Exceptional service in the national interest

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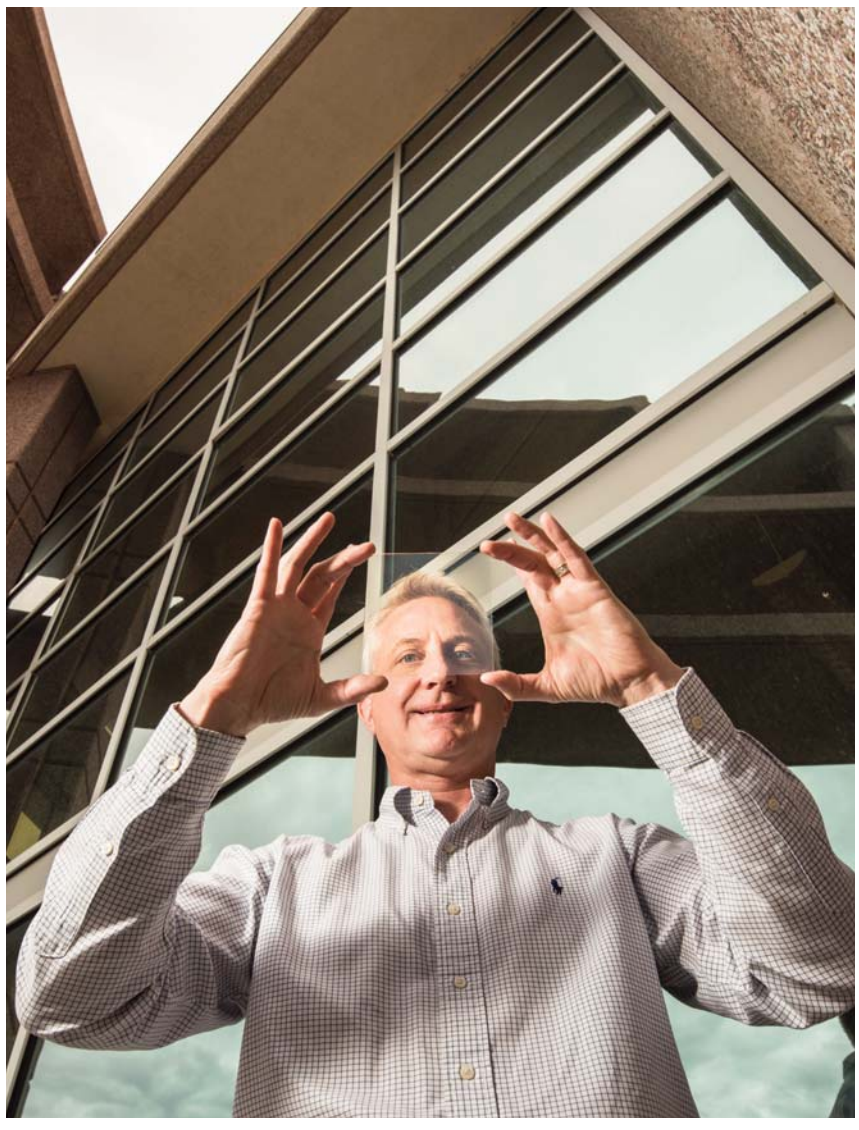
Solar eclipse at Sandia/New Mexico

See page 4



Beating the heat with nanoparticle films

House and car windows that stay cool in the summer, warm in the winter

By Mollie Rappe

It is a truth, universally acknowledged, that a car sitting in the sun on a summer's day must be sweltering. However, thanks to a partnership between Sandia and Santa Fe, New Mexico-based IR Dynamics, soon that truth might not be so universal.

Together they are turning nano-sized particles that reflect heat, or infrared radiation, into window films for offices, houses, even cars.

The partnership started in 2013 with the help of a New Mexico Small Business Assistance, or NMSBA, grant. Paul Clem, a Sandia materials physicist, was studying films 25 times thinner than a human hair that switch from insulators that block electricity to metals that conduct electricity depending on the temperature. Paul was looking at their possible use in electronics when he met William Kurtz, who was heading a company making energy-efficient aerogel-insulated windows and skylights. They met in a tech park in Santa Fe and started to discuss the need for windows that could let heat in during winter months and keep it out in the summer months.

Some materials are reflective, like aluminum foil, and reflect light and heat. Other materials are generally transparent to light, like glass and plastic. A few rare materials can be both depending on their temperature. Vanadium dioxide is one such material.

In fact, vanadium dioxide is thermochromic; it changes its optical transmission with temperature. At cooler temperatures it is transparent to infrared light. When it heats up, it becomes metallic and reflects infrared, or IR, radiation without obstructing the view. This dynamic switch between IR transparent and IR reflective is what gave rise to the company name IR Dynamics.

(Continued on page 4)

SANDIA MATERIALS PHYSICIST PAUL CLEM holds a sample of nanoparticle-coated glass. Thermochromic nanoparticles switch from infrared transparent to infrared reflective when they heat up, which will help to keep office buildings, homes, and even cars cool. (Photo by Randy Montoya)

Aerospace test at Sandia goes green with alternative to explosives

Hopkinson bar technology applied to gas gun shot to test rocket part

By Heather Clark

Sandia has successfully demonstrated a new, more environmentally friendly method to test a rocket part to ensure its avionics can withstand the shock from stage separation during flight.

The new method — called the Alternative Pyroshock Test — used a nitrogen-powered gas gun to shoot a 100-pound steel projectile into a steel resonant beam, which then transfered energy through a resonant cone attached to the part being tested. The resulting energy transfer mimics the conditions of stage separation in space. The first test of this type using the flight hardware was completed this spring.

Until now, pyroshock tests to ensure aerospace parts were ready for the rigors of flight had used explosives encased in lead to provide the impacts to parts needed for such experiments, mechanical engineer Mark Pilcher (5424) says.

The lead and explosives were environmental hazards, so cleanup was costly and time-consuming. Sandia's team wanted a better approach.

"We recognized early in the program that we needed to seek out alternative test methods to reduce our hazardous work exposure, minimize environmental waste, and develop a controlled and repeatable test capability," Mark says. "Investigating a large-scale nonexplosive gas gun test became a reality when we partnered with Sandia's large-scale mechanical test facilities. The combined team worked hard to get to this test."

Hopkinson bar technology proved a more controllable alternative to explosives

Asked to research whether an alternative means of testing was possible using a gas gun, Sandia mechanical engineer Bo Song (1528) turned to a 1-inch-diameter Hopkinson bar. The Hopkinson bar was first suggested in 1914 by Bertram Hopkinson, a British patent lawyer and Cambridge University professor of mechanism and applied mechanics, as a way to measure the pressure produced by explosives. It was further modified in 1949 for dynamic stress-strain measurements of materials.

In Sandia's Experimental Impact Mechanics Laboratory, Bo and his team conducted small-scale testing with a metal rod about 20 times smaller than that used in the full-scale test. They discovered the Hopkinson bar technology could provide the frequency levels and the mechanical energy needed in the large-scale test to recreate conditions found during flight.

