SANDIA LAB NEWS
PUBLISHED SINCE 1949
Vol. 71, No. 18, September 13, 2019

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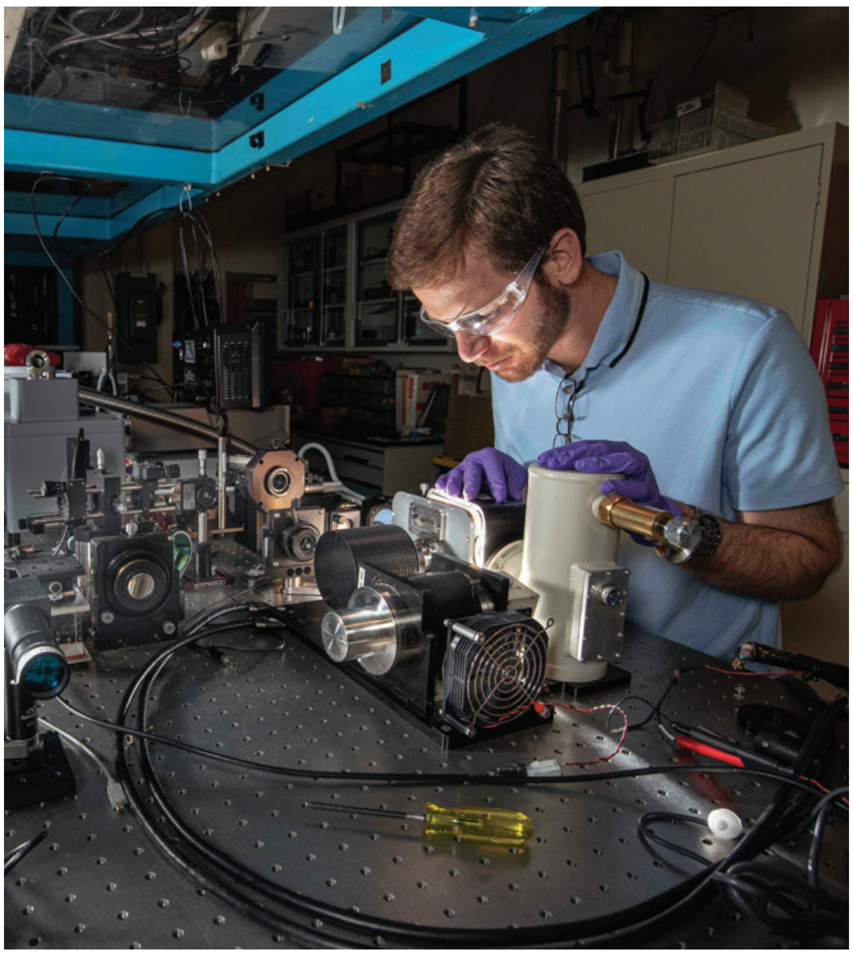
Seeing infrared: Sandia's nanoantennas help detectors see more heat, less noise



NANO LOADING — Optical engineer Michael Goldflam sets up equipment to load and characterize a new nanoantenna-enabled detector. **Photo by Randy Montoya**

By **Kristen Meub**

Sandia researchers have developed tiny, gold antennas to help cameras and sensors that "see" heat deliver clearer pictures of thermal infrared radiation for everything from stars and galaxies to people, buildings and items requiring security.

In a Laboratory Directed Research and Development project, a team of researchers developed a nanoantenna-enabled detector that can boost the signal of a thermal infrared camera by up to three times and improve image quality by reducing dark current — a major component of image noise — by 10 to 100 times.

Thermal infrared cameras and sensors have existed for 50 years, but the traditional design of the detector that sits behind the camera lens or a sensor's optical system seems to be reaching its performance limits, said David Peters, Sandia manager and nanoantenna project lead.

Improved sensitivity in infrared detectors, beyond what the typical design can deliver, is important for both Sandia's national security work and for other uses, such as astronomical research, David said.

The sensitivity and image quality of an infrared detector usually depends on a thick layer of detector material that absorbs incoming heat and turns it into an electrical signal that can be collected and turned into an image. The thickness of the detector layer determines how much heat can be absorbed and read by the camera, but thick layers also have drawbacks.

"The detector material is always spontaneously creating electrons that are collected and add noise to the image, which reduces image quality," David said. "This phenomenon, called dark current, increases along with the thickness of the detector material — the thicker the material is, the more noise in the image it creates."

The research team developed a new detector design that breaks away from relying on thick layers and instead uses a subwavelength nanoantenna,

— CONTINUED ON PAGE 2

Experiments at sun temperature offer solar model solutions

Z machine may reconcile sun's energy and composition

By **Neal Singer**

Experimenting at 4.1 million degrees Fahrenheit, physicists at Sandia's Z machine have found that an astronomical model — used for 40 years to predict the sun's behavior as well as the life and death of stars — underestimates the energy blockage caused by free-floating iron atoms, a major player in those processes.

The blockage effect, called opacity, is an element's natural resistance to energy passing through it, similar to an opaque window's resistance to the passage of light.

"By observing real-world discrepancies between theory and our experiments at Z, we were able to identify weaknesses in opacity figures inserted into solar models," said Taisuke Nagayama, lead author on the group's latest publication in Physical Review Letters.

The good news is that Sandia's experimental opacity measurements can help bloodlessly resolve a major discrepancy in how the widely used Standard Solar Model uses the composition of the sun to predict the behavior of stars.

Resolving a major discrepancy

Until 2005, the SSM's multiplication of the amount of each element present by its opacity accounted for the observed temperature structure of the sun. But new astrophysical observations and more sophisticated physics led astronomers to revise their estimates of the sun's composition.

