LDRD

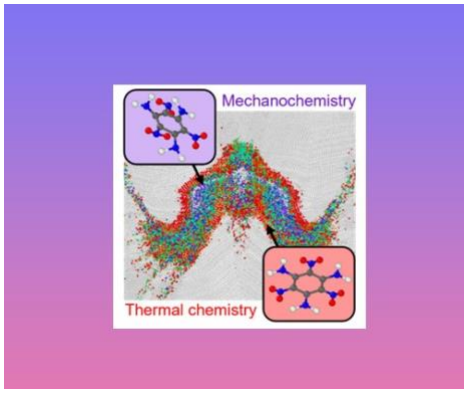
# Quarterly Highlights

Mission Agility | Technical Vitality | Workforce Development

**FY22 Q4**

## FEATURED HIGHLIGHTS FOR Q4

Lawrence Livermore National Laboratory




Reactive molecular dynamics simulations predict that a complicated distribution of molecular states is generated in explosive hotspots formed under shock conditions.

### Research finds mechanically driven chemistry accelerates reactions in explosives

Scientists at the Lawrence Livermore National Laboratory Energetic Materials Center and Purdue University Materials Engineering Department used simulations performed on the LLNL supercomputer Quartz to uncover a general mechanism that accelerates chemistry in detonating explosives critical to managing the nation's nuclear stockpile. Read more… (LLNL-WEB-458451)

- **Mission Agility, Technical Vitality**

The L3 HAPLS (High-Repetition-Rate Advanced Petawatt Laser System) at ELI Beamlines Research Center in the Czech Republic. Photo courtesy of ELI Beamlines.

## LLNL researchers design new plasma optics for the development of compact high-power lasers

Researchers have designed a compact multipetawatt laser concept that uses plasma transmission gratings to overcome the power limitations of conventional solid-state optical gratings. The design could enable construction of an ultrafast laser up to 1,000 times more powerful than existing lasers of the same size. The new design could make it possible to field a laser system similar in size to the LLNL-designed L3 HAPLS (High-Repetition-Rate Advanced Petawatt Laser System) at ELI Beamlines in the Czech Republic, but with 100 times the peak power. Read more… (LLNL-WEB-458451)

- **Mission Agility, Technical Vitality**

Sandia National Laboratories

This video, created by Sandia's Valhalla program, previews a preliminary concept for a satellite performing a remote sensing mission. **(Video by Sandia's Valhalla program)**

## Sandia's "build-a-satellite" LDRD program could fast track national security space missions

Valalla, a Python-based performance modeling framwork developed at Sandia, uses high-performance computing to build preliminary satellite designs based on mission requirements and then runs those designs through thousands of simulations. The results of the simulations feed into an interactive multidimensional video-like view of satellites executing their mission and hundreds of plots that show the user the relationship between each of the outputs and inputs at a glance. This data enables the user to quickly find the solution that best executes the mission. Read more… (SAND2022-72103E)

- **Mission Agility, Technical Vitality**

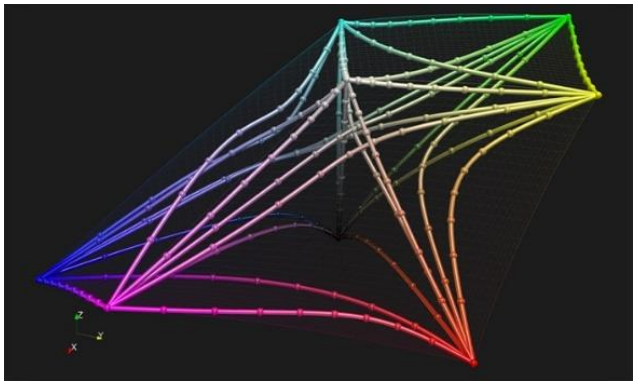
Sandia's Twistact technology proves beneficial in lowering costs, improving sustainability and reducing maintenance for next-generation direct-drive wind turbines. (Photo by Zhang Fengsheng).

