

## Highlights

Gschneidner Wins Acta  
Materialia Gold  
Medal.....2

DOE ACTS  
Program..... 4

New Look of  
Superconductivity..... 7

# INSIDER

Newsletter for the Employees of Ames Laboratory ■ Volume 18, Number 8 ■ September 2007



## Ames Laboratory Named Outstanding Lab

Federal Laboratory Consortium recognizes Ames Lab's technology transfer success

**A**mes Laboratory has been named the Federal Laboratory Consortium's 2007 Outstanding Laboratory for the Mid-Continent Region. The Outstanding Laboratory award recognizes Ames Lab for exceptional transfer of technologies to other research organizations and to the private sector.

Ames Laboratory received the award based on demonstrated success in technology transfer in the forms of licensing intellectual property, providing specialized materials through the MPC and educating future scientists.

In fiscal year 2006, Ames Lab, the smallest DOE national laboratory in terms of budget and staff, ranked first in the DOE lab system for licensing income. Much of the income is due to the success of lead-free solder invented by senior metallurgist Iver Anderson and his research team. Since the European Union banned lead in consumer electronics, Ames Lab's lead-free solder technology has been licensed by over 60 companies and has generated more than \$13 million in royalty income.

"I congratulate Ames Laboratory on receiving the FLC Outstanding Laboratory Award and for their success in technology transfer," says Pat Dehmer, the Department of Energy's Associate Director of Science for Basic Energy Sciences. "Lead-free solder is a great example of the worldwide impact of DOE research."

Ames Lab was also recognized for the work of the Materials Preparation Center in providing research and industrial clients with high-quality specialized materials available only from the MPC. In fiscal year 2006, the MPC processed more than 145 orders, transferring the Lab's unique materials technologies to other government laboratories and to many companies.

Tom Barton, former lab director, often said that the Lab's greatest technology transfer is educating graduate students, since they are the next generation of scientists. In 2006, 31 graduate degrees were conferred to ISU students who did their thesis or graduate dissertation research at Ames Lab, and since the Lab started keeping count, approximately 3,000 graduate degrees have been awarded to students who did their research here.



**Deb Covey, associate laboratory director and FLC representative, presents Interim Director Alan Goldman with the FLC Outstanding Laboratory award.**

Debra Covey, associate laboratory director, accepted the Outstanding Laboratory award at the Federal Laboratory Consortium's Far West and Mid-Continent joint regional meeting on Sept. 12.

"I am thrilled to accept the award on behalf of the Laboratory and our scientists and staff," says Covey. "This award acknowledges the importance of the cutting-edge materials research that is performed at Ames Laboratory and recognizes that the MPC provides an extremely valuable service to not only DOE, but other federal agencies and research organizations worldwide." ■

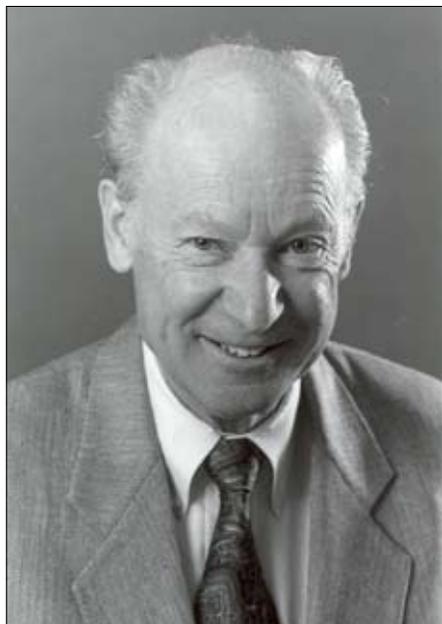
*~Breehan Gerleman Lucchesi*

# Gschneidner Receives Top Materials Award

*Acta Materialia Gold Medal just the latest award for decorated metallurgist*

**K**arl A. Gschneidner, Jr., senior metallurgist, has been selected for the prestigious Acta Materialia Gold Medal, considered by many scientists and engineers to be the top award worldwide in the field of materials research. The honor is just the latest of many for Gschneidner, who earlier this year was elected to the National Academy of Engineering.