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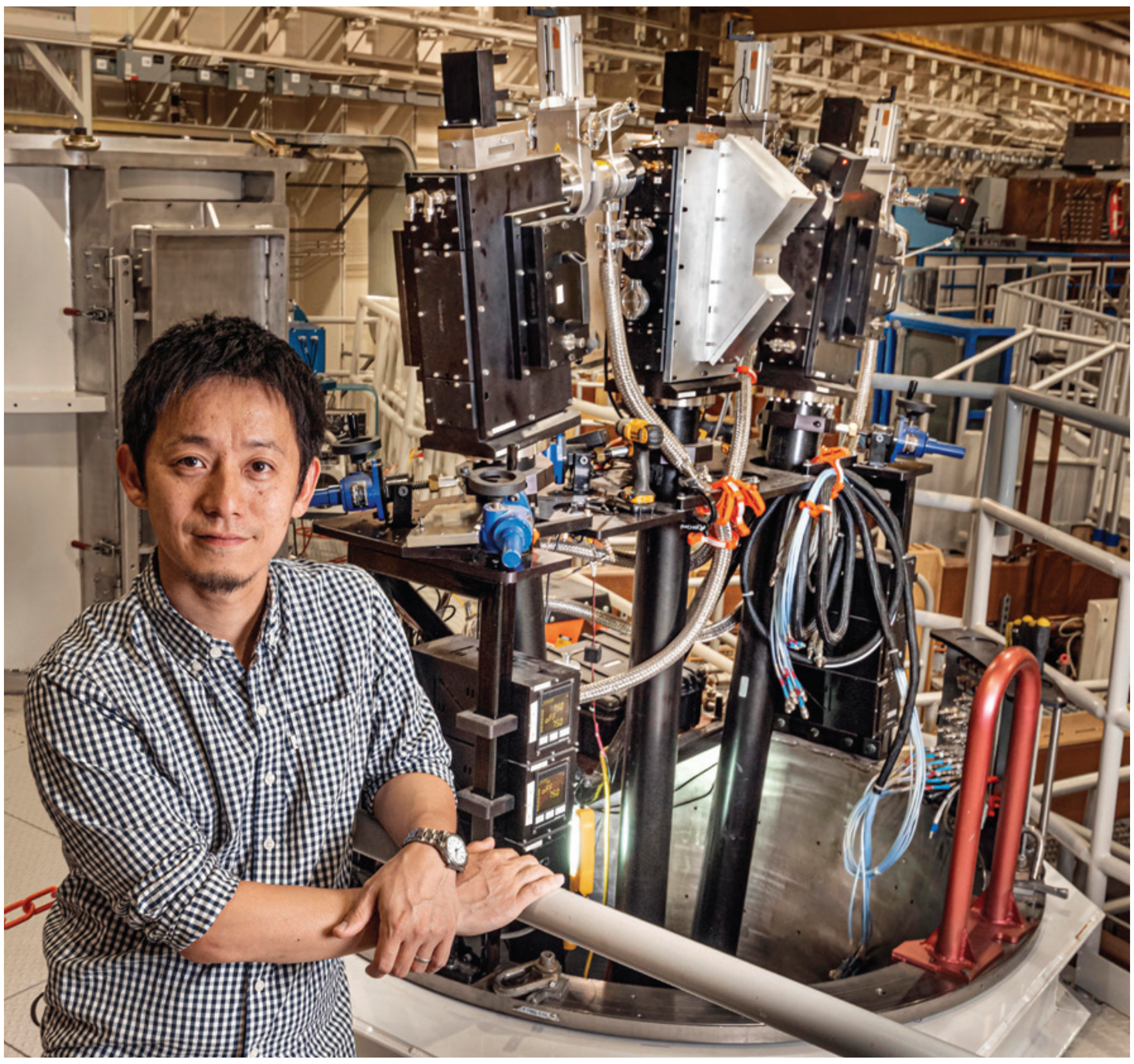

ASTRONOMICAL MODEL — Physicist Taisuke Nagayama enjoys a quiet moment at Sandia's Z machine. **Photo by Randy Montoya**

Strategic Priority No. 5

Seeking new pathfinder systems to address threats

By **Dori Ellis**
Deputy Labs Director

Note: Prior to becoming Sandia deputy labs director in June 2019, Dori served as the associate labs director for Division 8000, Integrated Security Solutions. In this role, Dori oversaw Strategic Priority No. 5 for most of fiscal year 2019.

Since 1949, Sandia has developed advanced technologies to ensure global peace. Some of these innovations — for example, contributions to nuclear weapons, space missions and national intelligence assessments — exemplify what Sandia's senior leadership team considers to be the Labs' flagship pathfinder systems.

Reflecting on such systems and their pioneering contributions to national security over the years led Sandia's strategic planning team to conceive of Strategic Priority No. 5: Invent and demonstrate pathfinder systems to address threats.

The goal of this strategic priority is to think beyond Sandia's traditional boundaries. We are convinced that Sandia is uniquely positioned to develop new pathfinder systems because of our technical depth and breadth across multiple disciplines. Inventing and demonstrating these systems are important steps toward creating the future at Sandia.

Defining pathfinder systems

What are pathfinder systems? We define them as "advanced systems that help solve significant technical challenges of national interest, explore new technologies and system concepts, demonstrate advanced concepts that support evolving mission requirements, reduce technological risk, shape new programs and transfer technology to the private sector."

Furthermore, a pathfinder system is an effort whose success requires integrating far-reaching capabilities (people, research and facilities) to deliver something that has never been possible before. Pathfinder systems depend on the maturation of cutting-edge technology and systems solutions through technology readiness levels.

NEW PATHFINDER — Deputy Labs Director Dori Ellis seeks engagement from across Sandia to develop pathfinder systems that push beyond leading-edge technologies to address national security concerns. **Photo by Rebecca Gustaf**

Sandia is interested in developing threat-informed pathfinder system solutions that push beyond the leading edge of technology to address critical national security concerns on mission-relevant time scales. We will focus on systems that are too risky for industry and academic partners to pursue on their own. We welcome diverse ideas, and we plan to leverage R&D and technology partnerships from the private sector, as well as our relationships with thought leaders in academia.

These pathfinder system solutions must be large in scale and cross multiple program portfolios at Sandia, supporting several different customers and mission areas. In addition, they must be innovative and address a major national security threat that either has not been anticipated or simply does not exist yet.

Finally, the new pathfinder systems should be driven by Sandia's other mission-focused strategic priorities (No. 2: Nuclear deterrent; No. 3: Intelligence science; No. 4: Threat detection; and No. 6: Engineering, science and technology).

Seeking ideas for new pathfinder systems

To achieve Strategic Priority No. 5, we must first identify pathfinder systems to focus on as a national laboratory. We seek engagement from across the Labs to help us accomplish this goal.

Sandia's strategic planning team has discussed several methods for finding such pathfinders. In addition to collaborating with industry and academia, we encourage taking steps to partner with our Laboratory Directed Research and Development program, discern national security gaps that Sandia is uniquely positioned to address and draw upon our vast breadth to think about problems differently.

For example, a pathfinder system could be developed by following an incubator concept via the LDRD program. After starting as a high-risk, unconstrained LDRD project that challenges the status quo, the system could then move on toward achieving technology demonstration.

Other pathfinder systems could be identified as possible ways to tackle national security gaps and innovation challenges through Sandia-unique technologies and capabilities in our program portfolios.

If you have ideas for a pathfinder system that could push beyond leading-edge technologies to address national security concerns, contact Amy Shrouf, the lead for Strategic Priority No. 5 and senior manager of the advanced systems program.

