



Did you know that was **LDRD**?

September 2026



Innovation starts here.

Explore the impact of LDRD
across LANL—driving discovery
today and shaping tomorrow.

Welcome to the September issue of ‘Did you know that was LDRD?’

Each month, we spotlight a selection of recent publications, discoveries, and accomplishments that grew from or were supported by the Laboratory Directed Research and Development (LDRD) program at Los Alamos National Laboratory (LANL). Even if you’ve seen this work before, the LDRD connection may be new.

Explore this month’s selections below and discover how LDRD helped make the work possible.

Scientists map the shape of RNA that can shut down genes

An international team, including Los Alamos scientists, investigated how the structure of SINE B2 (short interspersed nuclear element B2) ribonucleic acid (RNA) influences its role as a self-cleaving molecular switch that regulates gene expression. This rare mammalian self-cleaving RNA acts as a molecular switch involved in regulating gene expression. Published in [Communications Biology](#), the study combined cell biology, X-ray scattering and RNA biochemistry experiments with RNA modeling using Los Alamos’ Chicoma supercomputer. The findings will inform the team’s “Beyond Alpha Fold” artificial intelligence (AI) project, which aims to predict the multiple three-dimensional structures RNA can adopt.



A Los Alamos research team is unraveling the structure and function of RNA. Image credit: LANL

Why this matters: Understanding how RNA’s changing structure affects its function could help explain how cells regulate gene expression and respond to stress, heat and infection. This work provides a foundation for improved RNA modeling and future research into RNA’s therapeutic potential.

The work is partially supported by LDRD project 20260525ER- **Beyond AlphaFold: Artificial Intelligence (AI)-Driven Discovery of Viral Ribonucleic Acid (RNA) and Regulatory Element Structures**, led by Karissa Sanbonmatsu, T-6 (Theoretical Biology and Biophysics).

Westinghouse eDeimos experiment sets new temperature record for NCERC

A multiweek experiment at Los Alamos' National Criticality Experiments Research Center (NCERC) pushed the vacuum chamber core to new thermal milestones. The team initially reached 905°C using high-end electric heaters. This was followed by a cooling cycle and neutronics measurements. Two days later, the team pushed the peak temperature to 1011°C, setting a new NCERC record. Insights from an earlier ZiaCore campaign also informed other criticality experiments.

Why this matters: These experiments advance NCERC's understanding of high temperature reactor behavior and validate improved heating and vacuum techniques. Setting new thermal records strengthens future experiment design, supports safer and more efficient operations, and accelerates progress toward next generation reactor concepts. Additionally, this data is crucial for the deployment of Westinghouse's eVinci microreactor, which was recently selected to be installed at Fort Drum as part of the US Army's Janus Program.

eDeimos builds off the [R&D 100 Award winning Deimos Advanced Reactor Testbed](#), established under LDRD. The inner core is replaceable by representative geometries for reactors of interest as demonstrated by both ZiaCore and eDeimos. The [Deimos](#) and [ZiaCore](#) projects have both received support from LDRD.

- **Deimos- 20220084DR- Next Generation Small Nuclear Reactors**, led by Theresa Cutler, NEN-2 (Advanced Nuclear Technology); Erik Luther, SIGMA-2 (Finishing Manufacturing Science); and Michael Rising, (XCP-3) Monte Carlo Codes.
- **ZiaCore- 20240055DR-** led by Christopher Matthews, MST-8 (Structure/Property Relations); Samantha Lawrence, SIGMA-1 (Fabrication Manufacturing Science); and Nicholas Thompson, NEN-2 (Advanced Nuclear Technology).