The Acta Materialia Gold Medal is awarded annually by the Board of Governors of Acta Materialia, Inc. with partial financial support



from Elsevier, Ltd. Nominees are solicited each year from the Cooperating Societies and Sponsoring Societies of Acta Materialia, Inc. based on demonstrated ability and leadership in materials research. The candidates are placed on a ballot for a panel of international judges who select the winner. The award consists of the gold medal, an inscribed certificate, and a check from the Board of Governors.

Gschneidner will receive the award during the 2008 annual meeting of The Minerals, Metals & Materials Society in New Orleans, La. on March 11, 2008. The conference will feature a symposium in Gschneidner's honor, with the gold medalist delivering the keynote address.

"It's quite an honor," Gschneidner says. "While I knew I'd been nominated, it was still a surprise to find out I'd been selected. There are so many other deserving scientists out there."

He added he received a call "unofficially" notifying him of the award last February as he and his wife were waiting for a plane in Chicago. Ironically, it was just four days earlier during this same vacation trip when he was notified of his election to the National Academy of Engineering.

"Karl's contributions to materials research are well known in the scientific community worldwide. This award is further recognition of his lifetime of achievement in this area," says interim director Alan Goldman.

Throughout his illustrious career at Ames Laboratory and as an ISU Anson Marston Distinguished Professor in Materials Science and Engineering, Gschneidner has been at the forefront in research of rare-earth materials. He was the founding director of the Rare-earth Information Center at ISU's Institute for Physical Research and Technology from 1966 to 1996, and director of the Metallurgy and Ceramics Program at the Ames Laboratory from 1974 to 1979.

Gschneidner's research activity has been primarily concerned with the physical metallurgy of rare-earth metals and alloys, theory of alloy phase formation, electronic transformations of cerium, spin

fluctuations in exchange enhanced solids, heavy fermions, superconductivity, magnetic refrigeration, and passive and active magnetic regenerator materials. He is author or coauthor of 394 journal articles, 131 chapters in books, 28 reports and bulletins, 204 phase diagram evaluations, and has written or edited 42 books about these subjects. He holds 14 patents (plus six pending) for metallurgical or ceramic processes, and for magnetic refrigeration and cryocooler regenerator materials.

He has served as an invited speaker at numerous national and international conferences and 164 seminars on rare-earth materials, on the theory of alloy formation and on magnetic refrigeration. He has served on several government advisory committees and panels, and is a member of several editorial boards of scientific journals. He is the senior

*"Karl's contributions to materials research are well known in the scientific community worldwide." ~ Interim Director Alan Goldman*

editor of a series of 36 volumes entitled the *Handbook on the Physics and Chemistry of Rare Earths*.

In addition to his election to the National Academy of Engineering for "contributions to the science and technology of rare-earth materials," he has received several other nationally and internationally recognized awards and distinctions. These include the William Hume-Rothery Award of The Minerals, Metals & Materials Society (1978, for his contributions to the science of alloys); the Burlington Northern Award (for Excellence in Research) from Iowa State University (1989); the Frank H. Spedding Award from Rare Earth Research Conferences, Inc. (1991, for distinguished contributions in the field of rare earth science); and the Iowa State University David R. Boylan Eminent Faculty Award in Research (1997). ■

*~Kerry Gibson*



**Gschneidner's career at Ames Lab and ISU spans four decades. Here, Gschneidner sits with Frank Spedding, the Lab's first director, during the 1960s. Gschneidner was the founding director of the Rare-earth Information Center from 1966 to 1996.**



## Walking and Running for Dollars

*Lab teams take part in 5K for Life*



**Cynthia Feller and her son, Andrew Feller, participated as a Wizard and a Nerd, respectively, in the 5K for Life. Andrew was the first person to complete the 5K, finishing his run in a noteworthy 17 minutes and 37 seconds.**

**A**mes Laboratory employees raised \$2,090 for the American Cancer Society on Saturday, Aug. 25, when both walkers and runners took part in the 5K for Life of Story County at Brookside Park in Ames.