We look forward to hearing from you. Our nation is counting on Sandia to use our resources and capabilities as a national laboratory to solve the most pressing challenges facing our world today. We are eager to see how Sandia will continue its long history of rendering exceptional service in the national interest by developing pathfinder systems that advance global peace.

SANDIA LABNEWS
PUBLISHED SINCE 1949
Managed by NTESS LLC for the National Nuclear Security Administration

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Classified Ads 505-844-4902

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Published on alternate Fridays by Internal, Digital and Executive Communications, MS 1468

LAB NEWS ONLINE: sandia.gov/LabNews

LABNEWS Notes

EDITOR'S NOTE: Lab News welcomes guest columnists who wish to tell their own "Sandia story" or offer their observations on life at the Labs or on science and technology in the news. If you have a column (500-800 words) or an idea to submit, contact Lab News editor Tim Deshler at tadeshl@sandia.gov.

Nanoantennas

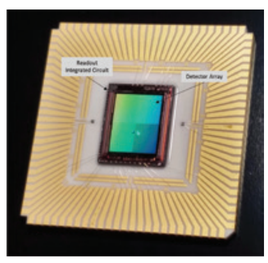
CONTINUED FROM PAGE 1

a patterned array of gold square or cross shapes, to concentrate the light on a thinner layer of detector material. This design uses just a fraction of a micron of detector material, whereas traditional thermal infrared detectors have a thickness of five to 10 microns. A human hair is about 75 microns wide.

The nanoantenna-enhanced design helps detectors see more than 50% of an object's infrared radiation while also reducing image distortion caused by dark current, whereas current technology can only see about 25% of infrared radiation. It also allows for the invention of new detector concepts that are not possible with existing technology.

"For example, with nanoantennas, it's possible to dramatically expand the amount of information acquired in an image by exquisitely controlling the spectral response at the pixel level," David said.

The team makes the nanoantenna-enabled detectors by slightly altering the usual process for making an infrared detector. It starts by "growing" the detector material on top of a thin disk called a wafer. Then the detector material is flipped onto a layer of electronics that read the signals collected by the nanoantenna and the detector layer. After discarding the wafer, a tiny amount of gold is applied to create the patterned nanoantenna layer on top of the detector material.



UNDETECTABLE DETECTOR — Sandia's nanoantenna-enabled detector sits on an assembled focal plane array for a thermal infrared camera. The gold nanoantennas are so small they aren't visible on top of the detector array. **Image courtesy of Sandia National Laboratories**

"It was not a given that this was going to work, so that's why Sandia took it on," David said. "Now, we are to the point where we have proven this concept, and this technology is ready to be commercialized. This concept can be applied to different detector types, so there's an opportunity for existing manufacturers to integrate this new technology with their existing detectors."

David said Sandia is pursuing leads to establish a Collaborative Research and Development Agreement to start transferring the technology to industry.

"This project is a perfect example of how a national lab can prove a concept and then spin it off to industry, where it can be developed further," David said.

HOT SHOT findings could save defense technology developers time and money

By ***Troy Rummler***

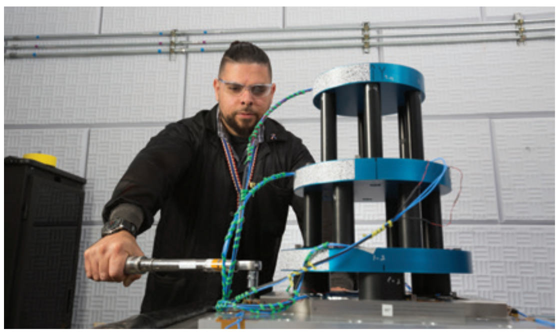
An early milestone for developing missile technologies is to show they can work in computer simulations or large-scale field tests that shake and spin components without falling to pieces.

"Screws can back out; things can break," said Greg Tipton, a structural dynamics engineer at Sandia. Similar tests are performed in the auto, aircraft and aerospace industries.

Now, an analysis of HOT SHOT sounding rocket data has revealed a way to improve these tests, providing an earlier, more accurate indicator of whether an experimental technology will ultimately succeed in flight. This could save taxpayer money by eliminating approximately a year's worth of additional research and development ordinarily needed to get the same level of information.

In a series of experiments, Greg and his team dressed the insides of sounding rockets with pea-sized instruments that measure vibration. Their work has produced a more complete picture of flight vibrations that is now being used to create more accurate simulations and ground tests.

"Flight gives you combined environments that you wouldn't get on the ground," Greg said. "So, it's spinning and it's accelerating and it's vibrating — there are shocks. It's a whole different kind of environment."



WEDDING CAKE — Sandia technologist Ralph Lied-Lopez helped study the amount of vibration that mechanical objects, including the so-called "wedding cake" seen here, endure in flight. **Photo by Norman Johnson**

Olga Spahn, Sandia's HOT SHOT payload integration manager, explained that having better data at an early stage of development could create opportunities to explore new, innovative ideas by reducing the risk of failure. It could also improve the overall performance of future missile systems by fostering development of components that reduce size, weight and power requirements.

TAKING FLIGHT — A HOT SHOT sounding rocket takes off from Sandia's Kauai Test Facility in Hawaii. Data collected from onboard sensors is allowing researchers to improve computer- and ground-based simulations of flight vibrations. **Photo by Mike Bejarano and Mark Olona**

A new way to predict flight vibrations

In May 2018, Greg and his team supplied their own experiment. They built a mock component for the rocket, which they called the "wedding cake," after its shape. Then they decorated it with vibration sensors. After the launch, they played a mathematical game with the data they got back. Knowing only the vibration data from a few sensors, they tried to calculate the readings on every other sensor.

"We showed we could do this and predict what the vibration environments were pretty much anywhere on that structure," Greg said.

In April, they repeated the experiment, this time outfitting the entire payload sections of two rockets, measuring vibrations on and around more than a dozen pieces of experimental hardware. Initial analysis of that data has suggested they can predict vibration at virtually any point in space within that section of the rocket.

"With this last round of flights, we kind of added another layer of complexity," said Brandon Zwink, an engineering consultant who worked with Greg's team and helped analyze the data. "Because originally, with the 'wedding cake,' we had hardware that was specifically designed to work with this. And now we're really instrumenting hardware that, you know, it's flight hardware. We really didn't have any input into the design of it. It wasn't designed for this experiment; it's just what it was."

To realize the potential cost savings, the Sandia team must now recreate the HOT SHOT flight environment using ground test technology. If successful, this will be a sophisticated testing platform that generates more and better data than is usually available for missile technologies in early stages of development. The team is exploring acoustics and vibrating patches as ways to recreate complex vibrational patterns that are difficult to reproduce using conventional shaker tables alone.

