U.S. DEPARTMENT OF ENERGY

Office of Science

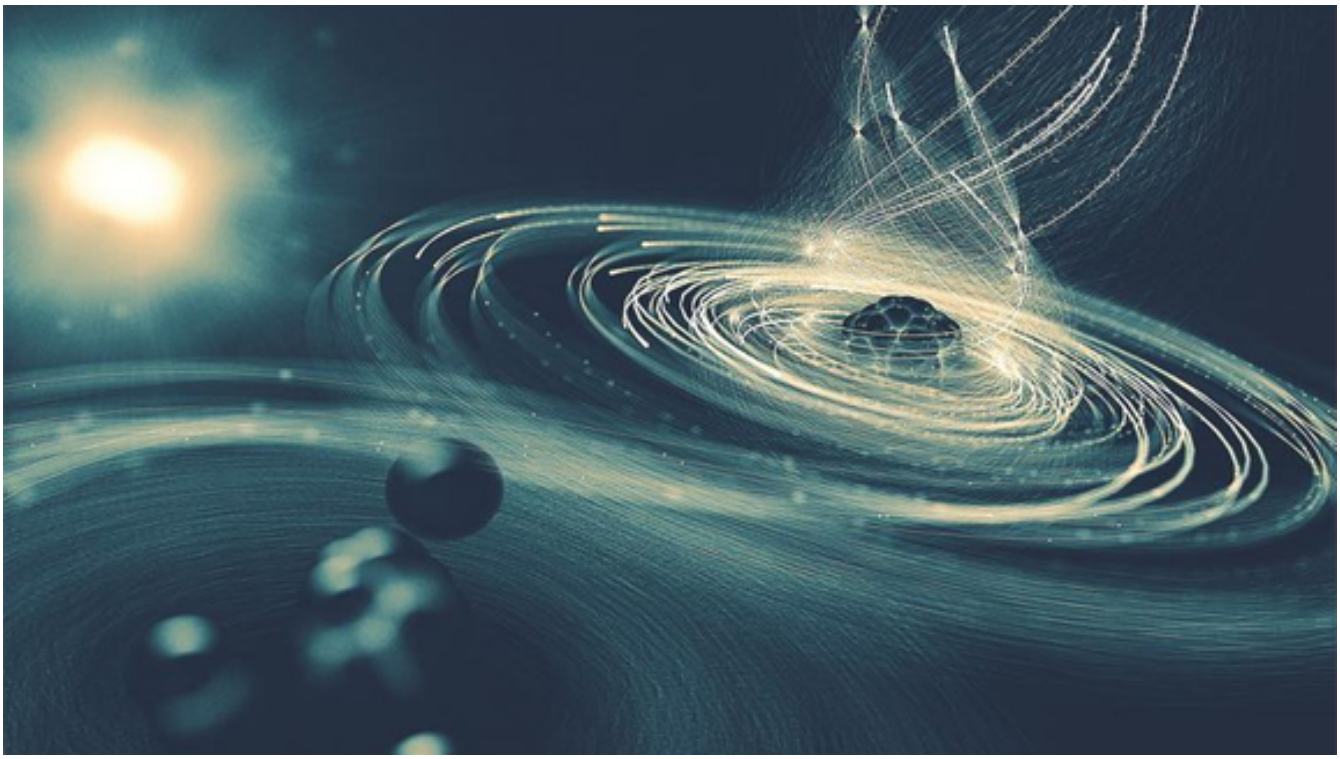
COMMUNIQUE

10 December 2018

*Comm*unique provides a biweekly review of recent Office of Science Communications and Public Affairs work, including feature stories, science highlights, social media posts, and more. This is only a sample of our work promoting the research done at universities, national labs, and user facilities throughout the country.

Please note that some links may expire after time.