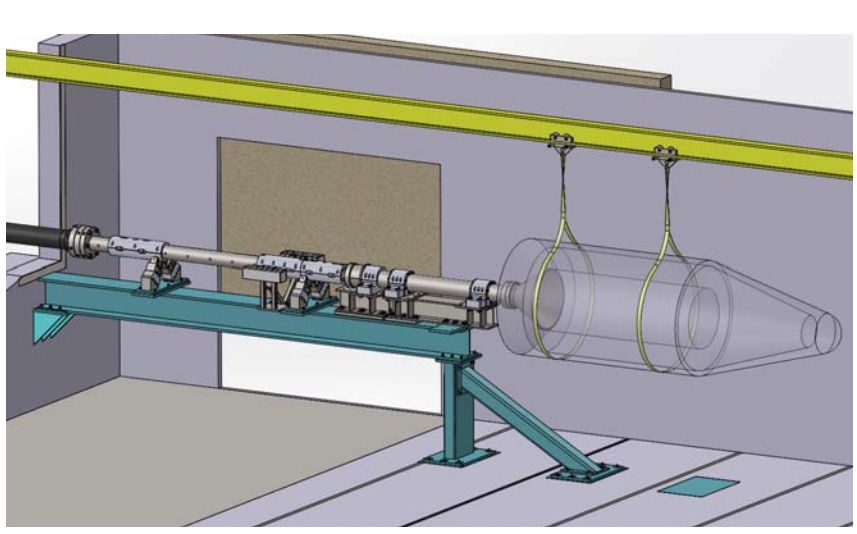
Bo's team conducted more than 50 tests. They looked at what types of projectiles to use, how fast the gas gun needed to shoot, how to design a Hopkinson bar-type apparatus called a resonant bar at a larger scale, how to design a steel resonant cone to transfer the energy to the object being tested, and how to manipulate the pulse of energy using small copper "coins" called programmers or pulse shapers, which were placed on the surface of the resonant bar.

"The most difficult part was designing the programmers, or pulse shapers, because we had to select the right material, geometry, and dimensions," Bo says. "We got a lot of experience through this kind of testing for the future large-scale testing. The same concept can be used for a variety of defense and space applications. This provides a new path for pyroshock testing, but very clean and more controllable and will save a lot of costs."

Meet Susan Seestrom

Susan Seestrom followed her curiosity about life, people, and science to leadership at two national labs

Story on page 8



AN IMAGE from a 3-D computer-aided design illustrates a new Sandia testing method. The Alternative Pyroshock Test used a nitrogen-powered gas gun to shoot a steel projectile into a resonant beam, which then transfers energy through a resonant cone attached to the part being tested.

Gas gun used in large-scale tests

The next phase of the Alternative Pyroshock Test applied the Hopkinson bar technology to a pneumatically driven gas gun.

For this test, the gas gun was not required to reach its maximum capacities. The 60-foot-long gas gun used compressed nitrogen gas to shoot metal projectiles into a resonant beam coupled with a resonant cone to expand the final diameter to inter-

(Continued on page 4)

That's that

It's been 16 years now — nearly a full generation — since the attacks on the World Trade Center and the Pentagon and that terrible desperate struggle on United Flight 93 that ended with a crater in the ground in a farmer's field in Pennsylvania.

For those of us who were around at that time, it's a day we'll never forget, a day we vowed on the lives of the dead to remember forever.

We remember, will always remember, the smoke and the debris and the confusion, the scared, dazed, empty looks on the faces of those fleeing Ground Zero. We'll remember the courage of the first responders who headed up into the flaming towers when everyone else was going down. And we'll remember, most vividly, the horrible loss of life.

But for those of a new generation, I wonder: How can they never forget something they never remembered? Can they be expected to feel the same way about 9/11 that we do, those of us where were "there?"

It is our role, the role of those of us who can still see the bodies falling, falling, falling from the 100th floor of the World Trade Center, to try to tell those who have come after us how it was. It is up to us to tell them to imagine a situation where leaping out into the empty void from 1,000 feet in the sky was a better option than staying.

But in the telling, we need to recognize that for those born after, say, the mid-1990s, the 9/11 attacks are not current events, but history, something to be engaged intellectually, in the abstract, but not viscerally.

Generation Z, the Post-Millennial generation, or the Homeland Generation (as it is sometimes called) has the same relationship to 9/11 as I do to World War II. I was born five years after the end of that war. For my parents, my teachers, the nation's leaders, it was the monumental, singular, defining experience of their lives. For them it was, with all its unspeakable horrors and its unbelievable heroism, its everyday courage, shared purpose and shared sacrifice, the biggest thing that ever happened or ever would happen. But I never knew that war; not like they did. It was not my war.

When we talk about remembering 9/11 we have to understand that our experience of it is not transferable, nor is the personal significance that we place upon it. And someday, when years have passed and the world is a better place — and I believe against all evidence that that day will come — 9/11 will recede into history to become yet one more ancient grievance, one that must someday be set aside. History seems to show us that hanging onto grievances for generation after generation, however justified they may have been, is the root of a lot of the discord in this world.

* * *

Having said that, though, it's also true that righteous anger has its place and some outrages demand redress. That was the situation in the days and weeks after 9/11. Sandia played an important role in the nation's immediate response to the terror attacks. In the spirit of telling those who weren't there what it was like for us here, I offer this excerpt from a personal message then-Labs Director C. Paul Robinson wrote for the *Lab News* in the immediate wake of the 9/11 attacks:

". . . Who will now rise to avenge their deaths? Who will create the means of preventing or blunting such attacks in the future? Who will devise the new means of protecting our air travel systems and restoring our open and trusting ways of life? Who will design the buildings of the future to still be just as beautiful as those we lost, but prove even more protective of the lives inside? Further, who will step forward to wage peace by grappling with the fundamental problems that divide mankind and succeed in securing a lasting peace with freedom for all? These tasks are not ours alone, but they indeed are our challenges, just as surely as there is any truth in our belief that science and engineering have an enormous power to make the world a better place. This week the trumpet has sounded the call for "exceptional service" louder than at any time in our lives. Let us answer the call."

See you next time.

— Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

Retiree deaths

Dusan Pegan (age 95) . . . . . Jan. 30
Barbara Shaw (96) . . . . . March 12
Joel Landrum (93) . . . . . May 29
Martin Gonzales (85) . . . . . May 30
Betty Ross (79) . . . . . June 6
Keith Creveling (94) . . . . . June 8
David Denton (87) . . . . . June 8
Luciano Archuleta (97) . . . . . June 11
Richard Rogers (76) . . . . . June 13
Gloria Chavez (66) . . . . . June 16
Emily Young (95) . . . . . June 17
Albert Chabai (88) . . . . . June 17
Rene Mercado (72) . . . . . June 19
John Snowdon (87) . . . . . June 19
Frank Keene (88) . . . . . June 24
Leonidas Wilson (94) . . . . . June 24
Douglas Allen (76) . . . . . June 27
Marybelle Tabet (73) . . . . . June 29
S. Chemistruck (94) . . . . . July 8
William Putnam (89) . . . . . July 8
Leslie Jones (87) . . . . . July 10
Leo James Reynolds (95) . . . . . July 11
Thelma Carpenter (93) . . . . . July 11
Mary O'Shea (78) . . . . . July 12
Pamela Hansen Hargan (63) . . . . . July 14
Janice Johnston (76) . . . . . July 15
Phillip Skogmo (81) . . . . . July 16
Clinton Tuthill (89) . . . . . July 17
Richard Terwilliger (89) . . . . . July 21
M. Bennett (90) . . . . . July 23
James Wright (83) . . . . . July 27

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Bldg. 891, lobby
Bldg. 836, lobby
Bldg. 831/832 north lobby
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Bldg. 870, lobby
Bldg. 823, lobby
Bldg. 701, next to elevator
IPOC, lobby
CGSC, lobby
CRSI, lobby
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Bldg. 905, lobby
800(A), outside of Vicki's

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Career Milestone

BUT WHO'S COUNTING? — Steve Girrens (right), Associate Laboratory Director for Nuclear Deterrence, and the rest of the Labs' Senior Leadership Team honored George Clark (2627) for his 55 years at Sandia, where he's worked on impact fuzes, firing sets, and isolators for many of the weapons in Sandia's portfolio: B61, W76, W78, B83, and W88. Steve said he was honored to recognize George's long career in nuclear weapons, calling it a testament to an ethos of national service. "He has personally contributed to a safe, secure, and effective national stockpile," Steve said. "He has continued to give back and pass along his profound knowledge to future generations of Sandia leaders." In a 2010 interview with the *Lab News*, George said the Labs' focus on preventing another world war was a big draw in his early years: "There was a conviction . . . that what we did at Sandia every day was keeping the Soviet Union at bay."