Two more HOT SHOT flights launched Aug. 28 from Sandia's Kauai Test Facility in Hawaii. Brandon fielded microphones around the launch site to measure sound produced by the rocket, which can contribute to vibrations.

PSEL wraps up nonreflective solar panel testing

Collaboration with Sandia helps small business scale anti-glare portable PV system to utility-grade

By ***Kelly Sullivan***

Sandia's Photovoltaic Systems Evaluation Laboratory is in the final phase of a collaborative research project with Nishati, a veteran-run manufacturer of light-weight, portable photovoltaic panels. The collaboration will shift to the PV proving grounds project at the end of the fiscal year.

In 2016, Nishati sought Sandia assistance through DOE's Small Business Vouchers program to scale up its portable PV system into utility-grade equipment. The portable equipment was designed to meet stringent Marine Corps requirements for anti-glare panel surfaces to reduce visibility in tactical environments.

"These same requirements could be useful at military air bases and airports," Sandia researcher Bruce King said.

Once Nishati was awarded a voucher, work took place in three phases.

Phased approach

Phase I included materials screening activities using mini-modules to assess different packaging materials and surface textures, Bruce said.

"Glare testing was performed at the National Solar Thermal Test Facility," he said, "and electrical response was tested at PSEL to determine the optimal materials package to use for the product."

Phase II included scaling up the mini-module designs to three, prototype utility-grade, 72-cell photovoltaic panels. These were also sent to the NSTTF to validate reflectivity, Bruce said. Results from this testing were added to the Sandia-developed Solar Glare Hazard Assessment Tool, now GlareGauge™, to assist with PV plant design near airfields. The prototypes were then brought back to PSEL for indoor and outdoor electrical characterization.

Bruce said Phase II results showed that while the electrical performance of the panels was undifferentiated from commercial products currently on the market, the panels' reflectivity results were off the chart.

"The product's electrical performance was indistinguishable from anything I might read on any spec sheet," Bruce said, "but what was significant was the reflectivity. It was unbelievably better. We knew from testing for SGHAT that reflectivity was low, but we weren't expecting to see it translate

PV BOOST — Researcher Bruce King collaborated with Nishati at Sandia's Photovoltaic Systems Evaluation Laboratory. **Photo by Lonnie Anderson**

PHASE III — The final phase of the project involves side-by-side outdoor performance validation of Nishati's prototype PV panels on Sandia's unique two-axis tracking system. **Photo by Bruce King**

into potential power gains compared to conventional products."

Next steps

In Phase III of the project, a second set of panels similar to the Phase II panels are being used to validate the results.

"We'll take the output from the validation studies and run power prediction simulations to understand the potential magnitude of these gains for different system configurations," Bruce said.

Phase III will conclude at the end of fiscal year 2019 with the two sets of panels installed outdoors in side-by-side systems at PSEL to validate the simulations. The panels will be connected to the grid for a year or more, Bruce said, and will also provide valuable information about their durability.

As the SBV project comes to a close, the modules will transition into PSEL's PV proving grounds project, where researchers can continue to learn about their unique behavior, he said.

80 Sandians recognized with special appointments

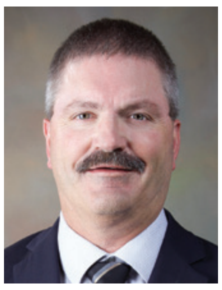
Every year, Sandia promotes high-achieving employees to the rank of Distinguished, Senior Scientist/Engineer or Senior Administrator. These special appointments include employees from all areas of the Labs' operations.

Promotion to the Distinguished level signifies a move to the fourth level of the job. This level is populated with a select group of employees who have distinguished themselves in their careers at Sandia. This year, 73 Sandians earned promotion to the Distinguished rank.

Also featured are seven exceptional Sandians appointed to the title of Senior Scientist/ Engineer or Senior Administrator, a unique recognition of professional accomplishment.

Senior Scientists/Engineers


Johnny Bochev
Computer Science


Randy Schunk
Materials Science


Kurt Larson
Computer Science


Richard Wickstrom
Systems Engineering


Bill Rorke
Systems Engineering


Cliff Ho
Mechanical Engineering


Jackie Chen
Mechanical Engineering

Executive Office


Gerald Hendrickson
Intelligence Professional


Sandhya Rajan
Protocol Officer


Marie Hoagland
Administrative Support

Division 1000


Paul Clem
Physics


B. van Bloeman Waanders
Computer Science


Jon Berry
Computer Science


Jim Laros
Computer Systems


Rekha Rao
Chemical Engineering


Phillip Reu
Mechanical Engineering


Kyle Thompson
Optical Engineering


Dan Dolan
Physics


Joshua Leckbee
Electrical Engineering


Dale Huber
Materials Science


Don Susan
Materials Science


Michael Torneby
General Technologist


Roger Harmon
CAD & Drafting Technologist


Jason Brown
R&D Lab Support Technologist


Michael Smith
R&D Lab Support Technologist

Division 2000


Doug Wall
Systems Research & Analysis


Linda Jones
Systems Engineering


Bernie Jokiel
Mechanical Engineering


Kathy Alam
Materials Science


Jennifer Gjulliin
Computer Engineering


Thomas Rogers
Mechanical Technologist

Jenny Harding Compensation Analyst

David Florez Facilities Team Lead

Joe Saloio Nuclear Engineering

David Wheeler Materials Science

Shelley Leger Cybersecurity

Tabitha Kennedy Electronics Engineering

Michael Rye Microelectronics Technologist

Luis Obando CAD & Drafting Technologist

Arne Gullerud Mechanical Engineering

Mark Ensz Mechanical Engineering

Jeffery Williams Microwave/Sensor Engineering

Roy Gutierrez Engineering Support Tech.