*Westinghouse eDeimos Critical Assembly at NCERC.
Image credit: LANL*



*Modeling phage therapy improves understanding of how to combat antibiotic resistant bacteria.
Image credit: LANL*

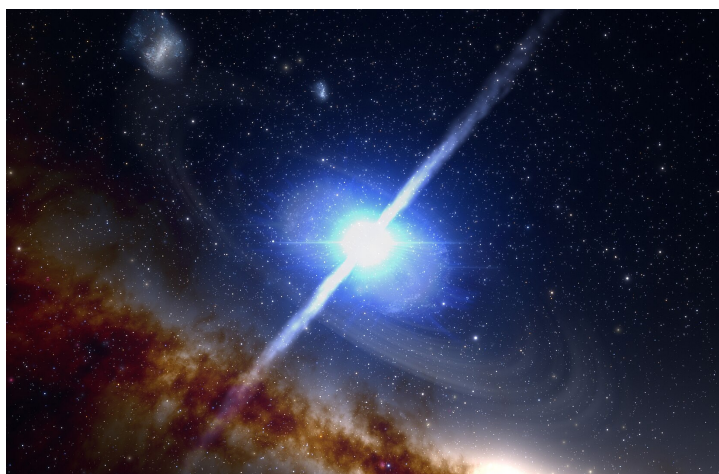
Bacteriophage therapy modeling offers hope for drug-resistant bacterial infections

Los Alamos researchers and collaborators have developed a mathematical model to better understand bacteriophage therapy, an approach that uses viruses called phages to infect and destroy bacteria. Published in [PLOS Computational Biology](#), the research identifies factors that can improve phage therapy and help optimize treatments for drug-resistant bacterial infections.

Why it matters: As multidrug antibiotic resistance grows as a public health challenge, bacteriophage therapy offers

another way to target bacterial infections. But individual phages narrowly target specific bacteria, which can rapidly evolve resistance. Understanding these complex interactions could help researchers develop more effective phage cocktails — combinations of phages tailored to a particular infection — and better understand why treatments succeed or fail.

The work was supported by LDRD project **20200695ER-Combating Antibiotic Resistance with Phage Therapy**, led by Alan S. Perelson, T-6 Theoretical Biology & Biophysics.



LANL researchers use machine learning to analyze astrophysical data from neutron stars and their mergers.
Image Title: [Neutron Star Merger in the Early Universe](#).
Image Courtesy: [Wikimedia CC-4.0](#)

[Constraining Hamiltonians from chiral effective field theory with neutron-star data](#)

A LANL research team used machine learning to infer parameters governing nuclear interactions from observations of neutron stars and their mergers. The team combined physics-informed machine learning models of neutron matter with neural networks modeling stellar structure, making an otherwise computationally prohibitive analysis feasible.

Published in [Physics Letters B](#), the study demonstrates that astrophysical data can constrain microscopic interactions between nucleons—protons and neutrons—even at the extreme densities found inside neutron stars.

Why this matters: The research connects astronomical observations to the microscopic nuclear interactions that determine how dense matter behaves. By reducing computational costs, this approach enables researchers to use neutron-star data to refine nuclear models and better understand matter under extreme conditions.

The work is partially supported by LDRD projects:

- **20230315ER- Unified Equation of State for Nuclear Matter from Low to High Densities and Temperatures for Multimessenger Astrophysics**, led by Ingo Tews, Stefano Gandolfi, and Mark Paris, all from T-2 (Nuclear & Particle Physics, Astrophysics & Cosmology),
- **20260260ER- Unraveling Nuclear Interactions with a Data-Driven Approach**, led by Ingo Tews, T-2 (Nuclear & Particle Physics, Astrophysics & Cosmology); and Rahul Somasundaram, T-5 (Applied Mathematics and Plasma Physics),
- **20240477CR- Center for Space and Earth Science (CSES): Foundational Research in Space and Earth Science**, led by Lisa Danielson, NSEC (National Security Education Center); and Ann Ollila, ISR-1 (Space Science & Applications), and
- **20250750ECR- Probing Nuclear Astrophysics from Neutron Star Mergers with Artificial Intelligence: Toward a Foundation Model in the Multi-Messenger Era**, led by Soumi De, T-5 (Applied Mathematics and Plasma Physics)

Technology Snapshot

Intellectual property (IP) such as patents and software copyrights tell powerful stories about how LDRD-funded work can lead to real-world impact. LDRD consistently generates a disproportionate share of the Laboratory's intellectual property—fueling inventions, copyrights, and technology transitions that would not exist without early LDRD investment. The technology featured below provides an example of that impact.