(Photo by Lonnie Anderson)

Gen. Klotz discusses NNSA priorities, FY2018 budget request

Under Secretary of Energy for Nuclear Security and NNSA Administrator Frank Klotz held an all-hands meeting at Sandia's California lab on Monday, Aug. 21. Klotz discussed key Sandia accomplishments, NNSA priorities, and the FY2108 budget request. Following his presentation, he took questions from the standing room only audience. After the all-hands meeting, Klotz visited the site's flagship weapon facility, the Lightweight Structures Lab (LWSL), which is developing advanced composite structures and next-generation coatings for the W80-4 Life Extention Program and future opportunities in support of Sandia's modernization program. (Photo by Randy Wong)

Sandia CaliforniaNews
Exceptional service in the national interest

Tim Briggs instills 'Always Ready' motto to work in Division 8000

FROM 1997-2001, Tim Briggs served aboard the US Coast Guard Cutter *Point Hannon* out of Jonesport, Maine, and at the Marine Safety Office in Puget Sound in Seattle. He attended the University of Washington while stationed in Puget Sound. (Photo by Madeline Burchard)

By Michael Padilla

US Coast Guard veterans like mechanical engineer Tim Briggs (8222) contribute to developing advanced technologies that ensure world peace. Tim says his service in the Coast Guard taught him about planning, teamwork, resiliency, and focus on deliverables that are core to Sandia's mission.

"Joining and serving in the US Coast Guard instilled in me experiences and skillsets that have transferred to every part of my life," says Tim, who served in the Coast Guard from 1997 to 2003.

Tim says the Coast Guard's motto, *Semper Paratus* — Latin for "Always Ready" — signifies to him a devotion to duty, attention to detail, and a strong discipline to train, plan, and carry out successful missions by always being ready.

"The operations I contributed to in the Coast Guard primarily focused on search and rescue and federal law enforcement, which often involved day-to-day scenarios and environments that were life-threatening and full of inherent risks," he says. "A strong trust for your team, adequate training, equipment, and planning were essential to positive outcomes."

Tim says that while the engineering and research activities at Sandia are not as directly life-threatening or risky as was his work in the Coast Guard, they are motivated by the same underlying spirit: to protect the nation and ensure global peace.

"The information and technologies we are entrusted with developing and advancing require a significant dedication, discipline, and educational background," he says. "The experiences and skillsets the Coast Guard instilled in me have allowed me to be ready to adapt, overcome, and succeed in all the challenges I've encountered since I served, and I continue to apply these principles towards a new mission here at Sandia."

From 1997-2001, Tim was stationed onboard the US Coast Guard Cutter P*oint Hannon* in Jonesport, Maine, and then at the Coast Guard's Marine Safety Office Puget Sound in Seattle, Washington. From 2001-2003 he continued to serve in the Coast Guard Reserves at MSO Puget Sound in the Vessel Inspections Division while beginning college full time on the Montgomery GI Bill. He earned his PhD from the University of Washington in 2010 and joined Sandia as a staff member.

The Coast Guard, established in 1790, celebrated its 227th anniversary on Aug. 4.

Even though he no longer puts his life on the line, Tim is proud to work on projects that strengthen national security and ensure global peace.

Operation Backpack 2017: a wildly successful mission

Donation of supply-stuffed backpacks to military families breaks records

By Jules Bernstein
Photos by Krissy Galbraith and Madeline Burchard

Sandia's California campus this year nearly doubled the number of backpacks filled with school supplies for kids of local military families. A total of 112 backpacks were collected this year; 87 for delivery to US Army Reserves Garrison Camp Parks in Dublin, California, and 25 for Travis Air Force Base in Fairfield.

The donations far exceeded last year's total of 65 backpacks collected and the previous year's 48 backpacks. The impressive haul this year comes courtesy of Sandia employees including security personnel, escorts and personnel from lab contractors JR Griffin and JD General.

Additionally, donations for this year's charity operation have rolled in from Lawrence Livermore National Lab employees. The combined total donations from LLNL and Sandia this year exceeded 200 backpacks.

Rachel Sowell (8000) served as the lead point of contact for the project, and it was her idea to recruit Livermoreans. "Before we officially kicked off this summer's campaign, I realized we could have a broader impact if we reached out to the veterans group at Lawrence Livermore," she said. "They eagerly accepted the invitation."

SANDIANS pose amidst an overflow of donations. Bottom, left to right: Associate Labs Director Dori Ellis and Rachel Sowell (8000). Top, left to right: Adrian Valenzuela, Lawrence Livermore National Lab, Sarah Ann Flores (8524), Brian Abelgas (8146), and Angela Tallman, LLNL

KIDS at US Army Reserves Garrison Camp Parks, excited to show off their stylish new backpacks.

Operation Backpack was founded as a way for the site to thank military families for their sacrifice in service to the nation. The back-to-school season can be a stressful and costly time for any family, but can be especially trying for military families with a deployed family member or single-earner households.

By providing school supplies, the Operation Backpack planning committee helps alleviate stress and lets military families know that they are supported by the Sandia/California community.

Due to the wild success of this year's drive, Operation Backpack will expand to a third military base for the 2018-19 school year.

Aerospace test

(Continued from page 1)

face with the rocket part, essentially a hybrid version of a large-scale Hopkinson bar.

Like a tuning fork

"What's novel is the application of the Hopkinson bar," says mechanical engineer Patrick Barnes (1531). "Typically the bar and test objects are really small, but in our case, we used a 1,500-pound, 8-foot-long, 8-inch diameter bar."

Like a musical tuning fork, the resonant bar and the resonant cone needed to vibrate at certain frequencies to apply the right amount of energy to the test object, Barnes says.

Ahead of the final tests, Patrick's team used an empty mock test object outfitted with accelerometers to measure the impact. Patrick changed the geometry and composition of the programmers to simulate the test conditions required for the program.

Now that Sandia has put in analysis and testing, future tests of this sort should require less development and cost less. "Ideally, we can create a repeatable environment, something we can dial in, so if they need to do this test again in the future, we can build this back up and start testing," Patrick says.

PREPARING TO TEST — Sandia's Mike Beabout and Patrick Barnes, left to right, top, and Mark Stroman and Jamison Lee, left to right, bottom, prepare a nitrogen-powered gas gun for an Alternative Pyroshock Test by completing installation of a resonant cone to a resonant beam. Sandia successfully demonstrated a more environmentally friendly way to test that avionics can withstand the shock from stage separation during missile flight. (Photo by Randy Montoya)

Nanoparticle films

(Continued from page 1)

Vanadium dioxide materials switch due to temperature instead of from applying electricity like electrochromic materials. Electrochromic glass is a growing sector of the window industry but is expensive and requires infrastructure like wires and switches. Because they switch due to the temperature of the environment thermochromic materials are quite interesting scientifically and commercially.