Douglas Thompson Microwave/Sensor Engineering

Bryan C. Smith General Technologist

Tom Friedmann Electronics Engineering

Christopher Nordquist Microwave/Sensor Engineering

John Teifel Electronics Engineering

Darlene Udoni R&D Lab Support Technologist

Michael Lawton Microelectronics Technologist

Major Monochie Microelectronics Technologist

Scott Brooks R&D Science/Eng. Manager

Mario Cortez Electromechanical Technologist

Kevin Dullea Electromechanical Technologist

Vibeke Halkjaer-Knudsen Engineering Project Lead

Park Hays Systems Engineering

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Dom Pohl CAD & Drafting Technologist

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Rob Warrick Computer Science

Jason Wheeler Mechanical Engineering

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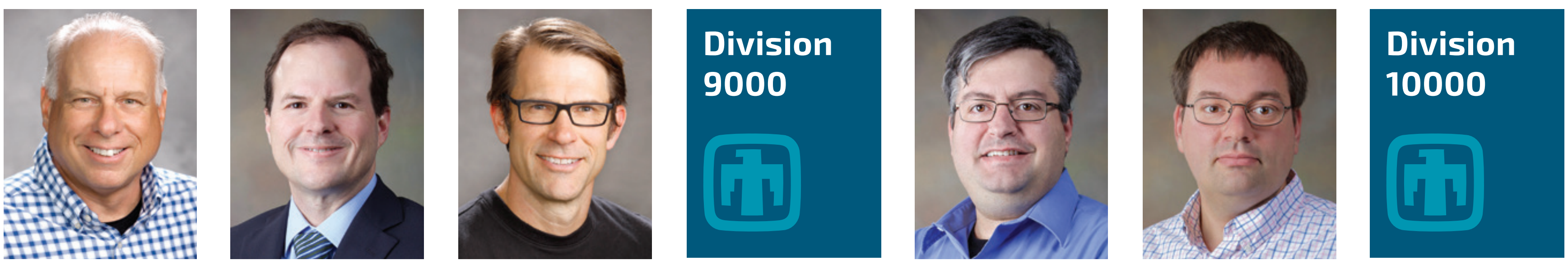
Nathalie Le Galloudec Systems Engineering

Chris LaFleur Mechanical Engineering

Kevin Carlberg Computer Science

Tim Gilbertson R&D Lab Support Technologist



Brian Holliday Machinest

Darren Branch R&D Science/Eng. Manager

Jay Foulk Mechanical Engineering

David Karelitz Computer Science

Charles Smutz Cybersecurity

Kim Hallatt Financial Policy Accountant

Guy Kent Info. Sys. Eng. Project Manager

Joseph Maestas Computer Systems

David J. Martinez Engineering Project lead

Amber Romero Quality Systems Professional

Robert Velasco Project Manager

Joseph Wharton Project Manager

Solar model solutions

CONTINUED FROM PAGE 1

Unfortunately, these new estimates, inserted into the model and multiplied by their opacities, did not account for the sun's temperature. There were three possibilities: the new composition observations were inaccurate, the venerated SSM was wrong or the theoretically derived opacities of elements were incorrect.

The best resolution clearly would come from experiments performed at the same temperatures as those found in the sun's interior.

Experiments at the temperature of the sun

More than a decade ago, Sandia researchers began taking pieces of iron, each smaller than a dime, and inserting them into the target area of Z. When Z fired, the extreme heat changed the solid into plasma (a gas) as it exists in the sun, but only for nanoseconds. That was long enough, however, for researchers to send an energy wave through each sample and measure how much got through. The idea was to create, for the first time, laboratory-derived measures for the opacity of iron at the temperature of the sun to learn whether it agreed with the theoretical figures used in SSM calculations.

Increasing the opacity of iron to the extent demonstrated by Z in multiple independent experiments removed about half the discrepancy between computed and actual solar temperature, Taisuke said.

"Astronomers are happy with us because we're saying it's the opacity figures that may be wrong," said paper co-author and Sandia researcher Jim Bailey. "Then they don't have to come up with a new model and redo all their calculations using the sun as a benchmark for predicting the evolution of stars."

That's because astronomers use the sun's composition as a reference for the universe.

"Decreasing the oxygen amount in the sun by 50% is equivalent to halving the amount of water in the universe," Jim said. "There are many exoplanets orbiting around sun-like stars; revising the understanding of our sun would also have significant impact on understanding those exoplanets.

"The astronomers liked the opacity supposition the best, and that's what we're finding so far," he said.

A metallic surprise

On the same test, Sandia also measured the opacities of chromium and nickel under the same conditions used on iron. The idea was to use those elements — respectively smaller and larger than iron, but adjacent to iron in the periodic table — as though iron were being tested closer and farther from the sun's core. Surprisingly, those elements produced experimental opacity results basically in accord with model predictions at some photon energies. Still, they differed from opacity predictions at particular wavelengths — further grist for model revision.

"Our work over the last five years has been focused on resolving the discrepancies," Taisuke said. "And yet the new results mean new science may be necessary to account for them."

To explain new experimental results, physicists are examining new models. One, called two-photon opacity, explores the idea that an element may absorb two photons at a time instead of the one thought standard.

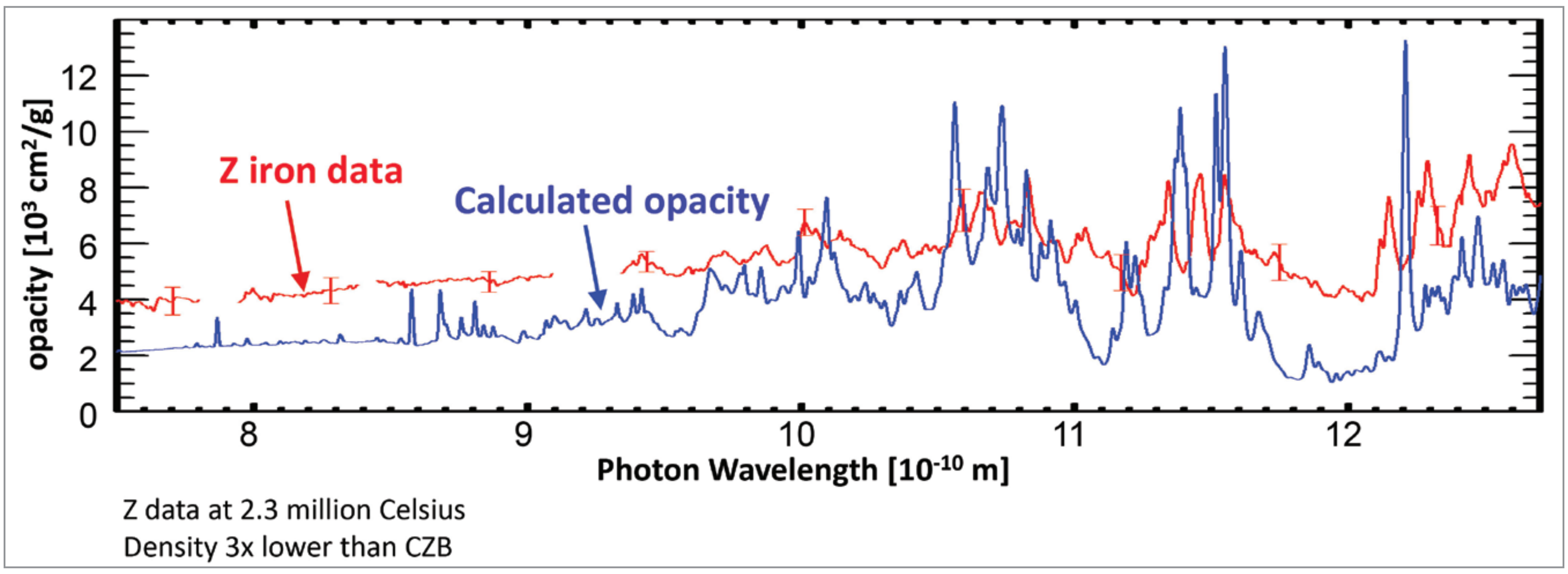
"If this multi-photon absorption is considered in the model, it would enhance the calculated iron opacity and may resolve the discrepancy," he said.

