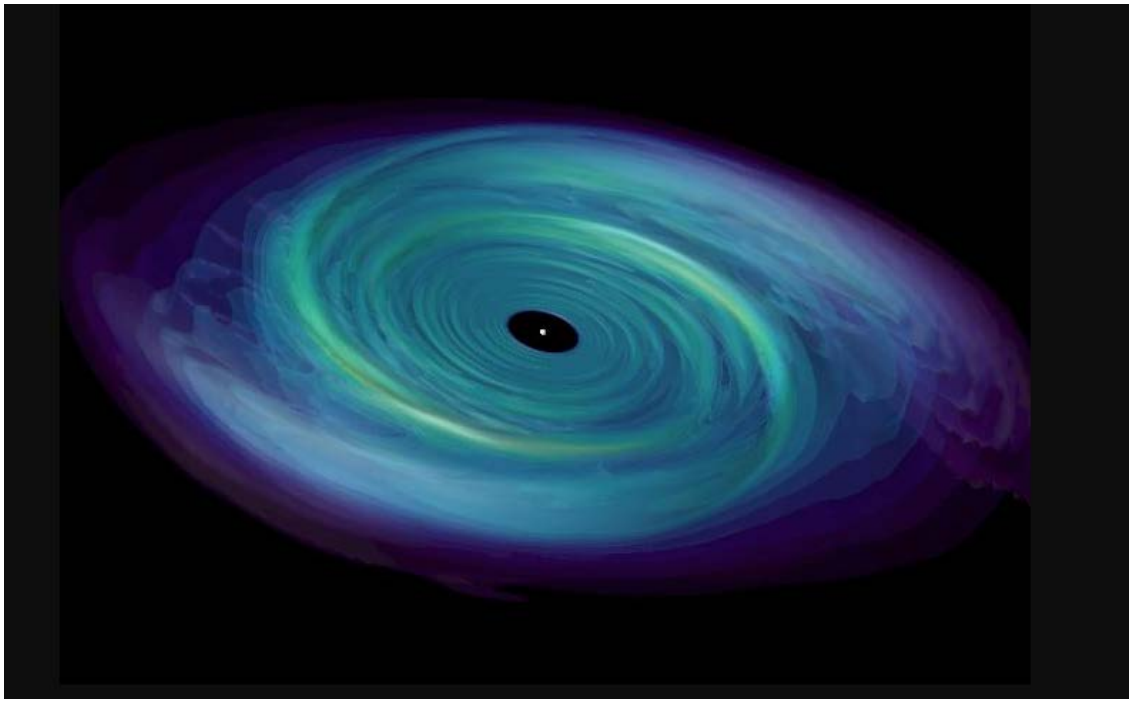
U.S. DEPARTMENT OF ENERGY

Office of Science

COMMUNIQUE

19 February 2019

*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 recent work promoting research done at universities, national labs, and user facilities throughout the country.
Please note that some links may expire after time.



Novel experiment validates a widely speculated mechanism in the growth of heavenly bodies

How have stars and planets developed from the clouds of dust and gas that once filled the cosmos? A novel experiment at Princeton Plasma Physics Laboratory has demonstrated the validity of a widespread theory known as "magnetorotational instability," or MRI, that seeks to explain the formation of heavenly bodies.

The theory holds that MRI allows clouds of dust, gas, and plasma that swirl around growing stars, planets, and black holes to collapse into them. According to the theory, this collapse happens because the turbulent swirling plasma gradually grows unstable.

Click here to read more about the MRI experiment at PPPL.

NEWS CENTER

The Office of Science posted 57 news pieces between 2/4/2019 and 2/18/2019, including 28 university articles and 26 pieces from the labs and user facilities.

When moving from a system used for development—a personal laptop, for instance, or even a university's computing cluster—to a large-scale supercomputer, researchers traditionally would only migrate the target application, leaving the underlying software stack behind. To help alleviate this problem, the Argonne Leadership Computing Facility has deployed Singularity, an open-source framework for creating and running platforms. This service, specifically intended for scientific workflows and high-performance computing resources, is designed to package code and its dependencies so as to facilitate fast and reliable switching between computing environments.

Researchers at the George Washington University have taken a major step toward reaching one of the most sought-after goals in physics: room temperature superconductivity. Until now, superconducting materials were thought to have to cool to very low temperatures, limiting their application. The key to this discovery was the creation of a metallic, hydrogen-rich compound at very high pressures. The researchers used diamond anvil cells to squeeze together miniscule samples of lanthanum and hydrogen. They then heated the samples and observed major changes in structure. This resulted in a new structure which the researchers previously predicted would be a superconductor at high temperatures.