***Comm*unique will be taking a break for the holidays. We will return January 7th, 2019.**



Science Up-Close: Blasting Molecules with Extreme X-Rays

Physicist Artem Rudenko from Kansas State University and his colleagues pondered how to improve the images of viruses and microparticles that scientists get from X-rays. To dig into the issue, they shot the most powerful X-ray laser in the world—located at the DOE Office of Science's Linac Coherent Light Source (LCLS)—at a series of atoms and molecules. The team looked at how X-rays affect heavy atoms with lots of protons, neutrons, and electrons. Many heavy atoms play important functions in biological reactions, such as iodine's role in producing hormones. Because heavy atoms interact more with X-rays than light ones, scientists often use heavy atoms to get clearer images.

Like everyone else, the team had to compete for time at the LCLS, an Office of Science user facility hosted by SLAC National Accelerator Laboratory. Compared to medical research, it was a tough sell. "We

just wanted to blast the heck out of a molecule," said Daniel Rolles, an assistant professor at Kansas State University. "Our argument was, 'Hey look, you guys can only understand what you're doing if you let us do our stuff first.'"

Click here to read more about how damage from high-energy X-rays affects imaging.

NEWS CENTER

The Office of Science posted 55 news pieces between 11/26/2018 and 12/9/2018, including 28 university articles and 21 pieces from the labs and user facilities.

Misoprostol, a generic drug that induces labor and stops postpartum bleeding, has become a staple in developing countries because it's affordable and easy to store and administer, but it also targets receptors in a variety of other tissues, bringing about serious side effects. A team of researchers from the Bridge Institute at the University of Southern California and SLAC National Accelerator Laboratory used X-rays to map the shape of a receptor in the body as it binds with misoprostol, helping in the quest to design low-cost drugs that can tackle postpartum bleeding without affecting other tissues.

Scientists at the University of South Florida are taking the lab to the landfill, refining a groundbreaking process that uses trash to make liquid fuel. Across the United States, more than 3,000 active landfills are currently producing a potentially valuable—but often unutilized—resource – biogas. A byproduct of the decomposition of biomass like food waste, lawn clippings, and agricultural waste, biogas is generally made up of methane and carbon dioxide. Once they collected the, these researchers chemically convert the gas into a sustainable form of diesel fuel, which can then be used anywhere traditional fossil fuels are used.

Inspired by Chinese ink—a material effective at absorbing a broad range of light—researchers at Argonne National Laboratory are exploring affordable photothermal materials that could absorb the sunlight necessary to evaporate and recapture water, leaving salt and contaminants behind. This solar steam approach aims to concentrate heat only at the surface, where evaporation occurs, by covering it with a light-absorbing material. With dry climates, development and growing populations driving demand for new sources of clean water, alternative desalination strategies, like the one being developed at Argonne, could have a large-scale impact.

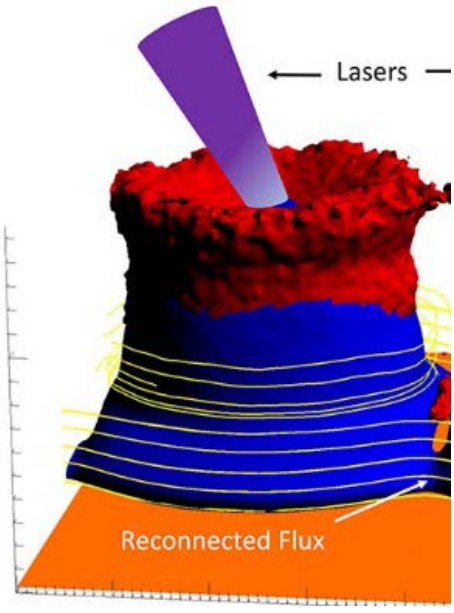
Modelling 13 different major forest types from around the western United States and taking into account climate conditions and atmospheric carbon dioxide levels over the next 30 years, researchers from Oregon State University's College of Forestry found that forests in the Pacific Northwest will be less vulnerable to drought and fire over the next three decades than those in the Rocky Mountains and Sierra Nevada. This computer model represents an important tool for scientists and land managers because woodlands throughout the western United States are under increasing stress from accelerated rates of drought-related mortality.