If correct, the new physics model must calculate the opacity increase only for iron, since model and data already agree for chromium and nickel.

Other experimental limitations include the fact that little is known about the structure of the sun inside particular distances from the sun's center.

"Is the discrepancy worse if you go even deeper in the sun? We don't know. It all depends on what's causing the discrepancy," Taisuke said. "We may find that the discrepancy is even worse in the solar core, or the problem may be isolated to the region around 0.7 solar radii, the distance that matches the energies at which these experiments were performed." Answering those questions should lead to a more accurate model, he said.

"Experiments of hot dense plasma are challenging enough that we should not rule out the possibility of error," Taisuke said. "And the science impact is enormous — this obligates us to continue examining the experiment's validity."



CORE TESTING — The red line shows greater opacity of iron as determined experimentally by Sandia's Z machine. The blue line shows the earlier theoretical calculation.

Image courtesy of Taisuke Nagayama

SANDIA CLASSIFIED ADS

AD SUBMISSION GUIDELINES

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

Questions to Michelle Fleming at 505-844-4902.

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Due to space constraints, ads will be printed on a first-come, first-served basis.

MISCELLANEOUS

ELECTRIC HOSPITAL BED, used ~6 mos., $500. Hunter, 505-363-8822, ask for Becky.

WOOD PELLET SMOKER, Pit Boss 440D, new-in-box, never assembled/used, $350. Brewer, 595-293-7192.

CUSTOM CABINET, large, oak, hardwood, w/light inside, $200 OBO; Harley-Davidson stock muffler, $50 OBO; Schott jacket, size 46, $300. Romero, kristeenaelise616@gmailcom.

WOOD BED FRAME, twin, Pottery Barn, open storage underneath, w/mattress, you pick up, $100. Wolz, ben@wolz.us.

TITLEIST CLUBS 915D driver, $50; 915F 3 wood, $50; $90/both; good condition. Holmes, 505-873-5255.

TWO-BIKE RACK, Thule Raceway 9001, fits over trunk/hatch, great condition, $50. Allard, 505-463-2258.

ELLIPTICAL, Sole E25, ~1 yr. old, power incline, heartrate monitor, 20 levels resistance, 8 programs, $500 OBO; vintage stereo, $125 OBO. Gutierrez, 505-900-8944.

LADDER-BACK CHAIRS, woven seat, antique, excellent condition, $150/pair. Stubblefield, 505-263-3468.

SEINFELD TICKETS, 2 pair: Oct 4, 7 p.m., Kiva Auditorium, sec. 1, row X, seats 21-22, $164/pair; sec. 2, row D, seats 2-3, $296/pair. Stuart, 505-239-7799.

TRANSPORTATION

'13 SUBARU WRX STI, 5-dr. hatch, turbo, AWD, 305-hp, 6-spd. manual, silver, 39K miles, great condition, $28,000. Levine, rdlevin15@gmail.com.

'15 JEEP RENEGADE LATITUDE, 2.4L, 4-cyl., AT, 45K miles, very good condition, $13,500. Ramos, 972-951-0290.

'99 LINCOLN CONTINENTAL, all options, runs well, 125K miles, new Michelin tires, $3,000. Gutierrez, 505-239-7059.

'18 TOYOTA YARIS iA, white/charcoal, 19K miles, runs perfect, salvage title, have photos of minor damage, repaired, no structural damage, NADA >$12,000, asking $8,000. Dwyer, 505-249-6935.

'16 FORD MUSTANG, coupe 2-dr., V6, 49K miles, brand new tires, excellent condition, $18,000 OBO. Chacon, 505-450-4321.

RECREATION

HONDA XR 250 MOTORCYCLE, new front tire, completely rebuilt, photos available, $650 OBO. Hanks, 249-1931, call or text.

'09 YAMAHA R1, white/red, 21K miles, clean, $6,500. Jones, 505-573-0253.

MOORE 24 SAILBOAT, completely outfitted, new bottom paint, lots of extras, top-rate, road-ready trailer, excellent condition, $8,750. Allard, 505-228-8930.

REAL ESTATE

4-BDR. HOME, 3 baths, 3,023-sq. ft., prestigious Rancho Verde mountain home, Tijeras Canyon, 18 mins. to Albuquerque, https://tinyurl.com/y4dkjujs, $489,900. Garcia, elainegarcia007@yahoo.com.

40-ACRE RANCH PROPERTY, adjacent to Berrenda Creek Ranch conservation land, near Gila Black Ranch, water & electric on site, $85,000. LaFleur, 505-977-8460.

4-BDR. HOME, 2 baths, 1,922-sq. ft., solar, well, 4.2 wooded acres, 20 mins. to KAFB, MLS#949785. Turpin, 505-281-5933.

AD RULES

1. Limit 18 words, including last name and home phone (web or email address counts as two or three words, depending on length).
2. Include organization and full name with 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. The same ad may not run 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 and retired Sandians only.
10. Housing listed for sale is available without regard to race, creed, color or national origin.
11. Work wanted ads are limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in poor taste.

Mileposts

New Mexico photos by Michelle Fleming, California photos by Randy Wong


Henry Apodaca 35

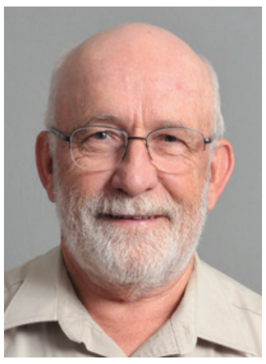

Thomas Davis 35


Cathy Vortolomei 35


Jay Clise 30


Linda Jaramillo-Alfaro 30


Justine Johannes 25


Ellan Anderson 20

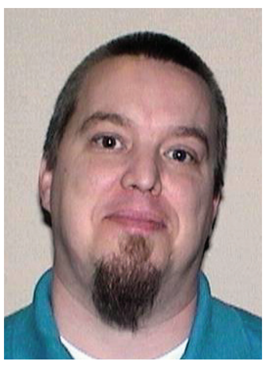

Jay Brotz 15


Teresa Kizziah 15


Mindi Koudelka 15


Cathy Sanchez 15


Alice Sobczak 15


Cody Steele 15


Raeanne Thatcher 15

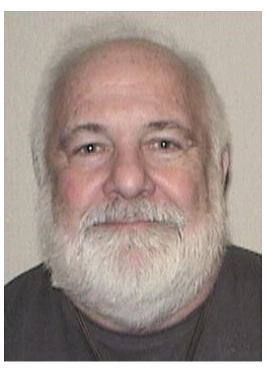

Teri Walker 15

Recent Retirees

New Mexico photos by Michelle Fleming, California photos by Randy Wong


John Cilke 33


Richard Garcia 27


Duane Richardson 5

HISPANIC HERITAGE MONTH

"Honoring our Heritage to Achieve Greatness"