Scientists at Oak Ridge National Laboratory have developed a process that could remove carbon dioxide from coal-burning power plant emissions in a way that is similar to how soda lime works in scuba diving rebreathers. Soda lime is used in scuba rebreathers, submarines, anesthesia, and other closed breathing environments to prevent the poisonous accumulation of carbon dioxide gas. The mixture collects molecules, turning into calcium carbonate as it amasses carbon dioxide. The ORNL team's carbon dioxide scrubber works in essentially the same way to treat the carbon dioxide-rich flue gas like that released by coal-burning power plants. This research offers an alternative, simpler strategy for carbon capture and requires 24 percent less energy than industrial benchmark solutions.

Researchers at the University of Pennsylvania, the University of Illinois at Urbana–Champaign, the University of Cambridge, and Middle East Technical University in Ankara, Turkey have built a sheet of nickel with nanoscale pores that make it as strong as titanium but four to five times lighter. The empty space of the pores and the self-assembly process in which they're made make the porous metal akin to a natural material like wood. Just as the porosity of wood grain serves the biological function of transporting energy, the empty space in the researchers' "metallic wood" could be infused with other materials. Infusing the scaffolding with anode and cathode materials would enable this metallic wood to serve double duty: a plane wing or prosthetic leg that's also a battery.

Commercial battery materials are only able to release about half of the lithium ions they contain. A promising fix for this problem is to cram cathodes with extra lithium ions, allowing them to store more energy in the same amount of space, but every new charge and discharge cycle slowly strips these lithium-rich cathodes of their voltage and capacity. Providing a comprehensive model of this process, researchers from SLAC National Accelerator Laboratory, Lawrence Berkeley National Laboratory, and Stanford University have identified what gives rise to this phenomenon and how it ultimately leads to the battery's downfall.

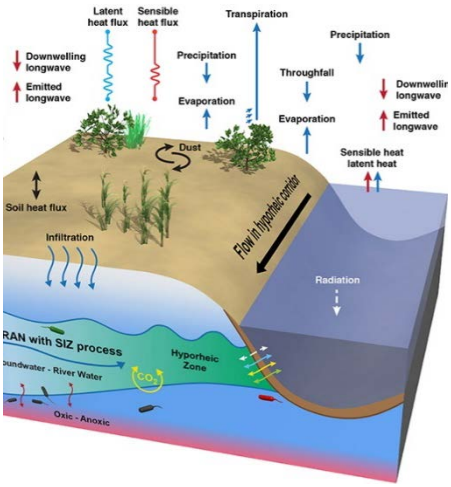
The Mapping Nearby Galaxies at Apache Point Observatory (MaNGA) initiative and its principal investigator, UC Santa Cruz's Kevin Bundy, are seeking to understand the "life history" of present-day galaxies, from their initial birth and assembly, through their ongoing growth via star formation and mergers, to their death. Using technique called resolved spectroscopy, MaNGA is able to study galaxies in much greater detail than previous surveys. Spectroscopy is a powerful tool for astronomers, yielding a wealth of information by measuring how much light an object emits at different wavelengths.

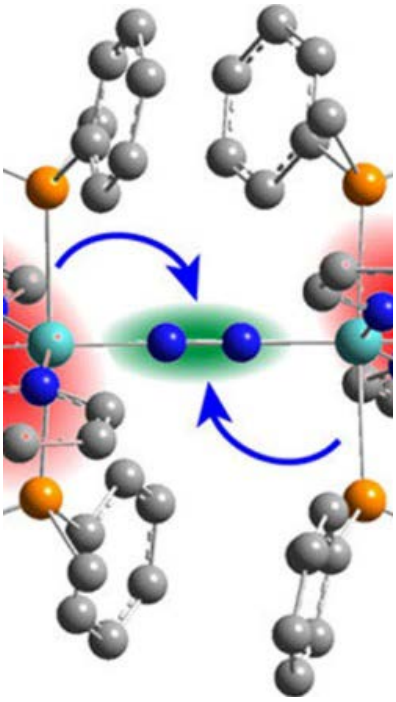
SCIENCE HIGHLIGHTS

The Office of Science posted 15 highlights between 2/4/2019 and 2/18/2019 spotlighting science from three programs: ASCR, BER, and BES.

Pinnacle Engines is developing an opposed-piston engine for automotive use, one that should be more efficient than the traditional internal combustion engine. Through access to the Titan supercomputer at the Oak Ridge Leadership Computing Facility, the Pinnacle Engines team enhanced their prototype's reciprocating sleeve-valve system, allowing them to now build an engine with better combustion and reduced pollutant emissions.