The two Ames Lab teams, Walking Wizards and Nimble Nerds, were again expertly captained by Ila Haugen, budget officer. Haugen also served on the 5K for Life organizing committee, coordinating the sale and distribution of tribute flags, which participants could purchase to display the names of loved ones and friends who had either survived or lost their battles with cancer. Placed along the 5K route, the tribute flags honored those individuals and served as an inspiration to event participants.

This year, the 5K for Life of Story County brought in donations totaling \$42,400 for cancer research. Thanks to the Wizards and the Nerds for representing Ames Laboratory at this worthwhile event and collecting donations in excess of \$2,000. If you haven't had the honor of becoming a Walking Wizard or Nimble Nerd yet, contact Haugen, and she'll happily sign you up for next year! ■

~Saren Johnston



**Ila Haugen records the donation as Iver Anderson completes a tribute flag for his friend and colleague, Bob Terpstra, who lost his battle with cancer in April.**

## Ames Lab Scientists Receive ISU Research Awards



**Rodney Fox**

**Rodney Fox**, associate, received the Iowa State University Award for Outstanding Achievement in Research.

The award recognizes a faculty member who has a national or international reputation for contributions in research, and who has influenced the research activities of students. Fox, who is also Herbert L. Stiles Professor of Chemical Engineering, accepted the award at the Iowa State University convocation on Sept. 10.



**Surya Mallapragada**

**Surya Mallapragada**, program director for Materials Chemistry and Biomolecular Materials, received the Iowa State University Mid-Career Achievement in Research.

The award recognizes a faculty member who has demonstrated outstanding accomplishments in research at the mid-career stage. Mallapragada, who is also a professor of chemical and biological engineering and a professor of materials science and engineering, accepted the award at the Iowa State University convocation on Sept. 10. ■

# Lab Launches Summer Program for Science Teachers

*DOE ACTS program a success in its first year*

**N**ine creative and motivated middle school teachers from Minnesota, South Dakota, Kansas and Iowa descended on the Ames Laboratory and ISU for four weeks this summer as part of the Lab's newly created DOE Academies Creating Teacher Scientists, or ACTS, program.

The goal of the program is to give participating teachers the skills to develop dynamic and innovative science programs in their schools that will not only excite students to pursue careers in science and math but will also help promote a well-established, science-educated citizenry in the future.

The four-week ACTS session had the teachers involved in a variety of activities, from training, lectures and workshops presented by Ames Laboratory scientists and staff, to visits to research laboratories and field stations for observations. ACTS participants also conducted their own small research projects under the mentorship of Ames Lab and ISU scientists to investigate topics in the physical sciences.

ACTS participants included Daniel Andrews, an eighth-grade teacher at Ames Middle School in Ames; Sharon Andrews, a fifth-grade teacher at Challenger Center in Sioux Fall, S.D.; Laura Cady, a sixth-grade teacher at North Cedar Middle School in Clarence, Iowa; Ginny Elliott, an eighth-grade teacher at STC Middle School in Toledo, Iowa; Kecia Goodman, an eighth-, 11th- and 12th- grade teacher at South Hamilton Community School in Jewell, Iowa; Margaret Sue Hicks, a seventh-grade teacher at Eisenhower Middle School in Topeka, Kan.; Rayford Sims, a kindergarten-through-sixth-grade teacher at Maxfield Elementary School in St. Paul, Minn.; Dennis Vaughn, a seventh-through-12th-grade teacher at Baxter Community School in Baxter, Iowa; and Charles Velasquez, a fifth-grade teacher at Mulberry Elementary School in Muscatine, Iowa.