Tunable and reflective nanoparticles

Supported by NMSBA grants and a Cooperative Research and Development Agreement, or CRADA, a team of researchers including Paul spent several years trying to develop easy-to-apply polymer films with thermochromic nanoparticles.

Nelson Bell (1815), a Sandia materials chemist, was primarily responsible for designing and implementing a multistage process to make nanoparticles. He also determined the best way to disperse the nanoparticles in a spray-paint-like mixture, which led Nelson to call himself a paint chemist.

The biggest challenge, say Kurtz and Paul, is figuring out how to scale up the synthesis to make pounds of the nanoparticles needed to manufacture commercial products.

In addition, the team worked on how to tune the switching temperature. For example, it might be best for car windows to start reflecting heat at 78 degrees but another temperature might be better for other applications. By tweaking the "recipe" and adding tiny amounts of different metals, the team was able to make nanoparticles that could switch at any temperature from 200 degrees to minus 40 degrees.

Characterizing these "batches" of nanoparticles to make sure they had the correct properties was the responsibility of Raegan Johnson (2521), Sandia materials scientist. She used high-end equipment, such as a Fourier transform infrared spectrometer, X-ray diffraction instrumentation, and a transmission electron microscope to determine the infrared absorbance, chemical structure, and physical structure of the nanoparticles.

"A startup the size of IR Dynamics can't afford to purchase the diagnostic equipment that is available through Sandia Labs. Through the NMSBA and CRADA programs we are able to use those resources to develop the technology," says Kurtz. "It is important for small technology companies like ours to be able to partner with the national laboratories. I think that it is part of what keeps us competitive as a nation with the rest of the world."

Nanoparticles for retrofitting windows

The first product Kurtz hopes to get to market is a film to retrofit windows: something homeowners could apply to their existing windows to reduce their heating and cooling bills. Future applications include incorporating the nanoparticles into new windows, adding them to architectural plastics, such as the kind used in the Water Cube of the 2008 Beijing Olympics, or high-performance athletic clothing.

In 2016, IR Dynamics received a $1.95 million grant from the DOE Advanced Research Project Agency-Energy's SHIELD program to bridge "the valley of death" — a difficult period for startups before they produce a profitable product — and make retrofit window films a reality. The goal of this ARPA-E program is to make single-pane windows as energy efficient as double-pane windows. If every single-pane window in the US was upgraded, it would save about 1.3 percent of all US energy, or roughly the amount needed to power 32 million US homes for a year.

Most of the other projects funded through the program focus on reducing heat loss, which is a key concern nationwide. However, in some areas of the U.S., cooling requires more electricity than heating, which makes windows that can reduce the costs from both real winners.

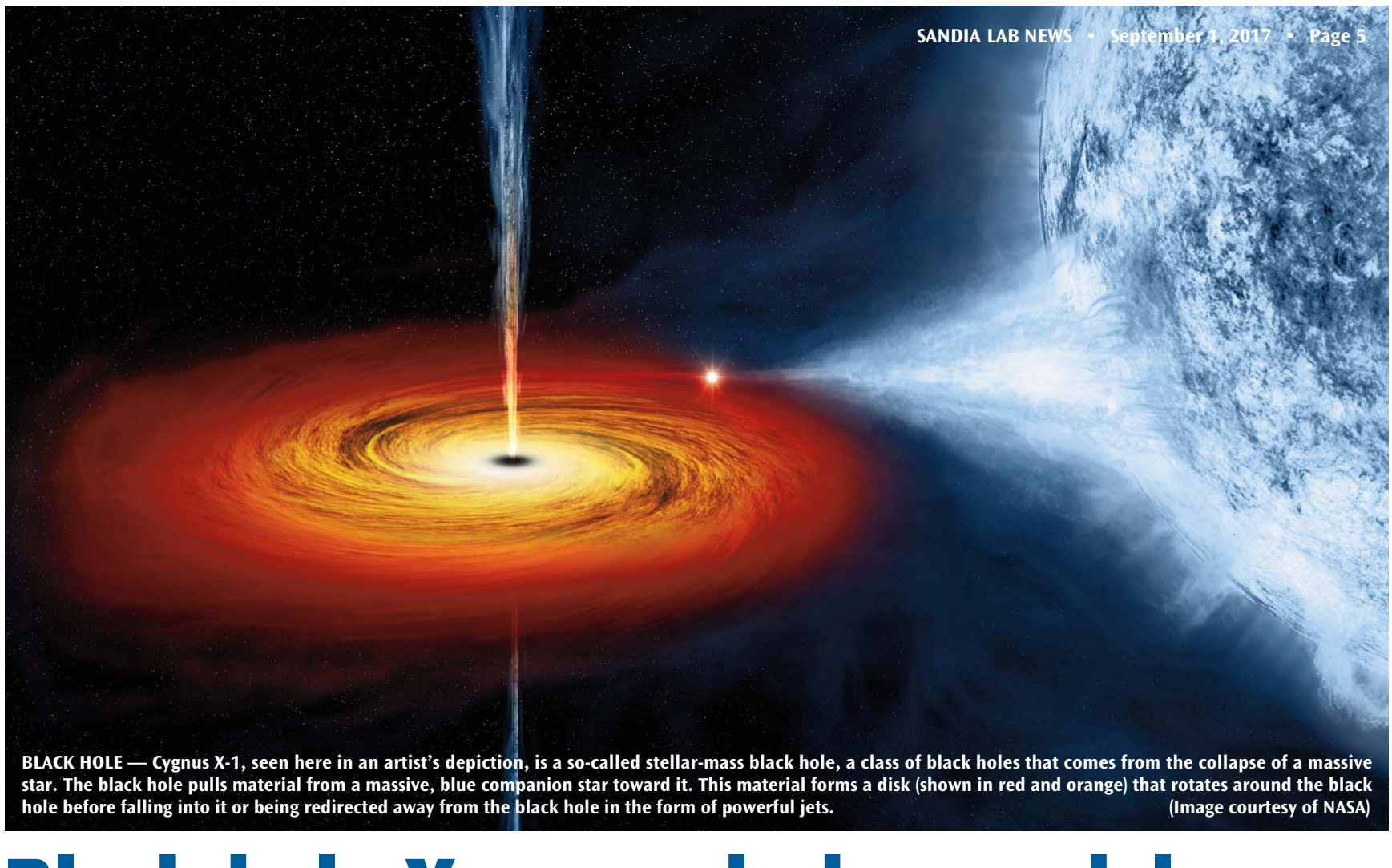
Kurtz hopes to have these retrofit window films on the market by late 2018. The company has filed several patents. IR Dynamics is also partnering with a leading corporation in the window-film and structural plastics industries and a leading company in the high-performance fabric industry.

"Usually the things we do are in technical journals or are presented at specialized conferences. It's rewarding to see things go from idea to a commercial product," says Paul. "For this company we can point to five new jobs that all started from the first NMSBA grant. Seeing new companies start up and grow knowing you've given them a technical boost is satisfying."

Solar eclipse at Sandia's Solar Tower

On Monday, Aug. 21, the solar eclipse reached its midpoint at approximately 11:45 a.m. MDT in Albuquerque, blocking about 73 percent of the sun. Sandia solar energy researcher Josh Christian (8823) and his colleagues will investigate the effects of 2017's eclipse on the ongoing research performed at the National Solar Thermal Test Facility.