Land system models are insufficiently configured to address the question of how water moves below the land surface. Now, scientists from Pacific Northwest National Laboratory and Lawrence Berkeley National Laboratory have developed a model that considers such waters. The new open-source model lets researchers get a clear view of processes occurring along river corridors and how these processes affect watersheds.





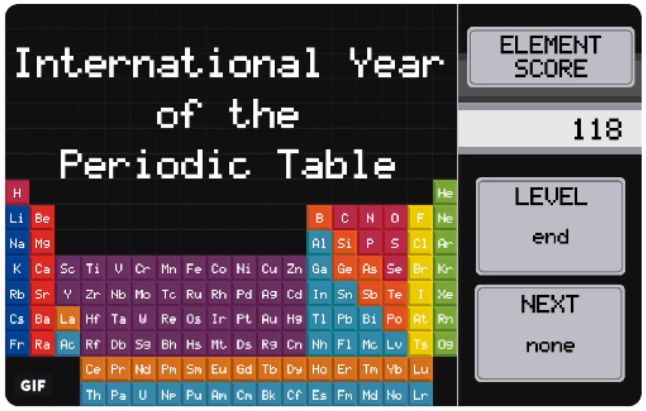
Driven by natural catalysts, alfalfa, peanut, and soybean plants take in nitrogen and hydrogen from the air and turn it into ammonia, which helps the plants grow. Inspired by these reactions, scientists from Princeton University uncovered how sunlight can kick start the functionalization of nitrogen molecules. They built a complex that harvests sunlight. The added energy from the sunlight causes electrons to shift and makes the nitrogen molecules receptive to bonding with hydrogen, taking the first step on the path to making ammonia.

TOP TWEETS

The Office of Science sent out 60 tweets between 2/4/2019 and 2/18/2019 and gained 253 new followers.

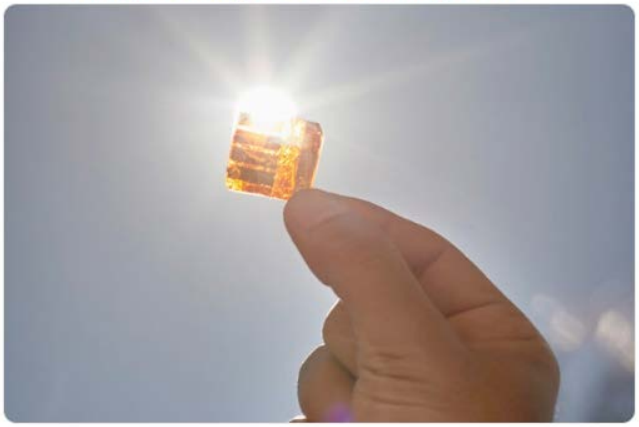
DOE Science ✓
@doescience

2019 is the 150th anniversary of the periodic table! Discovering 22 elements to date, @ENERGY scientists have helped put it all together #IYPT2019 #NationalPeriodicTableDay



DOE Science ✓
@doescience

Unleashing perovskites' potential for solar cells bit.ly/2N0iKgU @MIT @argonne



BY THE NUMBERS

2019 International Year of the Periodic Table

2019 is the sesquicentennial of the periodic table and the UN-declared International Year of the Periodic Table. For the 150th anniversary, OCPA will be posting a series of tweets spotlighting the elements, numbers 1-118. Follow our Twitter campaign and post your own celebration of the periodic table with the hashtag #IYPT2019.

END NOTES

American Scientific Leadership in the 21st Century

On January 29th, Under Secretary for Science Paul Dabbar wrote about the Office of Science, its mission, and the national laboratories. Read the full text of his vision for the Office of Science in FY 2019 here.

The prosperity, security, and national competitiveness of the United States depend on science and innovation. Due to the inquisitiveness of the American mind, our entrepreneurial spirit as a people, and the government's support for basic and early stage research in partnership with universities and private sector research, America is unsurpassed in scientific discovery and innovation. The Administration and Congress, through their support of the Office of Science and the entire DOE national laboratory complex, have made it clear that America is committed to remaining a wellspring of scientific understanding, technological sophistication, and engineering skill not only for today, but throughout the 21st century.

The DOE's Office of Science plays a vital role in the pursuit of this national agenda. Tackling the most daunting science and technology challenges, the Office of Science sponsors groundbreaking research and provides the academic and commercial sectors with uniquely powerful tools of discovery and analysis. In FY 2019, the Office of Science will continue to invest in a wide variety of pioneering research, including new emphases on several innovative fields with great potential to enhance human wellbeing. Through pioneering research, coordinated with other federal research and development investments, we will contribute to America's pre-eminence in science and technology.

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