U.S. DEPARTMENT OF ENERGY

Office of Science

COMMUNIQUE

13 November 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.

Rising Stars Seek to Learn from the Master: Mother Nature

If you want to be better than the best, you first must understand what makes them best—in detail. That's a daunting task when the best is Mother Nature. Two of her highly efficient creations, bacteria and algae, have great potential to produce fuels using fewer resources than today's industries. To improve fuel and chemical production, we need to understand and mimic these simple and yet complex microbes. The Office of Science is leading the effort to uncover nature's biochemical secrets to answer some of the toughest questions about mechanisms that perform some amazing chemical feats. The editors of ACS Biochemistry recognized a trio of rising stars in this area supported by the Office of Basic Energy Sciences within the DOE's Office of Science: Dave Savage of UC Berkeley, Steven Mansoorabadi of Auburn University, and Kyle Lancaster of Cornell University. Savage, Mansoorabadi, and Lancaster are studying carbon dioxide uptake, microbes, and ammonia production, each doing work made possible by Office of Science Early Career Research Program grants.

Click here to read more about these three rising stars in the field of biosciences.

NEWS CENTER

The Office of Science posted 64 news pieces between 10/29/2018 and 11/11/2018, including 33 university articles and 26 pieces from the labs and user facilities.

Using solid state nuclear magnetic resonance techniques, scientists at the DOE's Ames Laboratory discovered a new quantum criticality in a superconducting material, leading to a greater understanding of the link between magnetism and unconventional superconductivity. Most iron-arsenide superconductors display both magnetic and structural transitions, making it difficult to understand the role they play in superconducting states. But a compound first made at Ames Laboratory has been discovered to exhibit a new magnetic state.

Nuclear fusion may be the means to meet the world's energy needs, sustainably, far into the foreseeable future. Many scientists believe the most promising path to creating energy through nuclear fusion is one that uses heat to spur a similar reaction to the one in the sun. The kinetic energy of isotopes is increased by heating, which allows them to fuse. Scientists use magnetic fields to confine the resulting substance, which is no longer a gas, but a plasma. Eugenio Schuster, a professor of mechanical engineering and mechanics at Lehigh University, works on ways to control and stabilize the heated plasma.

Two DOE user facilities, the Environmental Molecular Sciences Laboratory (EMSL) and the Joint Genome Institute (JGI), have selected 12 proposals received from a joint call for 2019 research under the Facilities Integrating Collaborations for User Science (FICUS) initiative. Through the EMSL-JGI FICUS calls, users can combine EMSL's unique imaging, omics, and computational resources with cutting-edge genomics, DNA synthesis, and complementary capabilities at JGI. Members of the scientific staff from both user facilities work with the FICUS researchers to assess their needs and help them with their methodologies, experiments, and visualizations.

Hacker attacks on everything from social media accounts to government files could be largely prevented by the advent of quantum communication, which would use particles of light called "photons" to secure information rather than a crackable code. The problem is that quantum communication is currently limited by how much information single photons can help send securely, called a "secret bit rate." Purdue University researchers created a new technique that would increase the secret bit rate 100-fold, to over 35 million photons per second.

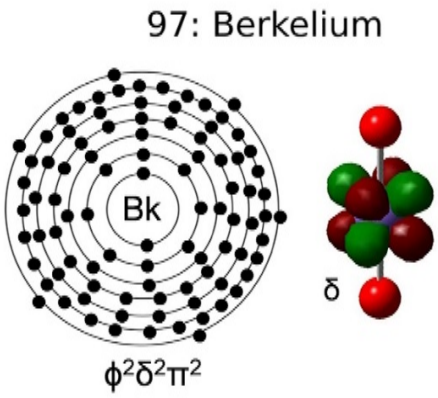
Researchers at the DOE's Lawrence Berkeley National Laboratory and the Joint Center for Artificial Photosynthesis, a DOE Energy Innovation Hub, have come up with a new recipe for renewable fuels that could bypass the limitations in current materials: an artificial photosynthesis device called a "hybrid photoelectrochemical and voltaic cell" that turns sunlight and water into not just one, but two types of energy – hydrogen fuel and electricity.

A team of researchers has observed that when they trigger a phase change by using intense pulses of laser light, rather than changing the temperature, the way that ordinary materials undergo a phase change occurs very differently. Nuh Gedik, a professor of physics at MIT, with his team at MIT, Stanford University, and Skolkovo Institute of Science and Technology in Russia, found that by using pulses of light, the phase change

proceeds by generating many singularities in the material, known as topological defects, which in turn affect the dynamics of electrons and lattice atoms in the material.

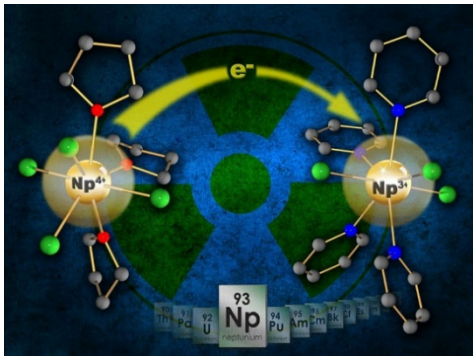
SCIENCE HIGHLIGHTS

The Office of Science posted 10 highlights between 10/29/2018 and 11/11/2018 spotlighting science from 2 programs: BES and BER.



