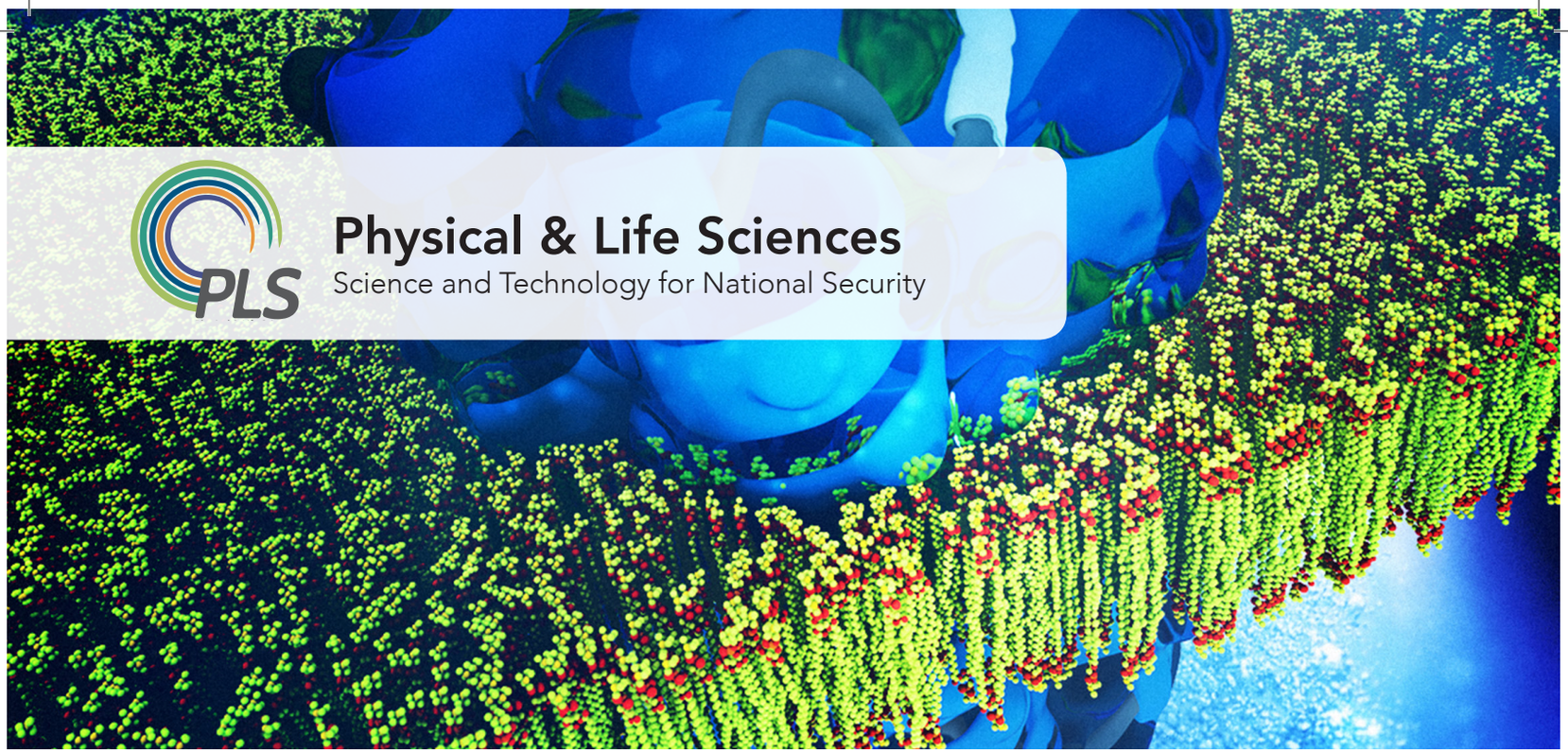
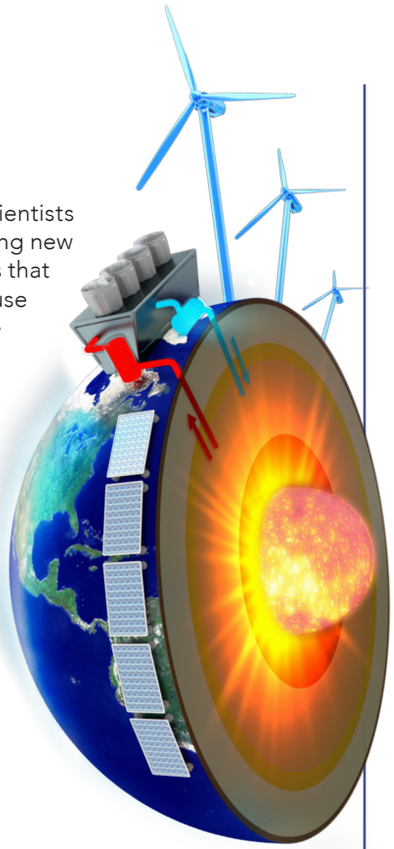


Physical & Life Sciences

Science and Technology for National Security

Based on an expert foundation of physics, chemistry, biosciences, materials science, and Earth and atmospheric sciences, Lawrence Livermore National Laboratory (LLNL) employs the latest scientific models, capabilities, and technologies to better understand the ever-evolving challenges affecting our national security. Our "capability centers" provide specialized resources—from nanoscale materials synthesis to biological agent identification, and from state-of-the-art forensic science to high-performance computing—across a range of scientific disciplines, and our user facilities provide unique capabilities to the broader scientific community.