HISPANIC HERITAGE MONTH SPEAKER, ART CONTEST JUDGING, AND FOOD TASTING EVENT
Wednesday, Sept. 25, 2019, 11 a.m.–2 p.m.
Steve Schiff Auditorium (SSA)

11:30 a.m.-12:30 p.m. Talk by former NASA Astronaut John "Danny" Olivas, veteran of two space shuttle missions

11 a.m-2 p.m. STEM youth art contest judging and Hispanic cultural food tasting (free)

HISPANIC HERITAGE MONTH DIVERSITY EVENT
Thursday, Oct. 3, 11 a.m.-2 p.m.
Hardin Field, Kirtland Air Force Base

11-11:15 a.m. Opening comments, HOLA Chair Reno Sanchez

11:15-11:45 a.m. Cultural dance, Ballet Folklorico and Baila Baila

11:45 a.m.-noon Samba Sizzle Latin dance workout, Lisa Jaramillo (earn HBE points)

Noon-12:15 p.m. National anthem, Sandia Singers Choir

12:15-12:30 p.m. VIP speakers Scott Aeilts (Sandia), Frank Gonzales (SFO) and Colonel David Miller (KAFB)

12:30-12:45 p.m. Keynote speaker, KRQE news anchor Crystal Gutierrez

12:45-1:30 p.m. Cultural music, Roberto Griego

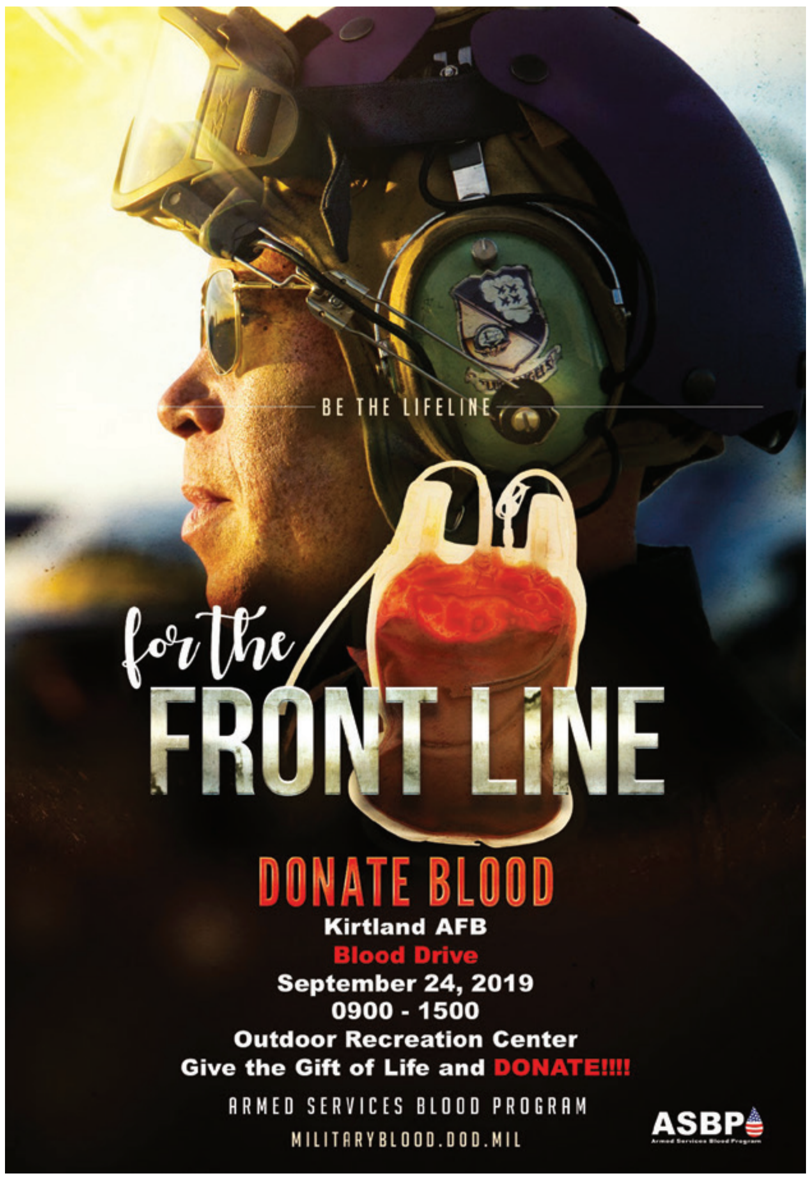
1:30-2:30 p.m. Cultural music, Mariachi Tenampa

Student art contest winners, education and awareness information, a car show and STEM Kids open house will be available at the event.

Food trucks available 11 a.m.-1:30 p.m.
Sanchez Tacos, Castaneda Kitchen, Black Iron Catering, Gourmet Food, Kimo's Hawaiian BBQ, Pop Fizz

