

Ladder Safety

At least 300 people a year die in simple falls from ladders. Another 100,000 people are injured. Portable ladders should not be substituted for more appropriate equipment such as scaffolding or other types of portable work platforms that raise a worker off of the ground.



The ladder database has been upgraded:
http://laserdb.lanl.gov/viewAll.aspx

Celebrating Service

Felix Olivas, AOT-MDE	35 years
Stephen Morgan, AOT-OPS	20 years

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