**Sharon Andrews (right), fifth-grade teacher from Sioux Falls, S.D., and Laura Cady, a sixth-grade teacher from Clarence, Iowa, adjust equipment used to measure solar radiation. Andrews and Cady worked with Ralph Ackerman, an ISU professor of ecology, evolution, and organismal biology.**

The teachers have two to 30 years of experience, teach in communities of all different sizes and represent classrooms from K-12. But all participants share a commitment to excellence in STEM — science, technology, engineering and mathematics — education. One example is Sharon Andrews, who was recently awarded the 2008 South Dakota



**Kecia Goodman, eighth-, 11th- and 12th- grade teacher at South Hamilton Community Schools, measures surface tension while collecting data for her research project in Ames Lab physicist David Vaknin's lab.**



**Raymond Sims, K-6 teacher at Maxfield Elementary School in St. Paul, Minn., and Dennis Vaughn, 7-12 teacher at Baxter Community School in Baxter, Iowa, work on their research project studying the efficiency of cook stoves used in developing countries. Sims and Vaughn worked with Mark Bryden, director of the Modeling, Simulation and Decision Science program, and graduate student Penn Taylor.**

Teacher of the Year award for her achievement in teaching scientific inquiry to her students. Andrews has a master's degree in elementary education and a doctoral degree in elementary curriculum and instruction. She received the Presidential Award for Excellence in Mathematics and Science Teaching in 2003 and the 2006-2007 PTA Life Achievement Award.

Ames Lab scientists who served as ACTS mentors are Mark Bryden, director of the Modeling, Simulation and Decision Science program, and David Vaknin, senior physicist. Others mentors included Ralph Ackerman, ISU professor of ecology, evolution and organismal Biology; and Curt Klaassen, manager of the Iowa Energy Resource Center in Ankeny, Iowa.

The ACTS program is one of the growing number of education programs managed by Ames Lab's Office of Public Affairs. The ACTS program is coordinated by Adah Leshem-Ackerman, who also coordinates

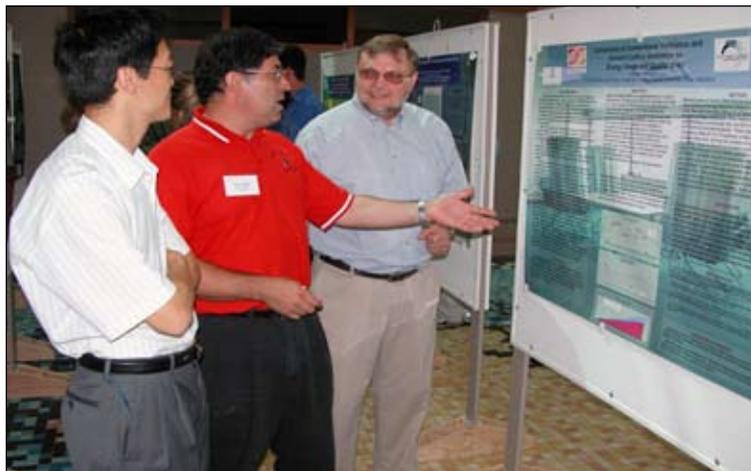
outreach activities for biological science teachers, including the ISU Research Experiences for Teachers program. She sees the inaugural year of ACTS as just the beginning of great things to come.

“DOE’s investment in teachers’ professional development is a sure sign that STEM education is being taken seriously,” says Leshem-Ackerman. “Iowa and its surrounding states will benefit greatly from having this program at Ames Laboratory. Watching the teachers absorb all the knowledge they were exposed to this summer is the most rewarding part of my job.”

All teachers make a three-year commitment to Ames Lab’s DOE ACTS program, which means we can look forward to seeing this year’s group again in the summers of 2008 and 2009. And Leshem-Ackerman hopes to expand the program to include a second cohort of teachers in 2008.

Likewise, the teachers are looking forward to returning to the Lab. “I have developed a better understanding of scientific inquiry both as a scientist and as a teacher,” says Ginny Elliot, ACTS participant. “When I get back to my classroom, I am going to spend more time at the end of an investigation asking the kids what questions they have now for further investigations. Students think that in science there is a beginning and an end, and I have learned that there isn’t really.” ■

~Breehan Gerleman Lucchesi



*Charles Velasquez, a sixth-grade teacher from Muscatine, Iowa, (center) explains his research results to Xiaohui Zhou (left) and Curt Klaassen from the Iowa Energy Center’s Energy Resource Station. Velasquez conducted his research project measuring the effect of ventilation on energy use in classrooms at the Iowa Energy Resource Center.*

## Everyday Materials, Extraordinary Science

**S**cott Chumbley, Ames Lab scientist, treated 45 fifth-graders from Edwards Elementary in Ames to an exciting and interactive presentation about properties of materials on Sept. 20.