(Photo by Randy Montoya)



BLACK HOLE — Cygnus X-1, seen here in an artist's depiction, is a so-called stellar-mass black hole, a class of black holes that comes from the collapse of a massive star. The black hole pulls material from a massive, blue companion star toward it. This material forms a disk (shown in red and orange) that rotates around the black hole before falling into it or being redirected away from the black hole in the form of powerful jets. (Image courtesy of NASA)

Black hole X-ray emission models need revision, tests at Z machine reveal

By Neal Singer

A long-standing but unproven assumption about the X-ray spectra of black holes in space has been contradicted by hands-on experiments performed at Sandia's Z machine.

Z, the most energetic laboratory X-ray source on Earth, can duplicate the X-rays surrounding black holes that otherwise can be watched only from a great distance and then theorized about.

"Of course, emission directly from black holes cannot be observed," says Sandia researcher Guillaume Loisel, lead author on a paper about the experimental results, published in August in *Physical Review Letters*. "We see emission from surrounding matter just before it is consumed by the black hole. This surrounding matter is forced into the shape of a disk, called an accretion disk."

The results suggest revisions are needed to models previously used to interpret emissions from matter just before it is consumed by black holes, and also the related rate of growth of the mass within the black holes. A black hole is a region of outer space from which no material and no radiation (that is, X-rays, visible light, and so on) can escape because the gravitational field of the black hole is so intense.

"Our research suggests it will be necessary to rework many scientific papers published over the last 20 years," Guillaume says. "Our results challenge models used to infer how fast black holes swallow matter from their companion star. We are optimistic that astrophysicists will implement whatever changes are found to be needed."

Most researchers agree a great way to learn about black holes is to use satellite-based instruments to collect X-ray spectra, says Sandia co-author Jim Bailey. "The catch is that the plasmas that emit the X-rays are exotic, and models used to interpret their spectra have never been tested in the laboratory till now," he says.

NASA astrophysicist Tim Kallman, one of the co-authors, says, "The Sandia experiment is exciting because it's the closest anyone has ever come to creating an environment that's a re-creation of what's going on near a black hole."

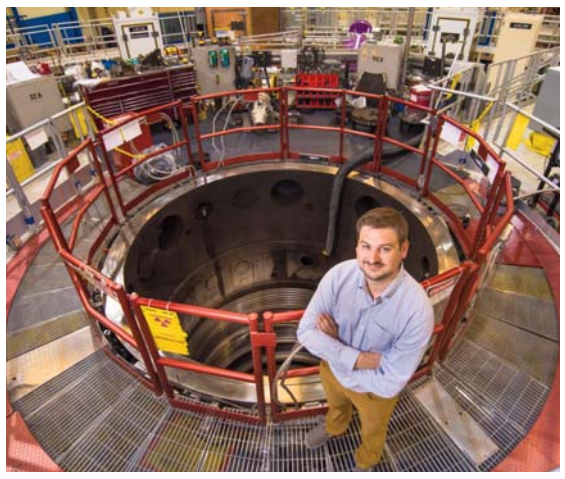
Theory leaves reality behind

The divergence between theory and reality began 20 years ago, when physicists declared that certain ionization stages of iron (or ions) were present in a black hole's accretion disk even when no spectral lines indicated their existence.

The complicated theoretical explanation was that under a black hole's immense gravity and intense radiation, highly energized iron electrons did not drop back to lower energy states by emitting photons — the common quantum explanation of why energized materials emit light. Instead, the electrons were liberated from their atoms and slunk off as lone wolves in relative darkness. The general process is known as Auger decay, after the French physicist who discovered it in the early 20th century. The absence of photons in the black-hole case is termed Auger destruction, or more formally, the Resonant Auger Destruction assumption.

However, Z researchers, by duplicating X-ray energies surrounding black holes and applying them to a dime-size film of silicon at the proper densities, showed that if no photons appear, then the generating element simply isn't there. Silicon is an abundant element in the universe and experiences the Auger effect more frequently than iron. Therefore, if Resonant Auger Destruction happens in iron then it should happen in silicon too.

"If Resonant Auger Destruction is a factor, it should have happened in our experiment because we had the same conditions, the same column density, the same temperature," says Guillaume. "Our results show that if the photons aren't there, the ions must not be there either."



SANDIA RESEARCHER Guillaume Loisel poses with the Z machine, where hands-on experiments contradicted a long-standing assumption about the X-ray spectra from the vicinity of black holes in space. He's the lead author of a paper on the experimental results, published in *Physical Review Letters*. (Photo by Randy Montoya)

That deceptively simple finding, after five years of experiments, calls into question the many astrophysical papers based on the Resonant Auger Destruction assumption.

The Z experiment mimicked the conditions found in accretion disks surrounding black holes, which have densities many orders of magnitude lower than Earth's atmosphere.

"Even though black holes are extremely compact objects, their accretion disks — the large plasmas in space that surround them — are relatively diffuse," says Guillaume. "On Z, we expanded silicon 50,000 times. It's very low density, five orders of magnitude lower than solid silicon."

The spectra's tale

The reason accurate theories of a black hole's size and properties are difficult to come by is the lack of first-hand observations.

Black holes were mentioned in Albert Einstein's general relativity theory a century ago but at first were considered a purely mathematical concept. Later, astronomers observed the altered movements of stars on gravitational tethers as they circled their black hole, or most recently, gravity-wave signals, also predicted by Einstein, from the collisions of those black holes. But most of these remarkable entities are relatively small — about 1/10 the distance from Earth to the Sun — and many thousands of light years away. Their relatively tiny sizes at immense distances make it impossible to image them with the best of NASA's billion-dollar telescopes.

What's observable are the spectra released by elements in the black hole's accretion disk, which then feeds material into the black hole.

"There's lots of information in spectra. They can have many shapes," says NASA's Kallman. "Incandescent light bulb spectra are boring, they have peaks in the yellow part of their spectra. The black holes are more interesting, with bumps and wiggles in different parts of the spectra. If you can interpret those bumps and wiggles, you know how much gas, how hot, how ionized and to what extent, and how many different elements are present in the accretion disk."

Says Guillaume: "If we could go to the black hole and take a scoop of the accretion disk and analyze it in the lab, that would be the most useful way to know what the accretion disk is made of. But since we cannot do that, we try to provide tested data for astrophysical models."

While Guillaume is ready to say R.I.P. to the Resonant Auger Destruction assumption, he still is aware the implications of higher black hole mass consumption, in this case of the absent iron, is only one of several possibilities.

"Another implication could be that lines from the highly charged iron ions are present, but the lines have been misidentified so far. This is because black holes shift spectral lines tremendously due to the fact that photons have a hard time escaping the intense gravitation field," he says.

There are now models being constructed elsewhere for accretion-powered objects that don't employ the Resonant Auger Destruction approximation. "These models are necessarily complicated, and therefore it is even more important to test their assumptions with laboratory experiments," Guillaume says.

The work is supported by the DOE and NNSA.

Sandians honored by IEEE Albuquerque Section

By Sue Major Holmes

The IEEE Albuquerque Section has recognized two Sandians: David Schoenwald as a 2017 IEEE Outstanding Engineer and Sheng Liu as a 2017 IEEE Outstanding Young Engineer.

David was honored for contributions to the development and realization of next-generation smart grid technologies by improving the damping of wide-area power system oscillations in the western North American grid. He's principal investigator for a project on wide-area damping control, co-funded by the Bonneville Power Administration's Office of Technology Innovation and the DOE Office of Electricity's Transmission Reliability and Energy Storage programs.

DAVID SCHOENWALD

Sheng's award recognizes his scientific contributions to the development of dielectric metamaterials and fundamental advances in understanding light-matter interactions of nanostructure materials using linear and nonlinear optical techniques. The award was both for his work in metamaterials and his research into novel silicon photonics.