Illustration of Yersinia Pestis cells. Image created using ChatGPT.

Bacterial Lipid Nanodiscs Platform- A safer alternative to handling live high risk pathogens

Patent: Pathogen Lipid Nanodiscs

Patent Application Date: 7/1/2026

The Bacterial Lipid Nanodiscs Platform developed by LANL provides a new way to study entire bacterial membranes in a controlled, nanoscale format derived directly from native lipid extracts. Researchers gain access to membrane components that typically remain difficult to isolate, stabilize or analyze, enabling more accurate evaluation of immunogenic lipids and membrane associated targets. The platform offers a safer alternative to handling live high risk pathogens while preserving the biological context that drives meaningful insights for vaccine design and antimicrobial discovery such as therapeutic antibodies to conserved lipids on bacterial membranes.

The Bacterial Lipid Nanodiscs Platform creates uniform nanoscale discs from total lipid extracts harvested from bacterial membranes. Membrane scaffold protein MSP1D1 encases the lipid mixture and forms a stable disc roughly 10 nanometers wide. The resulting particles retain the full complement of native bacterial lipids, arranged in a membrane like environment that supports realistic biological interactions without requiring synthetic lipids or live cells.

Advantages:

- Provides membrane like structures using native bacterial lipids
- Avoids the safety challenges of handling live pathogens
- Offers a broader and more realistic lipid environment than synthetic nanodiscs
- Enables improved assessment of membrane antigens and immune responses
- Supports analysis of diverse bacterial species using a unified workflow
- Creates consistent nanoscale particles suitable for research and development settings

Technology Description:

The method adapts established nanodisc assembly techniques to incorporate entire bacterial lipid extracts rather than defined synthetic lipid mixtures. Total lipids from a pathogen are solubilized, combined with MSP1D1 and dialyzed under controlled conditions to allow the scaffold protein to form a discoidal structure

around the heterogeneous lipid population. The process yields nanoparticles that represent the membrane environment of the source organism, including amphiphilic molecules that typically resist purification or structural study when isolated from their native context.

The approach was demonstrated using *Yersinia pestis* (*Y. pestis*), chosen to illustrate how membrane characterization can proceed without the hazards associated with live Tier 1 pathogens. The method captures lipopolysaccharides (LPS) and diverse immunogenic lipids in an arrangement that mirrors their natural organization. Researchers can evaluate binding interactions, immune stimulating properties and potential antigenic targets in a stable platform that avoids the limitations of outer membrane vesicle purification. Furthermore, using this platform we have identified antibodies specific to *Escherichia coli* lipopolysaccharide (*E. coli* LPS) and *Y. pestis* membrane lipids. These antibodies are independently licensable.

Market Applications:

- Life Sciences Research (membrane biology, immunology)
- Vaccine Development (bacterial antigen discovery)
- Drug Discovery (membrane associated targets)

This technology is supported by LDRD project **20220108ER- Lipid Targeting for Select Agent Countermeasures**, led by Jessica Kubicek-Sutherland, C-PCS (Physical Chemistry & Applied Spectroscopy); and Nileena Velappan, B-TEK (Biochemistry & Biotechnology).

[The Richard P. Feynman Center for Innovation \(FCI\)](#) helps businesses and organizations work with Los Alamos National Laboratory to turn research into practical products and solutions. The FCI tech transfer office connects industry partners with new technologies, research expertise and licensing opportunities. From protecting inventions to building collaborations, the Feynman Center makes it easier to bring scientific advances to the marketplace and create lasting impact. The Bacterial Lipid Nanodiscs Platform technology, along with many other LANL-developed technologies, is featured on the Richard P. Feynman Center for Innovation [Technology Snapshots webpage](#).

Are you interested in learning more about Los Alamos' LDRD program? [Visit our website](#).

Do you have a recent LDRD-related publication or highlight you would like to share? Reach out to us at ldrd@lanl.gov to let us know.

AI tools aided in drafting portions of the above article/highlight summaries. All final content was reviewed, edited, and further refined through human oversight.