A chorus of “sweet,” “cool” and “awesome” could be heard as Chumbley used everyday items to demonstrate principles of metals, glass and other materials.

What was sweet: Corn syrup changing the color of light to demonstrate optical properties and polarization.

What was cool: Liquid nitrogen shrinking balloons and freezing marshmallows to demonstrate thermodynamics.

What was awesome: All the hands in the audience eagerly shooting up whenever Chumbley asked for a volunteer, demonstrating the excitement of our next generation of scientists. ■



*Scott Chumbley, Ames Lab scientist, gives students a closer look at a piece of memory wire during his presentation about the properties of materials.*

**United Way**



**United Way of Story County**

**United Way Campaign**

The 2007 United Way campaign has begun, and Ames Laboratory and IPRT's fundraising goal is \$14,000. Iowa State University's overall goal is \$276,500.

United Way of Story County distributes funds to 31 partner agencies. These funds help provide assistance to over 30,000 Story County residents of all ages, backgrounds and interests.

As a reward, all donors will receive four free tickets to the ISU women's basketball game on December 5 and two free tickets to certain events in the 2007-2008 season at Stephens Auditorium.

The 2007 United Way campaign pledges are due on Friday, Oct. 19.

If you have any questions about the campaign or the free tickets, please consult <http://www.uw.iastate.edu/> for answers, or contact the Ames Lab/IPRT campaign chair, Steve Karsjen, at [karsjen@ameslab.gov](mailto:karsjen@ameslab.gov).

**Flu Shots Available in Nov.**

Flu shots will be available 10 a.m. – 4 p.m. weekdays Nov. 6 – Nov. 20 in 205 TASF. This year, employees will be required to have their ISU ID# when obtaining a shot. For more information, call 4-0874.

**October is DOE Energy Awareness Month**



The 2007 theme for DOE Energy Awareness Month is "Clean and Green for a Secure Energy Future." DOE suggestions for energy conservation are turn off lights and office equipment when not in use; use power-down or sleep mode for computers and monitors; change to compact fluorescent bulbs; purchase Energy Star equipment; drive a hybrid or fuel-efficient car; and combine trips, share rides and use mass transit. For more energy-saving ideas, visit [www.energysavers.org](http://www.energysavers.org).

**R&D 100 Awards**

Now is the time to start thinking about entering the 2008 R&D 100 Awards competition. The application form is available at the following Web site: <http://www.rdmag.com/awards.aspx>.

Public Affairs will assist with various aspects of the application process. If you think you'd like to apply for the 2008 R&D 100 Awards competition, please contact Breehan Gerleman Lucchesi at 4-9750 or [breehan@ameslab.gov](mailto:breehan@ameslab.gov).