Damping oscillations has wide-range effect on grid

Oscillations are a fact of life for the electric grid, particularly over the long distances on the western grid that encompasses the Mountain and Pacific time zones in the US and Canada. In recent decades, utilities have avoided undamped oscillations — and the potential for blackouts that can result from these oscillations — by transmitting less electricity than the lines are rated to handle, says David (8813). Utilities lose revenue doing that, which eventually could lead to building costly new lines rather than risk undamped oscillations by sending larger amounts of power on the existing grid, he says.

David and a Sandia team have been working to solve the oscillation problem for four years. He says the team has made significant progress and will likely have funding to continue the research for two more years. David estimates the technique can be further developed and implemented as an operational control system in the grid about two years after Sandia wraps up the project in 2019.

"The outstanding engineer award is a great honor," David says.

He was unable to attend the May banquet for the honorees because he was in Oregon, working on the smart grid project. "As excuses go, that one's pretty good," he jokes.

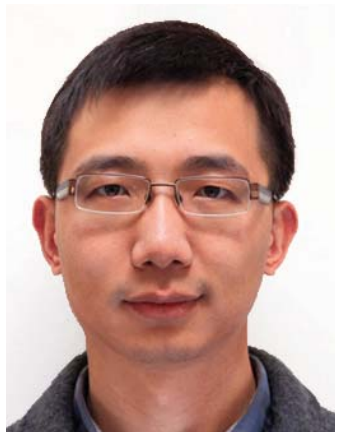
From metamaterials to silicon photonics

Sheng (5265), who says physics has fascinated him since he was a child, now researches nanophotonics, including metamaterials and silicon photonics.

"It is an honor and privilege to be awarded this, and it will motivate me to continuously contribute to the research in nanophotonics," says Sheng, whose work is done mostly at the Center for Integrated Nanotechnology, a DOE user facility jointly operated by Sandia and Los Alamos national laboratories.

For his doctorate, Sheng focused on experimental ultrafast optics. Since joining Sandia, where he has access to broad resources in nanofabrication, simulation, and nanophotonics characterization, Sheng has expanded his research into photonics devices and light matter interaction, developing techniques to study optical properties of materials at the nanoscale.

Initially, he concentrated on metamaterials, where fundamental physics discoveries still abound, but also has contributed to maturing silicon photonics technology. Metamaterials have potential to manipulate light in such a way that significant size, weight, power reduction, and new functions could be achieved for optical systems, such as infrared imaging and LIDAR. In addition to metamaterials, Sandia is a leader in silicon photonics that have applications in high-performance computing, electronic warfare, and quantum communication, sensing, and information systems, and has expertise to fabricate silicon and III-V photonic devices and microsystems.



SHENG LIU

Sheng says silicon photonics is more application-oriented and uses electronics industry tools and materials to make highly compact and scalable photonic devices and circuits. Applying silicon to optics could revolutionize daily life with, for example, significant improvements in cost, speed, and energy consumption for internet users in the future, he says.

"I'm always excited to learn new skills and embrace challenges," he says. "It's a pleasure to work here. It's a friendly, collaborative environment."

Sandia computer donation program

By Lindsey Kibler

Students in 26 schools around the state now have access to more than $3 million worth of technology many never had before, thanks to Sandia's K-12 Computer Donation Program. This year the program was able to donate 1,615 desktop and laptop computers and more than 1,000 computer accessories, including mice, keyboards, monitors, and printers. In addition, students were able to get their hands on 401 iPads distributed to schools.

"This is the first time we have ever included iPads and it was a huge hit with the recipients," says Reapplication Team Lead Michael Somuk (10264-1). Michael has been involved with the program since 2015 when he became lead of the reapplication team.

Of the 26 schools that received equipment, roughly half were located in the Albuquerque metro area, with eight in Silver City, five in Hatch, and one in Cliff.

The program is the result of a partnership between Community Involvement and Property Management and Reapplication and authorized under Executive Order 12999, which allows agencies to transfer to schools educationally useful federal equipment no longer in use.

"We truly look forward to this event every year, since it allows us to demonstrate our commitment to Sandia's tradition of giving back to our community. Many of these recipients have told us that if it wasn't for this event, they would not be able to obtain these resources on their own and would have to cancel programs that require IT resources," Michael says. "The team works extremely hard to get this right and it really gives us a great feeling to know that in some way we are contributing to the education and advancement of so many New Mexico students, some of whom could be future Sandians."

NW SPRINT contest 2017

By Sue Major Holmes

Some 22 interns competed this summer in Sandia's 3rd annual NW SPRINT, designing and fabricating a failsafe device using additive manufacturing techniques during an eight-week internship. NW SPRINT, which stands for Nuclear Weapons Summer Product Realization Institute, began after interns from three Sandia centers spent the summer of 2015 developing designs for a mechanism, using additive manufacturing and collaborating with the Kansas City National Security Campus. The annual summer intern contest focuses on having non-traditional teams develop innovative concepts using new technologies, identify gaps in those technologies and how to address them, and create a pipeline for recruitment.

For this year's contest, a panel of judges evaluated how well the devices irreversibly failed, as designed, when exposed to a shock environment. Judges for the Aug. 3 competition were Allen Roach (2241); Bryce Smith (2614); Matt Clark, National Security Campus; Megan Paciaroni, physics and engineering, Fort Lewis College; and Carolyn Seepersad and Richard Crawford, mechanical engineering, University of Texas, Austin.

Members of winning team, where they worked at Sandia, and their school: Bryce Kriegman (9433), University of Michigan; Andre Gouws (1556, year-round intern), North Carolina State University; Taylor Galliete (66131), University of Texas; Janelle Lee (2278, year-round intern), University of Kansas; Olivia McIntee (9433), Oakland University; Cameron Eanes (2278, year-round intern), Texas Tech University; and Ethan Buckley (2273), Penn State.

SANDIA CLASSIFIED ADS

MISCELLANEOUS

VACATION RENTAL, Maui, Kannapali Beach Club, 1-bdr., ocean view, w/kitchen, great resort, available Sept. 22-29, $1,450. Shirey, 505-550-5527.

POWER MOBILITY CHAIR, never used, $800 OBO. Salazar, 505-873-0680, Monday-Friday, 6-8 p.m., ask for Marcos.

ORIGINAL ART, by Fred Cleveland; Navajo rugs, various sizes, never used; Kachina dolls; Hopi pottery, email for photos & sizes. Owens, 505-235-8671, padillaowens@q.com.

COUCH & LOVESEAT, brown suede, nice, $400. Aranda, 505-697-8219, send text.

YAKIMA POD, $150 OBO. Hanks, 249-1931.

LAPTOP CASE, Kenneth Cole, new, unused, black, many compartments, checkpoint friendly, photos available, $35. Walton, 897-0092.

iPAD PRO, 9.7-in., 256GB , space gray, WiFi only, smart keyboard & back cover, great condition, $450. Soo Hoo, 821-9491.

Z-SHADE CANOPY, new-in-box, 10′ x 10′, straight legs, provides 100-sq. ft. of shade, $85. Hubbard, 505-293-2819.

MATCHING LOVESEAT/CORNER CHAISE, moss colored, purchased in 2014, excellent condition, paid $1,364, asking $680. Hussong, 505-280-4307.

LOVESEAT, Tema, contemporary, khaki, great shape, $200; moving boxes, packing paper, free. Logan, 459-5164.

ROLL-TOP DESK, antique, $500; mirrored dresser, $300; Amish nightstand, $150; dresser, $150; side table, $20; more. Bell, 505-301-0646.