Fundamental knowledge about the most basic, yet unknown, chemistry of the actinides could benefit environmental cleanup at nuclear production sites and aid in developing new nuclear fuels and their reprocessing. Examining two exceedingly rare actinides, berkelium and californium, scientists at Berkeley Lab, the University of Alabama, and Washington State University showed that the elements can lose electrons to bond like lighter actinides, resolving a longstanding uncertainty about actinides and furthering the understanding the essential nature and chemistry of these elements.

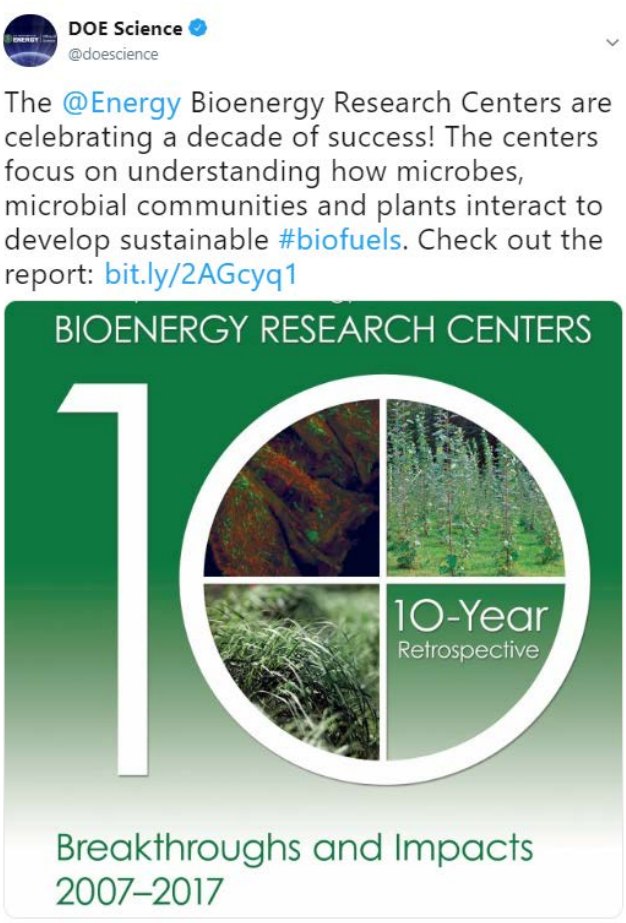
Experimental warming treatments show how peatland forests may respond to future environmental change. By warming mature spruce trees and surrounding plants in containment tents in a Minnesota peat bog, researchers at Northern Arizona University examined what happens when the growing season is extended. They found it makes plants more vulnerable to cold snaps.



To safely store leftovers containing neptunium from nuclear reactors, scientists need to know more about how to control the extremely scarce element. Using a commercially available solution, researchers from Purdue University and Los Alamos National Lab devised a new synthetic access route to explore neptunium chemistry, allowing a significant expansion in the number of neptunium molecules that can be analyzed.