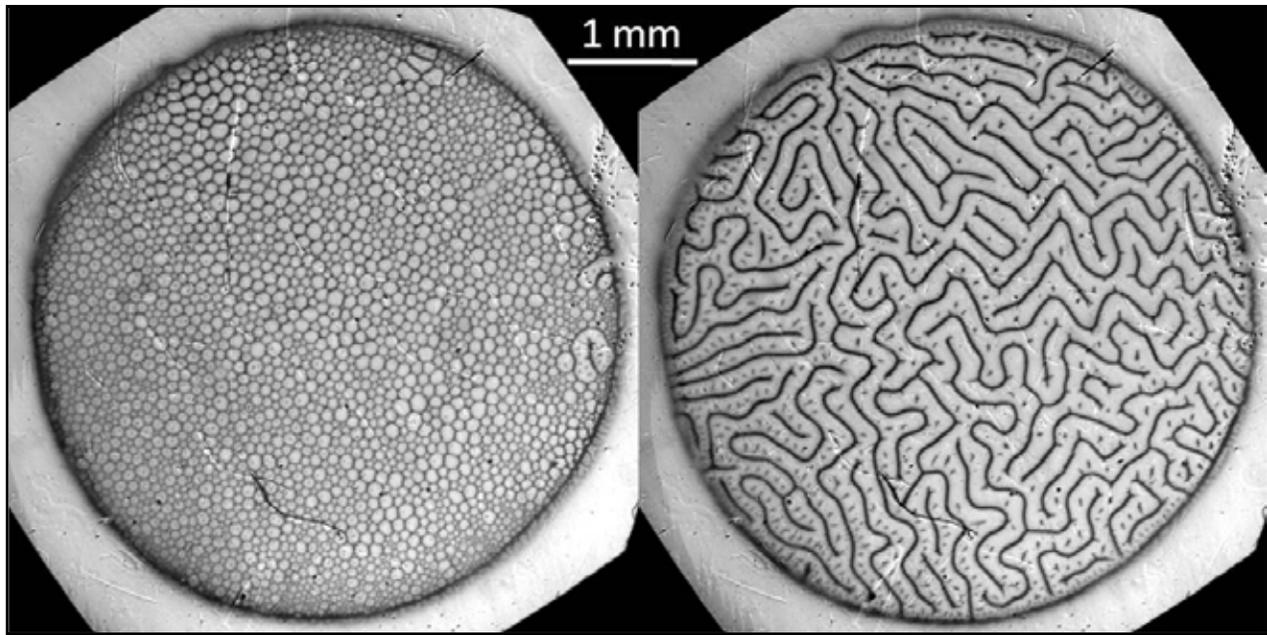
**Science Bowl Set for Jan. 26**

The Ames Laboratory/ISU High School Science Bowl will be Saturday, Jan. 26. To volunteer for this exciting science and math competition, contact Breehan Gerleman Lucchesi at 4-9750 or [breehan@ameslab.gov](mailto:breehan@ameslab.gov).

**Technical Information Reminder**

Please submit all technical information products (for example, research and development reports, journal articles, conference proceedings, and theses) to Alison Easter, STI Manager, 151 TASF. Once submitted, documents are assigned a number for future reference and the proper patent clearance authorization forms are processed through DOE-Chicago. Recently, a newly implemented Manuscript Submittal form was sent out via e-mail. If you have not received this form, please contact Alison Easter at [eastera@ameslab.gov](mailto:eastera@ameslab.gov).

# The New Look of Superconductivity



*Equilibrium patterns in superconducting lead: left, Prozorov's "soap-foam" pattern; and right, the Landau laminar pattern. Both images are obtained at the same temperature and magnetic field. The only difference is how the magnetic field was increased or decreased to reach equilibrium.*

Like the surface motif of a bubble bath, the spatial distribution of a magnetic field penetrating a superconductor can exhibit an intricate, foam-like structure. Physicist Ruslan Prozorov has observed these mystifying, two-dimensional equilibrium patterns in lead samples when the material is in its superconducting state, below 7.2 Kelvin, or minus 446.71 degrees Fahrenheit.

By relating the complex geometry of the equilibrium patterns to the macroscopic physical properties, such as magnetization, Prozorov has shown that the shape of the entire sample determines the pattern topology and overall magnetic behavior of the system. "You can have the same volume and same mass, but if you just change the shape, you get a different type of response from the sample and a different type of geometry of the equilibrium magnetic field pattern," he explains.

Prozorov's discovery of the elaborate patterns in superconducting lead marks a significant departure from the model first proposed by Russian physicist Lev Landau in the 1930s. Landau's model, which assumes a labyrinth or laminar pattern, has been the unchallenged standard in physics textbooks for 70 years. Now, however, Prozorov's innovative research has reopened the whole field of equilibrium in type-I superconductors, which had gone dormant because it was considered closed.

Over the years there have been observations of equilibrium patterns in superconductors that differ from the labyrinth model proposed by Landau. However, the unusual patterns were considered to be defects or fluctuations due to imperfections in the material under study. No one bothered to relate the patterns they were observing to macroscopic properties. No one, that is, until Prozorov.