TV CONSOLE, Scottsdale oak, 60-in., 35-3/4″H x 61-3/4″W x 20-3/4″D, excellent condition, $400. Velasquez, 505-280-6095.

GAS DRYER, LG, front-loading, white, $150. Elmazi, 505-856-2197.

TRUCK TENT, Conestoga-style, extends over tailgate, fits standard size truck bed, used 6 times, $100. Clark, 505-400-5205.

FISH TANK STAND, for 55-gal., solid oak, w/doors & light cover, $100; lots of moving boxes, free. Crawford, 505-401-6886.

SLEEP NUMBER BED, queen, new, just took out of box in April, $500. Edmonds, 505-554-0578.

BEER/ICE WATER GLASSES, set of 4, 17-5/8 oz., Riedel of Germany, Ouverture, in original box, never used, $35. Wagner, 505-504-8783.

VACATION, 2-bdr., 3 baths, beach condo, Cabo San Lucas, Dec. 26-Jan. 1, king bed, washer/dryer, full kitchen, contact for details/photos, $3,900. Carrasco, 505-803-3831.

HOYT BOW, 05, RH-complete set up, $350; long bed Ford camper shell, red, $350. Schroeder, 505-917-4516.

FORD F150 TRUCK BED TOPPER SHELL, blue, short bed, $400; bed extender, $150. Lebien, 505-459-4074.

MULTI-FAMILY YARD SALE, Labor Day weekend, 1200 block of Pocono Rd. SE, 87123, baby items, maternity clothes, much more. Ruiz, 575-650-2858.

LIVING ROOM MIRROR, 28″ x 42″, antique gold frame, 38″ x 52″, $100; Asian-style table lamps, $50/pair. Graeber, 248-0880.

TRANSPORTATION

′02 RAM 1500, Laramie Longhorn, 4x4, Rambox, air suspension, convenience & luxury pkgs., 43K miles, $37,500. Sivage, 505-259-7115.

′10 AUDI S4 QUATTRO PRESTIGE, 3.0L, supercharged, V6, 6-spd., loaded, 80K miles, excellent condition, $26,000. Sedillo, 505-286-7108.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.

Submit by one of these methods:

- **EMAIL: Michelle Fleming (classads@sandia.gov)**
- **FAX: 844-0645**
- **MAIL: MS 1468 (Dept. 3651)**
- **INTERNAL WEB: From Techweb search for 'NewsCenter', at the bottom of that page choose to submit an ad under, 'Submit an article'. If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.**

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

′12 CHEVY SUBURBAN LT, K1500, 4WD, 4-dr., black, leather, captain's chairs, 94K miles, $23,750 OBO. Donnell, 505-241-9111.

′14 HYUNDAI GENESIS COUPE, 2.0T, R-spec, 1 owner, 36K miles, excellent condition, $18,500 OBO. Szklarz, 306-2727.

′12 HYUNDAI ELANTRA, leather, navigation, keyless entry, back-up camera, original owner, well maintained, 35K miles, $10,000. Stroud, 505-205-4051.

′09 HONDA CIVIC EX, 4-dr. sedan, 1 owner, 45K miles, excellent condition, $8,200. Schwartz, 505-220-6301, ask for Barry.

′15 FORD EDGE TITANIUM, AWD, silver, black leather, all the features, 26K miles, great condition, $28,000. Atkins, 505-259-3634.

′08 BMW X5, 3.0 Si, AWD, 6-cyl., champagne exterior, brown leather, 77K miles, never wrecked, runs perfect, excellent gas mileage, <NADA, $10,000. Dwyer, 249-6935.

′90 CORVETTE, AT, red, black interior, 145K miles, excellent condition, photos available, $8,000 OBO. Marchi, 363-2096, ask for Don.

′09 HONDA CR-V EX, AWD, AT, 1 owner, call or text for photos, $7,800 OBO. Griego, 505-400-4328.

′15 NISSAN VERSA SEDAN, 4-dr., 4-cyl., silver, only 2,234 miles, $13,000 OBO. Olson, 715-8501.

′00 TOYOTA CAMRY LE, V6, 195K miles, $2,100. Rice, 515-6261.

′13 MAZDA CX-5, Touring, AWD, navigation, only 14K miles, like-new condition, KBB $19,000, asking $18,000. Massad, 505-453-2666.

RECREATION

′98 VIP VIXEN SKI & FISH BOAT, 19-ft., always garaged, well maintained, great all around boat, <average book, $6,500. Dukes, 505-604-0615.

′09 HONDA CRF 230M MOTORCYCLE, dual sport, street legal, 80-mpg., 2,300 miles, looks & rides new, $3,200. Goodman, 505-463-4415.

′16 PITCH COMP MOUNTAIN BIKE, black, XL frame, wheel 27-1/2″, used 1 season, well maintained, $450. Polyard, 273-0555.

KENT TANDEM BIKE, 21-spd., $150; SteadyRack Classic bike rack, $35. Witt, 505-991-1878.

′08 FLEETWOOD AVALON CAMPING TRAILER, hybrid, 3,710-lbs., sleeps 8-10, shower, cooktop, all amenities, $9,900. Eldred, 505-281-0224.

REAL ESTATE

2-BDR. HOME, new bath, updated kitchen, 800-sq. ft., south UNM area, beautiful, $169,000. Prior, 505-239-9586.

VACANT LAND, Tome NM, near Tome Hill & UNM extension, $40,000/acre, owner will negotiate price. Ramos, 304-593-3425 or 304-561-5612.

HOME, 2,442-sq. ft., amazing views/decks, workshop, hot tub, close to Labs, walking distance to open space, $336,000. Derzon, 206-2451.

4-BDR. HOME, 3 baths, 3,298-sq. ft., custom Ashcraft, Matthew Meadows in North Valley, fully remodeled, MLS #900522, $619,900. Shaw, 379-9366.

WANTED

ROOMMATE, Volterra, WiFi, no pets, 5 mins. to base, $400/mo., utilities included. Guillen, 505-385-8189.

KIDS BIKES, gently used condition, for 14-yr.-old boy & 15-yr.-old girl. Rhea, 505-227-4799.

ROOMMATE, 3-bdr. home, 2 baths, gated community, 5 mins. from Eubank gate, $575/mo. Barr, 505-252-2496.

Susan Seestrom

(Continued from page 8)

my daughter and quilts for various babies in the family including my newest grandchild Hendrix. But I ended up analyzing data eight hours a day for much of the time. I wasn't quite ready to be retired."

Steve's idea to put together a team to bid on the Sandia management contract, and her role as Associate Labs Director of Advanced Science & Technology and Chief Research Officer, resonated. Susan didn't want to leave New Mexico, and Steve's proposal would keep her close to where her husband still worked. "The job had things I didn't have in previous jobs," she says. "It was big in scope. It had LDRD and the weapons science and technology portfolio. It was a team that had the potential to take a great lab and make it better. I was excited about trying it. And then we won, and here I am. I love it."

Susan says her goal at Sandia is to "preserve the great culture and capabilities that are here and make a difference in a few ways that improve the trajectory of the Labs for the future."

She is driven by curiosity and problem-solving. "I love to understand things I didn't understand," she says. "Not just science, but history, people. My weak point is trying to solve problems that aren't mine to solve."

She thinks the defining moment in her life was the decision to go to college. "Life is full of moments that alter your trajectory, and every one gives you an opportunity to change and learn," she says. "Going to college made my life different from my brothers, sisters, and cousins. It opened huge opportunities for me and for my children and grandchildren. Education is transformational to families."