## Novel rotary electrical contact eliminates reliance on rare earth magnets for large-scale wind turbines

Thanks to LDRD initial funding, a fundamentally new type of rotary eletrical contact that eliminates expensive rare earth magnets in utility-scale direct-drive wind turnbines is available for the next generation of direct-drive wind turbines. Sandia's Twistact technology takes a novel approach to transmitting electrical current between a stationary and rotating frame, or between two rotating assemblies having different speeds or rotational direction, ideal for application in wind turbines. Read more… (SAND2022-9087S)

- **Mission Agility, Technical Vitality**

Los Alamos NATIONAL LABORATORY

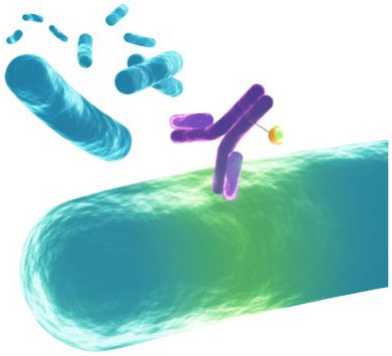


This visualization captures the 3D mathematical space used to map human color perception. A new mathematical representation has found that the line segments representing the distance between widely separated colors don't add up correctly using the previously accepted geometry. (Image courtesy of LANL)

## Math error: a new study overturns 100-year-old understanding of color perception

A new study by a LANL researcher corrects an important error in the 3D mathematical model developed by the Nobel Prize-winning physicist Erwin Schrodinger and others. The model has been used by scientists and industry for more than 100 years to describe how your eye distinguishes one color from another. This new discovery has the potential to boost scientific data visualizations, improve TVs, and recalibrate the textile and paint industries. Read more… (LA-UR-21-24630)

- **Mission Agility, Technical Vitality**



To find and kill dangerous pathogens (blue) within the body, an antibody (purple) that selectively binds to an antigen on the surface of the pathogen is linked to a chelator molecule (orange) designed to carry ions of a radioactive isotope with a brief half-life. Concentrated radiation from the attached isotope delivers a lethal dose to the pathogen before the isotope's radioactivity safely dwindles away. (Image courtesy of LANL)

## A nuclear hunter-killer for pathogens

LANL researchers find a new way to battle drug-resistant bacterial infections by taking a cue from a type of cancer therapy that is currently in development. This

new treatment delivers radioactive isotopes directly to the harmful bacteria within the body, thereby killing the bacteria with extremely localized irradiation. Other researchers at Los Alamos and Lawrence Berkeley National Laboratories have already begun testing different aspects of the treatment against infections such as pneumonic plague. Read more... (LA-UR-21-32363)

- **Mission Agility, Technical Vitality, Workforce Development** ]


## AMAZING LDRD HIGHLIGHTS

**LLNL PRODUCES NEW ESTIMATES ON SOIL CAPACITY TO STORE CARBON**: **Research reveals where carbon storage in soils has the most potential** > **Mission Agility,Technical Vitality** (LLNL-WEB-458451)

**UNDERSTANDING URANIUM CHEMISTRY IN ENERGETIC ENVIRONMENTS**: **Oxygen effects on uranium tested at LLNL** > **Mission Agility, Technical Vitality** (LLNL-WEB-458451)

**LLNL SCIENTISTS OBTAIN HIGH-PRECISION THERMODYNAMIC DATA: Breaking the strongest chemical bonds with laser shock compression** > **Mission Agility, Technical Vitality** (LLNL-WEB-458451)

**ATTRACTING A DYNAMIC, DIVERSE WORKFORCE: Sandia LDRD projects benefit from intern participation at Historically Black Colleges & Universities** > **Workforce Development** (SAND2022-8564L)

**4D VISUALIZATION OF X CHROMOSOMES: LANL: Supercomputers reveal how X Chromosomes fold, deactivate** > **Mission Agility, Technical Vitality, Workforce Development** (LA-UR-21-29486)

**LANL RESEARCH FINDS WARPING OF PLANET CRUST: Melting of polar ice shifting Earth itself, not just sea levels** > **Mission Agility, Technical Vitality** (LA-UR-21-31982)

This newsletter, published quarterly, features LDRD and SDRD work done by Lawrence Livermore, Los Alamos, Nevada National Security Site and Sandia. To see a PDF with all articles referenced in this newsletter or review past issues, visit NNSA-LDRD.lanl.gov and click on the Quarterly Highlights tab.

**For more information:**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