"It all started with an accidental finding," says Prozorov. "I was trying to calibrate a thermometer in my magneto-optical cryostat, so I put in a very clean, stress-free piece of lead. This is an easy way to calibrate because lead becomes superconducting at 7.2 Kelvin,

so when I looked at my sample and saw superconductivity, I knew my thermometer was correct."

But something else wasn't correct, at least not textbook correct. When Prozorov applied a sufficiently large magnetic field and looked at the lead sample in the magneto-optics system, he was surprised to see not the Landau labyrinth pattern but, rather, a pattern of two-dimensional tube shapes that he describes as looking like soap foam. "I was shocked because this was totally unexpected," he says. "So now the big question was which pattern represents equilibrium."

Prozorov's experiments showed that, depending on its purity and macroscopic physical shape, the sample under investigation displayed either the soap-foam pattern or the Landau laminar pattern. He knew that samples like disks or slabs that have two parallel surfaces also have a property known as geometric barrier. Only those sample shapes exhibited the Landau pattern, and only when the magnetic field was reduced. However, Prozorov discovered that shapes without two flat surfaces, such as spheres, hemispheres, pyramids and cones, don't exhibit the Landau behavior.

"We observed the foam, or tubular, phase in all of these sample shapes, and we don't have the Landau phase at all," he says. "So it's the foam phase that's the equilibrium state of the system. Most of the past studies were done on samples with flat surfaces, that's why people never observed this previously for decreasing magnetic field."

Emphasizing the difficulty involved in creating these less-common sample shapes, Prozorov says, "To observe this soap-foam phenomenon, the samples must be very clean and defect-free with a uniformity of crystal structure. We spent a lot of time trying to make lead samples in the shapes of hemispheres, cones and pyramids and finally succeeded. Having access to the materials expertise available at Ames Laboratory has been a tremendous benefit in our efforts," he adds. ■

~Saren Johnston

# Holiday Auction to be Held December 6

*Shop with a Cop selected to receive auction proceeds*



Unbelievable as it may seem, it's time once again to start bringing your new or slightly used items to Public Affairs, 111 TASF, for the silent and live auctions that are held as part of the annual Ames Lab/IPRT holiday celebration.

Thursday, Dec. 6, is the date for this year's Holiday Auction and Party, which will be held from 1:30-

3:30 p.m. in the Spedding Auditorium.

Please note that the earlier we receive your auction items in Public Affairs, the sooner employees will be able to view what's up for bid by going to the internal Ames Lab Web site, <http://www.internal.ameslab.gov>, and clicking on the link to the Holiday Auction.

Shop with a Cop, a charity event held by the Ames Police Benevolent Association, will be the recipient of funds raised at this year's Holiday Auction. Established in 1994, the Shop with a Cop program strives to help make the holidays brighter for disadvantaged families in the Ames area.

Officers from the Ames Police Department, ISU Police Department, Story County Sheriff's Office, Iowa State Patrol, Ankeny Police Department and Huxley Police Department host youth from throughout Story County. This year's event will take place Dec. 8, when officers and their special young guests will once again head off to Kmart via CyRide for a morning of shopping, eating, gift wrapping and fun. Since its inception, Shop with a Cop has helped more than 1,000 children and their families enjoy a happier holiday season.

As in the past, donations to the mitten, hat and scarf tree and the food pantry may also be brought to Public Affairs. These items will once again be given to Mid-Iowa Community Action.

Thanks to all Ames Lab and IPRT employees who so generously support the Holiday Auction. Last year the holiday auction raised



*An early donation to the annual food drive, home-style pickled green chillies, sits in 111 TASF waiting for fellow cans and jars to arrive. Former Lab director Tom Barton donated the pickled green chillies.*

\$3,644 for the Story County Emergency Residence Project. Your contributions to this worthwhile event truly help make the holidays a more joyous time for less fortunate families in Ames and surrounding communities. ■

## ***INSIDER***

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