All five of Susan's daughters graduated from college and have advanced degrees. One is a Ph.D. biophysicist at Johns Hopkins University, one is an attorney working in Portland, and another recently graduated from medical school and is doing her residency at the University of Michigan. "While I think my daughters are very smart, they have succeeded more than many people who are just as smart. They have had opportunities because their parents had college educations," she says.

Of all her achievements, Susan is most proud of the women in her family. "All five of our girls are accomplished and kind, good people who care about others in the world," she says.

Travel, TV, and a surprise

Susan's perfect day starts with an unrushed morning and some exercise, like a hike, then something productive. An even more perfect day involves travel. Favorite vacations spots include the beaches of North Carolina and Cabo San Lucas, Mexico. In recent years, the family has traveled to South Africa, Tanzania, Ethiopia, Egypt, and Greece. They hiked the Amalfi coast in Italy and, despite Susan's fear of heights, through the mountains of Peru to the remote Incan ruins of Choquequirao.

Closer to home, Susan likes to binge watch TV shows like "Orange is the New Black" and "Game of Thrones," and read murder mysteries set in places like the Shetland Islands and Sweden.

She says she wouldn't do anything differently in her life. "Some things didn't work out but they all made a difference in some way that I would not change," she says.

Even the tattoo, a recent surprise. She got it a few years ago in Santa Fe but had been thinking about it for some time. Her husband and grown children thought it was dumb, but that didn't deter her. One daughter questioned whether Susan had any idea what to pick as a tattoo, thinking that would be a more successful approach to convincing her not to do it.

But she thought of the tau, the symbol of lifetime and of her neutron project. "That was meaningful to me," she says. "I was retired. I didn't need to care what anybody thought about it. So I went ahead. I did it because I could."

SUSAN IN KATHMANDU, Nepal, visiting the home of her sponsored student, Srijana (in yellow), along with Srijana's mother and younger sister. Ever since Srijana started school, Susan has supported her education through Hands in Outreach, an educational sponsorship program for poor girls in Nepal. (Photo courtesy of Susan Seestrom)

Ebb and flow

From the banks of the Mississippi to the mountains of New Mexico, Susan Seestrom followed her curiosity about life, people, and science to leadership at two national labs

By Nancy Salem

The small tattoo peeks out from under Susan Seestrom's sleeve, a tau, the Greek letter t, often used to represent a particle lifetime in physics.

"The concept of lifetime is worth thinking about," Susan says. "Life is limited, and you should spend time doing things that make a difference, and not put things off, because you really don't know how long you'll have to do what you want to do."

Susan was trying, not entirely successfully, to wind down a groundbreaking career in physics and thinking about the things she thought she wanted to do in retirement — read, travel, write poetry, spend time with her grandchildren — when the phone rang. It was Steve Younger asking her to have coffee and talk about an idea.

AT THE BEACH — Susan with her two youngest daughters along with her youngest grandchild at Carolina Beach, North Carolina, in June 2017. (Photo courtesy of Susan Seestrom)

Susan grew up in Minnesota on the Mississippi, the eldest of four siblings. "Our yard literally ended in the river," she says. "I remember every night of every summer sitting on the porch waiting for my dad to come home from work and take off his boots so we could go swim."

Susan's father was an electrical contractor and her mom the company — Seestrom Electric — bookkeeper. She learned the business and thought her dad was the smartest guy in the world. "He invented things," she says. "He was not happy with the look of the front end of his Studebaker. He took it apart and rebuilt it in a sleek fashion using fiberglass. He designed and did the wiring for our house. There were a set of six lights that could be turned off and on from six or seven locations in house, including a panel next to his side of the bed."

GARDENING BY THE RIVER — Susan with her father and two of her three siblings working on a garden in their yard along the Mississippi River near Minneapolis. Susan, in the leopard print leggings, says her fashion sense has improved since then. (Photo courtesy of Susan Seestrom)

A gifted student, Susan was expected to go to college though neither of her parents had a degree. "It never occurred to me that I wasn't supposed to do something significant," she says. "The expectations were high."

She was strong in math and took college-level calculus in high school, but classes in advanced biology nearly led her in a different direction. On field trips to South Dakota and Wyoming, the biology students excavated Native American ruins and dinosaur fossils. "I loved it," Susan says. "We went out for two weeks and learned about archaeology and paleontology. My first real technical job was putting together a mobile environmental lab for the school district that had exhibits of fossils, plants, and other things we collected."

Drawn to that world, Susan's first major at the University of Minnesota was geology, housed in the Institute of Technology at the School of Engineering. She took classes in general anthropology, geology, physics, and math, which ended after one year on the geology track. "I didn't want to be done with math," Susan says. "So I switched to physics without really thinking about what that would mean. I became a physics major."

She liked it, particularly quantum mechanics, and gravitated to the university's nuclear physics lab. She also got married and had a daughter, Katie. Susan took a year off but finished her credits and got into the University of Minnesota graduate school. "They had a nuclear physics program and a lab, so I became a nuclear physicist," she says. "I enjoyed the work there and the hours were flexible so I could juggle being a mom. Sometimes I took Katie to the lab. One of my fellow graduate students kept M&Ms in his desk. Katie still remembers the guy with the M&Ms at the nuclear physics lab."

When the lab lost its funding to build the Los Alamos Meson Physics Facility (LAMPF) at Los Alamos National Laboratory (LANL), Susan moved there in 1978 with her thesis work. She did her dissertation experiment a year later, and after getting her doctorate from the University of Minnesota, became a postdoc at LANL and did three years as a UMN postdoc.

Susan's marriage didn't survive the move to Los Alamos, but she met a fellow nuclear physicist at LAMPF who became her second husband. They had two daughters while Susan was a postdoc at Minnesota. "I have three daughters and two stepdaughters, so my husband is surrounded by women. But he has a male dog," she laughs.

Research and leadership

Susan built a 30-year career at LANL in nuclear physics. Along the way she worked in the Weapons Neutron Research Facility measuring neutron cross sections for certain isotopes of nitrogen. "That was in the days of the Strategic Defense Initiative and one of our jobs was to build a big neutron flight path that would irradiate things a meter in diameter," she says.

She did basic research into nuclear structure with medium energy probes and studies of the weak interaction using neutrons. She initiated a groundbreaking effort to develop a source of ultra-cold neutrons (UCN) that was used to measure the beta asymmetry in neutron decay and worked in a collaboration measuring the neutron lifetime using UCN. "We just finished the first measurement of the lifetime of neutrons and submitted it for publication a couple months ago," she says. "My work at Los Alamos came to a nice and logical conclusion."

From 1994 to 2013, Susan moved in and out of management, serving as Associate Laboratory Director for Experimental Physical Sciences, Associate Laboratory Director for Weapons Physics, Physics Division Leader, and Deputy Group Leader for Neutron Science and Technology. Her portfolios as Associate Director included high-performance computing and computer science, weapons design, computer science, hydrodynamics testing, and material science and technology. She has co-authored more than 140 publications and is a Fellow of the American Physical Society.

SUSAN SEESTROM (Photo by Randy Montoya)

Stepping down from management in 2013, Susan stayed at LANL as a full-time Senior Fellow but, thinking she would further edge toward retirement, became a part-time associate working solely on LDRD-supported research aimed at making the world's best neutron lifetime, using the UCN source at Los Alamos. For three years she got more involved in the experiment, traveled, served on various advisory panels, and led reviews for the Nuclear Science Advisory Committee.

The call

Then came the call from Steve Younger. "In first six months of retirement, I never got around to doing a number of things I thought I wanted to do. I guess I didn't really want to do them," she says. "I did a few cool things like making a very special wedding quilt for

(Continued on page 7)