Contact Catalina Acosta for more information @ 844-2946 or cacosta@sandia.gov

HOLA ZERO WASTE



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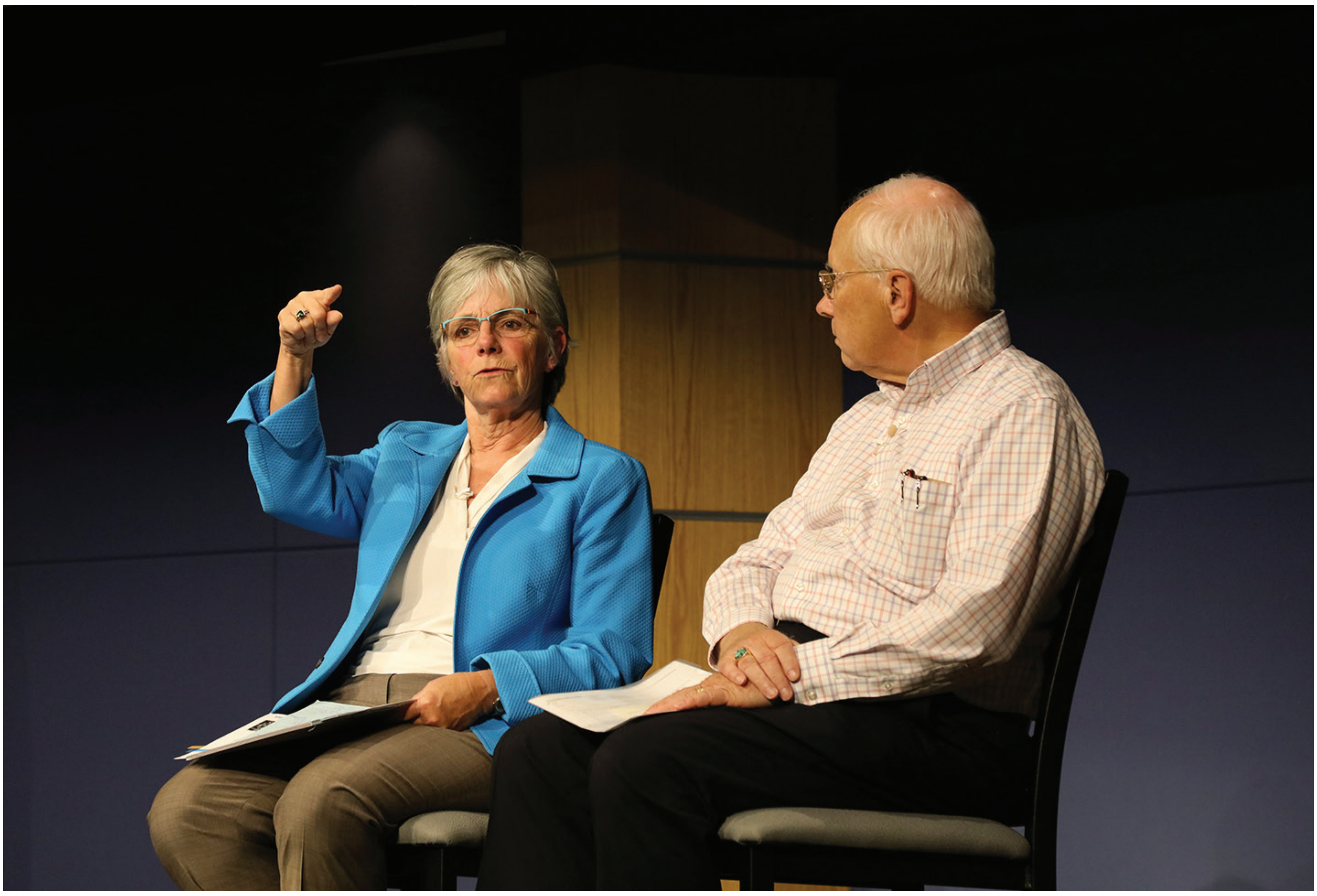

INVESTING IN DISCOVERY — Labs Director Steve Younger and Chief Research Officer Susan Seestrom took the stage at the Steve Schiff Auditorium Aug. 26 to discuss "discovery science" and what it means for Sandia.

Younger: There is a Sputnik moment coming

By ***Troy Rummler***
Photos by ***Lonnie Anderson***

Laboratories Director Steve Younger and Chief Research Officer Susan Seestrom took the stage at the Steve Schiff Auditorium Aug. 26 to discuss "discovery science" and what it means for Sandia. The talk was the latest installment of the New Research Ideas Forum.

Both Steve and Susan leaned on lessons from the past to talk about the Labs' future.

"The United States has, for the past 20 years or more — actually since the end of the Cold War — enjoyed technological supremacy," Steve said during opening remarks. "And we've gotten used to that, and we've thought: 'Well, this is normal.'"

Steve pointed out that this status is being challenged by other countries' heavy investments in technology, and it can be lost if we don't change the way we approach research.

"In my opinion, there is a Sputnik moment coming our way," he said, referring to the Soviet satellite that challenged the U.S. space program's presumed superiority, sparking the space race of the '50s and '60s.

Discovery science, he proposed, is the way Sandia will continue to out-innovate the nation's adversaries. He described this as fast-moving, risky research driven by the merits of the questions being asked rather than the likelihood of the project's success.

"We're not going to achieve our national security objectives by building walls around technology. We're going to achieve our national security objectives by running faster than anybody else," he said.

Susan also summoned images of the past in her opening remarks while elaborating that discovery science also means truly understanding experiments.

"You have to spend time to understand the unexpected when it comes up, and then combine your physical insight into what happened with the fact that you recognized it wasn't what was expected," she said. "And we're only here — in this laboratory, in the nuclear weapons complex — because a set of extraordinary scientists did that in the early 20th century."

Susan cited Marie Curie's discovery of the element thorium and Lise Meitner's discovery of fission as examples of discovery science in action. She said true discovery science means inventing tools that give researchers new ways of examining our world and thoroughly investigating phenomena without necessarily knowing what will be found. Sandia ought to do basic research, she said; however, she maintained, the sweet spot is research informed by end-use for Sandia's mission.

'Now's the time'

A question-and-answer period followed the opening remarks. Moderator Gil Herrera asked what creates the opportune timing to invest in discovery science at Sandia.

"Now's the time," Steve said, noting the healthy budget Sandia currently enjoys.

Susan echoed his urgency but focused on concerns about the health of Sandia's research program. She pointed to possible warning signs, including a low publication rate within the Laboratory Directed Research and Development program compared to labs with similar programs, as justification for changes.

Steve said later, however, that changes in culture and business practices might be necessary to enable more discovery science. He said he recognizes staff are busy with mission-directed work and may not have time and resources to pursue other interesting questions.

"We need to unwrap the axle," he said.

A new hire who previously worked for Chevron asked if Sandia had initiatives in place to help employees think more agilely and start applying the principles that had been discussed. Steve said he believed practice over time would probably create more lasting change than any "magic bullet," but that the LDRD program was the ideal engine for pushing this change.

Susan recognized Sandia's business excellence office as especially knowledgeable in these matters and said large facilities like the Z machine or Microsystems Engineering, Science and Applications may have the best opportunity to apply such initiatives.

Sandia Fellows Gil Herrera, Katherine Simonson and Jeff Tsao orchestrated the event. They also organized a meeting immediately following the event, in which a group of senior scientists discussed what had been talked about on stage.

"The main session was more philosophical," said Jeff, who led the second meeting, "while the post-hoc was more on the opportunities and challenges associated with the execution."

DISCOVERY Q&A — Audience members were encouraged to ask questions and participate in a dialogue about discovery during the New Research Ideas Forum event.