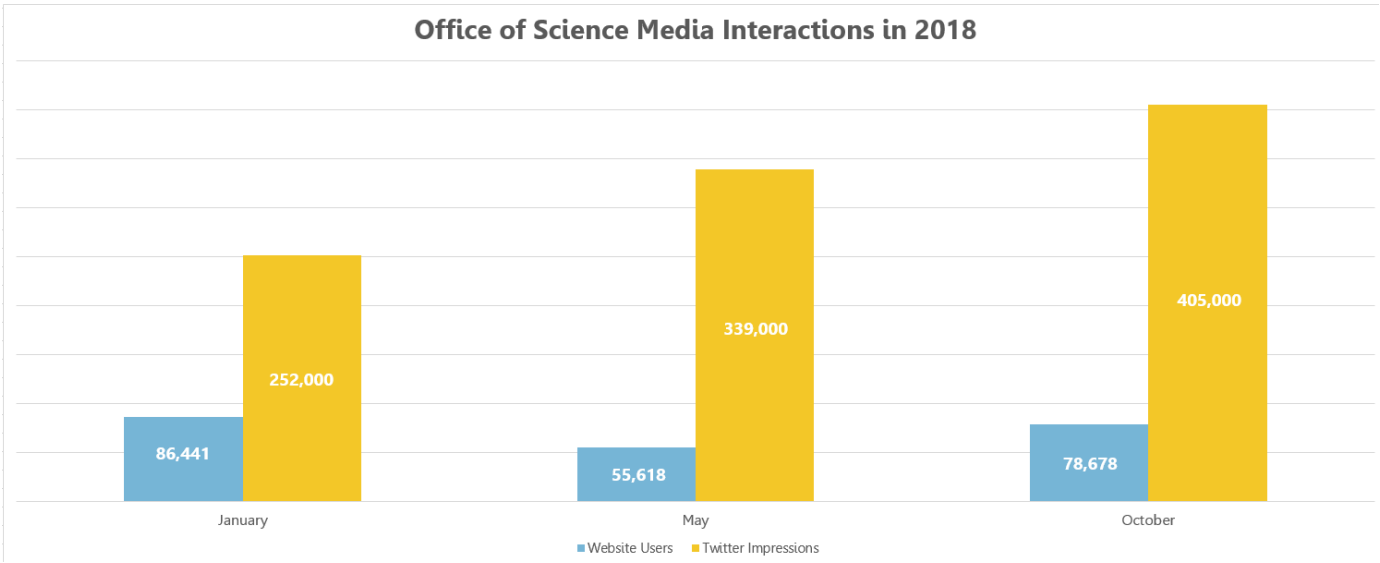
TOP TWEETS

The Office of Science sent out 53 tweets between 10/29/2018 and 11/11/2018 and gained 127 new followers.



STATISTICS

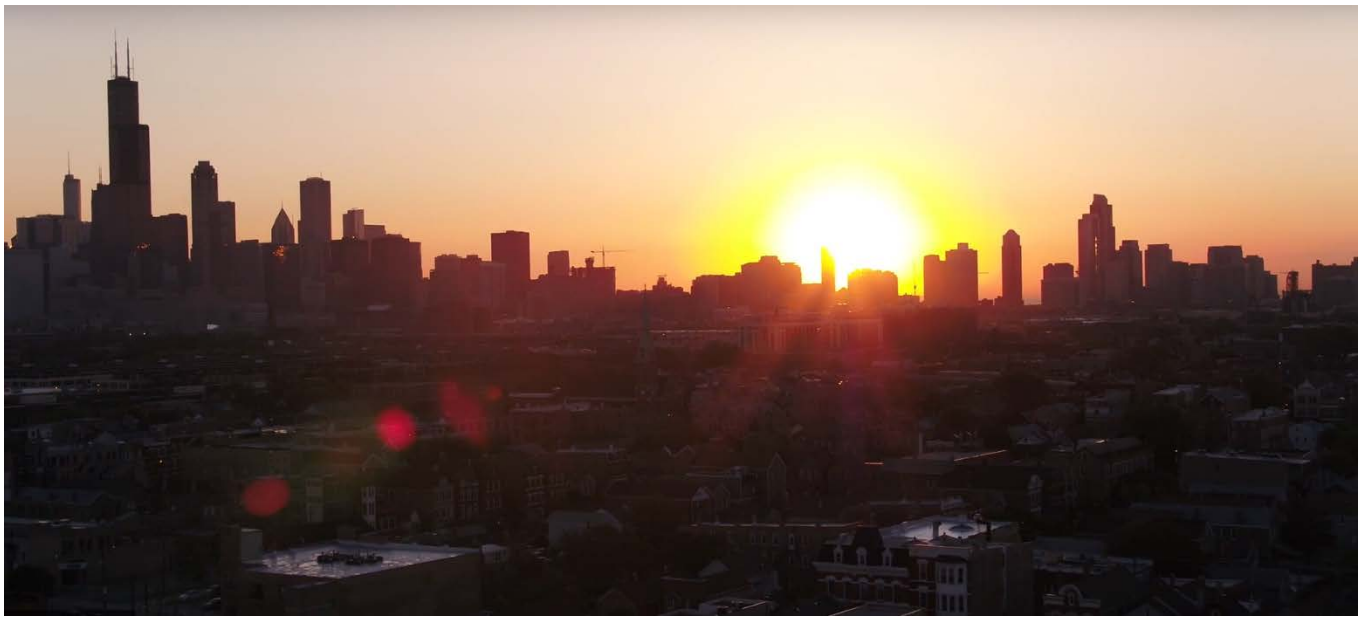
The Office of Science by the numbers.



The Office of Science posts content highlighting research funded through the six core program offices and additional programs and activities to the Science website and Twitter account. While the website has seen a slight decrease in visitors since January, the @doescience Twitter account impressions in October showed a 60% increase in traffic over those in January.

END NOTES

Blog: Unleashing A World of Quantum Opportunities



This past September, the White House held a summit on quantum science, the House of Representatives passed a National Quantum Initiative proposing $1.275 billion for quantum research, and the DOE announced $218 million in funding for research in the emerging field of Quantum Information Science (QIS). Along with these announcements, the DOE's Fermilab and Argonne National Laboratory, along with the University of Chicago and the University of Illinois at Urbana-Champaign, engaged in the Chicago Quantum Exchange, an intellectual hub that seeks to advance efforts in the science and engineering of quantum information. Building on this momentum, Under Secretary for Science Paul Dabbar published a blog post to Energy.gov last Thursday highlighting the advancements recently made in QIS research and supporting the upcoming Quantum Summit at the University of Chicago.