Researchers at Oak Ridge National Laboratory have demonstrated a new level of control over photons encoded with quantum information. The team performed distinct, independent operations simultaneously on two qubits encoded on photons of different frequencies, an experimental setup that provides stability and control. Stability and control enable quantum operations that preserve information, reduce information processing time, and improve energy efficiency. The researchers have compared their ongoing projects, begun in 2016, to building blocks that will link together to make large-scale quantum computing possible.

A research team from the University of Arkansas has shed light on the behavior of tin telluride (SnTe), an ultrathin material that can be used as a semiconductor in thermoelectrics and optoelectronics applications. The team studied the material at a range of temperatures, discovering that when SnTe is only a few atomic layers thick, it forms a layered structure different from its normal bulk, rhombic-shaped version.

SCIENCE HIGHLIGHTS

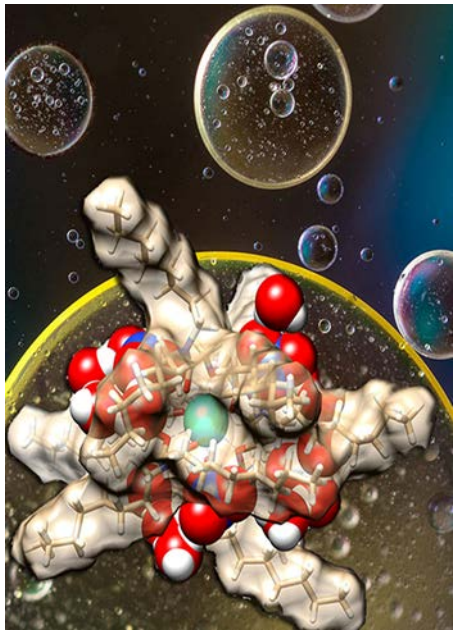
The Office of Science posted 9 highlights between 11/19/2018 and 12/9/2018 spotlighting science from 4 programs: BES, BER, FES, and ASCR.



Scientists at Princeton Plasma Physics Laboratory and Princeton University have found a new role for the Biermann battery effect: destroying magnetic energy during a process known as magnetic reconnection. Their experiments and simulations provide a new platform for replicating in the laboratory the magnetic reconnection observed in astrophysical plasmas, the results of which could help to better understand reconnection in space plasmas and could provide insight into the plasma and magnetic field dynamics in high-energy-density plasmas.

At the Environmental Molecular Sciences Laboratory, an international team identified a family of bacteria and enzymes that break down plant biomass. These bacteria appear to be critical for cows and other ruminants to obtain their nutritional needs from plants and could provide insights for converting corn stover and other biomass into fuels, uncovering more efficient and environmentally friendly ways to turn agricultural waste into biofuels.

Lanthanide elements are essential parts of today's high-tech commodities including flat-screen TVs, cell phones, electric cars, and satellites, but separating



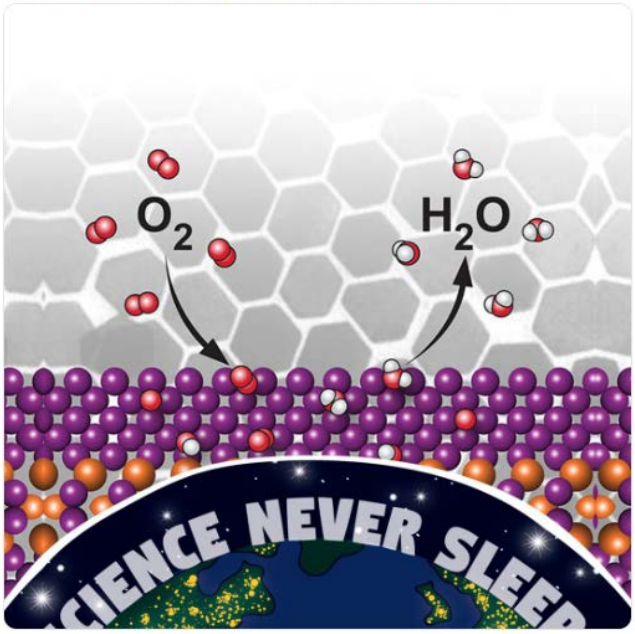
lanthanides from impurities is extremely difficult. New research from Oak Ridge National Laboratory and the Colorado School of Mines reveals how peculiar arrays of water molecules affect the liquid-liquid lanthanide extraction process. These findings have significant implications for the design of separation systems, emphasizing the conditions to control selectivity in the process.

