OAK RIDGE NATIONAL LABORATORY

Neutrons for New Discoveries and Solutions

Breakthroughs in medicine, energy, technology, and industry follow advances in the understanding of materials. Oak Ridge National Laboratory (ORNL) is the US epicenter of one of the most powerful techniques for exploring the nature of materials — neutron scattering.

ORNL hosts two of the world's most powerful sources of neutrons for research: the Spallation Neutron Source (SNS) and the High Flux Isotope Reactor (HFIR), which each produce different, but highly useful and complementary types of neutron beams. Because neutrons have no electrical charge, they can easily pass through materials — even dense metals — without altering them, revealing information about their atomic structure and other properties.

Neutron scattering is used by scientists and many industries — including automotive, aerospace, steel, defense, energy production and storage, data storage, and biomedicine — to address many of the major scientific and societal challenges of the 21st century.

518
Scientific publications in FY 2024*

1,085
Unique users in FY 2024

69,537
Hours of beamtime in FY 2024

861
Total experiments in FY 2024

Ensuring US Leadership

The Proton Power Upgrade (PPU) has increased the SNS beam power and significantly enhanced its capability to support the US research community. The PPU also was necessary to support a Second Target Station (STS) at the SNS to maintain US competitiveness in materials development as new European and Asian neutron facilities come online.

INNOVATION

ORNL strengthens America through discovery science enabled by multidisciplinary teams and powerful research tools, translating advancements to address national priorities. We deliver breakthroughs that move innovation from the laboratory to national impact.

ENERGY

ORNL advances technologies to ensure secure, affordable, and reliable energy to fuel the nation's economic growth and energy independence. Our teams develop solutions supporting the Department of Energy's mission and America's energy future.

COMPETITIVENESS

ORNL accelerates the transition of research into real-world applications to drive economic prosperity, reduce costs, and give US industries an edge. We foster innovation networks that create jobs, grow industries, and strengthen America's global competitiveness.

SECURITY

ORNL protects America's future through scientific and technological breakthroughs that secure critical infrastructure and address emerging threats. Leveraging our unique capabilities, we deliver solutions that safeguard our people, infrastructure, and economy against evolving security challenges.

**518 total publications including 461 peer-reviewed journal articles*

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U.S. DEPARTMENT of ENERGY | Office of Science

Impacts

- **Fighting Disease:** Neutron studies at SNS and HFIR have helped researchers understand and develop antiviral molecules and discover new drugs to combat deadly diseases and viruses.

- **Safer bridges:** Researchers have used neutrons at SNS to study breaks in suspension bridge cable wires inside the cable and how they affect cable strength and bridge safety. Neutrons enabled nondestructive studies of the wires to help develop more cost-effective cable maintenance methods.

- **Stronger glass:** Industry has used neutrons to study how silica behaves as it heats and cools. Better understanding of glass production means more durable glass for mobile devices, windshields, and TV screens.

- **Safer batteries:** Researchers at SNS used neutrons to peer inside a solid-state battery. They found its safer, longer-lasting performance results from a stabilizing layer, across which charged lithium atoms flow quickly.

- **Reliable aircraft:** NASA and Honeywell Aerospace used neutrons at SNS to examine welds used in turbines to facilitate producing more reliable aircraft components.

SNS is an accelerator-based facility that provides the world's most powerful pulsed neutron beams for scientific research and industrial product development. SNS delivers short pulses of protons — 60 times a second — to a target where neutrons are produced by a "spallation" process and sent down beamlines to sophisticated instruments used by researchers.

HFIR uses uranium-235 as the fuel to generate the highest rate of flowing neutrons, or neutron "flux," available for research in the United States.

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