Livermore scientists are developing new technologies that expand the use of renewable energy and improve the efficiency of existing systems.

ATMOSPHERIC, EARTH, AND ENERGY SCIENCE

We seek to understand the complex interactions among energy production, energy utilization, and the environment using both experimental and computational approaches. We apply our atmospheric science expertise to diagnosing climate change and understanding its impact on society, assessing the transport and impacts of hazardous materials released into the atmosphere, studying the potential of wind energy, and mitigating the environmental impacts of energy use. In the subsurface, our work includes geophysical and seismic monitoring for nuclear nonproliferation and energy production, the mechanics of geological materials under loading, and the reactive transport of fluids and contaminants.

BIOSCIENCES AND BIOTECHNOLOGY

Keeping the world safe from biological threats requires revolutionary advances in detection, characterization, and mitigation. As such, our scientists work at the intersection of the biological, physical, engineering, and computational sciences to address the nation's challenges in biosecurity, chemical security, bioenergy, and human health. We perform fundamental and applied research in areas such as genomics, molecular toxicology, computational biology, nanotechnology, host–pathogen biology, structural biology, genetics, microbial systems, and medical countermeasures. Our strategy is to focus on understanding human physiology, host–pathogen interactions, mechanisms, pathways, biomarkers, and therapeutic targets to be poised to respond to emerging security challenges.

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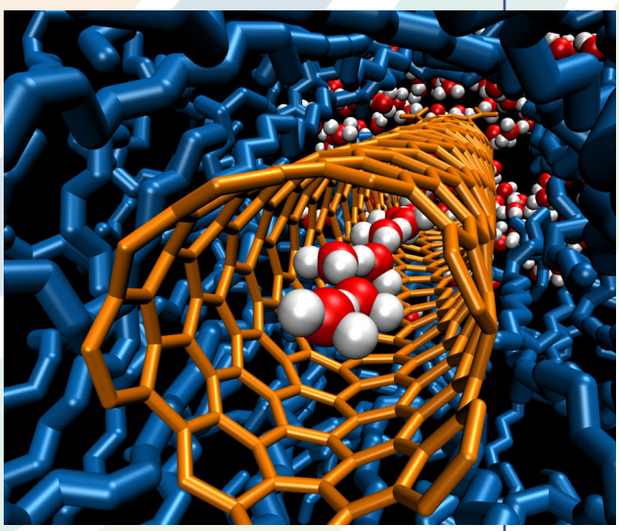
MATERIALS SCIENCE

Our multidisciplinary staff is dedicated to creating new materials and understanding the properties and performance of these materials. We use state-of-the-art characterization techniques coupled with modeling and simulation to meet both current and future mission needs. Focus areas include metallurgy, material corrosion and degradation, nanomaterials and assembly, advanced manufactured materials, optical materials, and computational materials science. From actinides and architected materials to polymers and energetic materials, LLNL is constantly innovating in materials science.



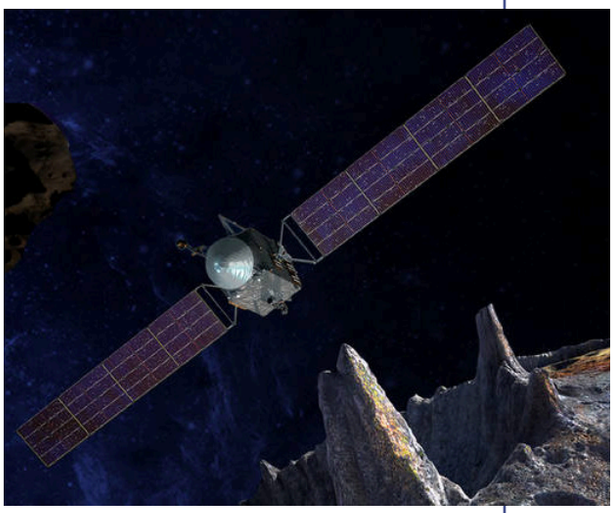
A single chain of water molecules fills the cavity inside a carbon nanotube (CNT). Water transport through CNTs is orders of magnitude faster than predicted by macroscopic hydrodynamics.

NUCLEAR AND CHEMICAL SCIENCES

We strive to leverage expertise in fundamental physics and chemistry to provide innovative solutions for stockpile stewardship and other national security programs, including forensic science, nuclear safety and security, and nonproliferation. Our world-class capabilities in radiation detection and nuclear measurements, chemical and nuclear forensic science, theoretical and experimental nuclear physics, and nuclear and radiochemistry help make the world safer every day. LLNL scientists also discover new particles and heavy elements and answer important scientific questions about dark matter, neutrino physics, nucleosynthesis, and the origins of the universe.

PHYSICS

Our research spans astrophysics, planetary science, condensed-matter physics, and atomic and plasma physics. A major focus area is high-energy-density science (HEDS) and its connections to Laboratory missions. We operate the Jupiter Laser Facility, an intermediate-scale user facility for HEDS research. Our activities also include the development of advanced optics, imaging systems, and detectors; magnetic fusion energy research; space science; and studies of materials under extreme conditions. Our theoretical and experimental research efforts are tightly coordinated to provide predictive, validated, and comprehensive solutions to national science and technology needs.



LLNL x-ray optics technology aids exploration of galaxies, supernova remnants, cometary and planetary atmospheres, and stellar coronae. An LLNL-designed gamma-ray spectrometer will be aboard the NASA mission headed for 16-Psyche in the asteroid belt.

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