TOP TWEETS

The Office of Science sent out 45 tweets between 11/26/2018 and 12/9/2018 and gained 123 new followers.

DOE Science
@doescience

Stress helps?? Yes. For fuel cells. Stress makes fuel cell catalyst perform nearly 10x better @FunctionalNano @BrookhavenLab @sciencemagazine #ScienceNeverSleeps science.energy.gov/bes/highlights ...



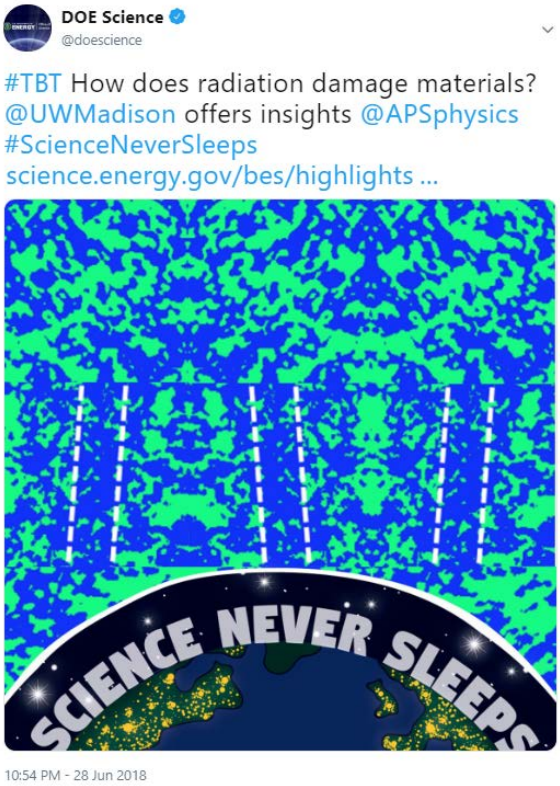
DOE Science
@doescience

Born #OTD in 1842, Ellen Swallow Richards was the 1st woman to graduate from @MIT #chemistry, researched and developed clean water standards, co-founded the American Assn of Collegiate Alumnae, which became @AAUW. #ecology #Bday @VassarNews bit.ly/2rgvE0q

STATISTICS

The Office of Science by the numbers.

#ScienceNeverSleeps



In April 2018, OCPA began a special campaign to bring back our most popular research tweets. Posted overnight and on the weekends, #ScienceNeverSleeps tweets reach audiences who may have missed the science the first time around. In FY2018, we posted 100 #ScienceNeverSleeps tweets, the three most popular of those above. These 100 tweets earned a total 373,846 impressions, 1,047 likes, 577 retweets, and 833 link clicks.

END NOTES

The New York Times: The Race Is On to Protect Data From the Next Leap in Computers. And China Has the Lead.

On December 3rd, 2018, the New York Times published an article on quantum computing and quantum encryption, detailing the work of several national laboratories and the Chicago Quantum Exchange.

In the United States, the government and industry have viewed quantum encryption as little more than a science experiment. Instead, researchers have focused on using ordinary mathematics to build new forms of encryption that can stand up to a quantum computer. This technology would not require new infrastructure. But many experts believe the more important work [on quantum] will happen in research labs, and the Department of Energy is funding a test network in Chicago that could eclipse the kind of systems deployed in China. The Los Alamos and Oak Ridge National Laboratories are working with Qubitekk, a Southern California start-up, to secure power grids in Tennessee with quantum technology. At places like the University of Chicago, researchers hope to go a step further, exploring what are called quantum repeaters — devices that could extend the range of quantum encryption. “We’re not there yet,” said David Awschalom, a professor at the University of Chicago who oversees much of the university’s quantum research. “But I am confident this will happen in the next couple of years.”

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