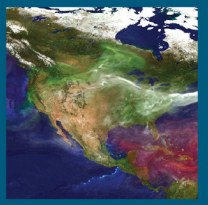
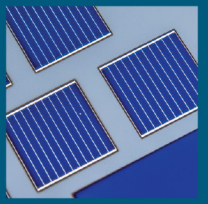
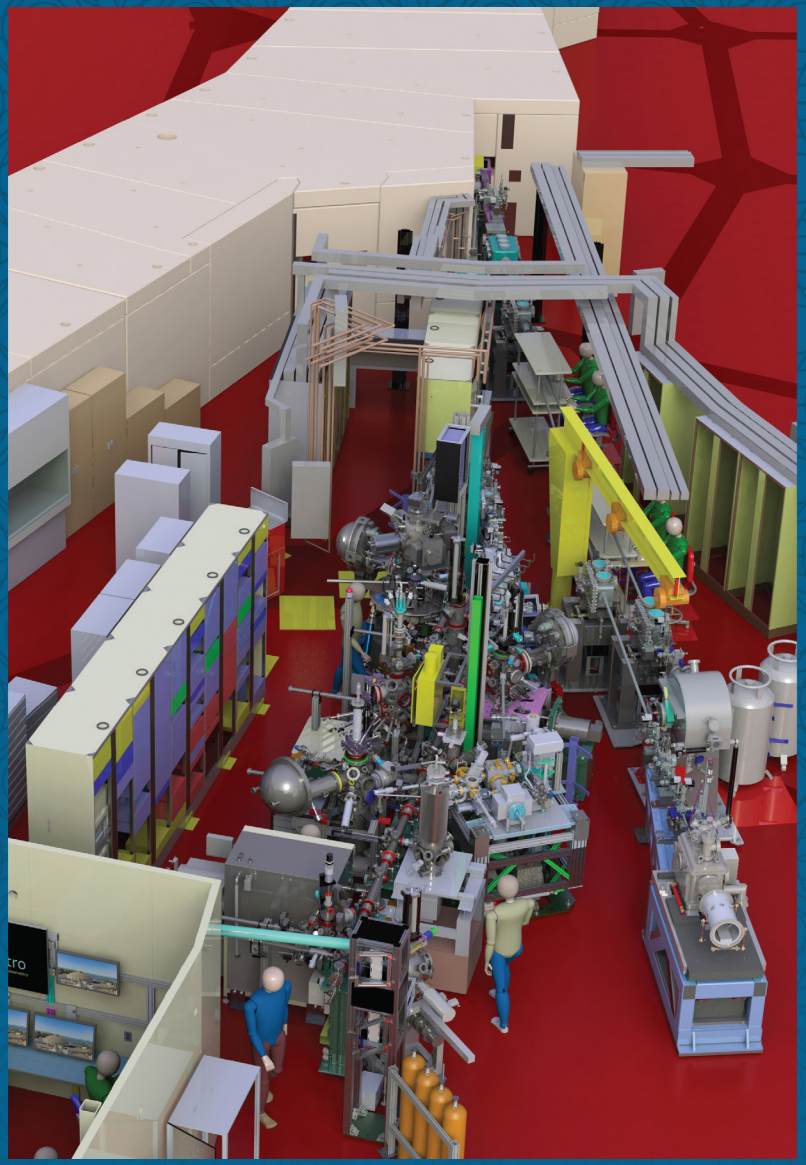
ADVANCED LIGHT SOURCE

Discover what's inside...







What is the Advanced Light Source (ALS)?

- A ring-shaped particle accelerator (also known as a synchrotron) that generates bright beams of light for scientific research.
- A tool for exploring the properties of materials (chemical, magnetic, electronic, and structural) using primarily x-ray light in addition to infrared and extreme ultraviolet.
- A national "user facility" open to scientists (users) from around the world, with access through a highly competitive proposal process.
- Home to a team of about 200 experts dedicated to serving and collaborating with the user community.
- A scientific division of Lawrence Berkeley National Laboratory.
- Funded by the U.S. Department of Energy, Office of Science.

User facilities such as the ALS are a critical and unique part of the nation's scientific infrastructure, underpinning innovations that spur economic growth and benefit society.

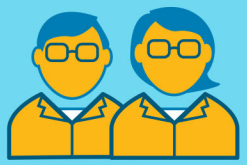
Number of **beamlines** working simultaneously:

40

REFEREED JOURNAL ARTICLES PER YEAR:

950

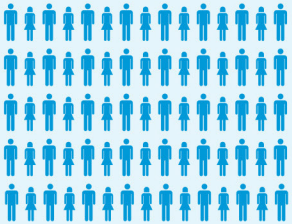
USERS PER YEAR:



2000+

USERS ON SITE AT ANY GIVEN TIME:

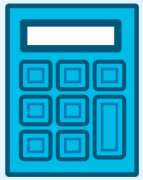
50 to 100



Typical stay of **users**: **1 hour to 10 days**

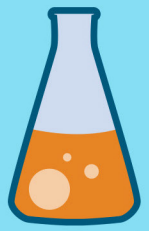
USERS REPRESENT:

Government • Academia • Industry



AVERAGE ANNUAL OPERATING BUDGET:

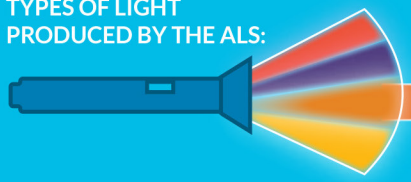
$65M



SOFT X-RAYS REVEAL PROPERTIES OF MATTER:

CHEMICAL
MAGNETIC
ELECTRONIC

TYPES OF LIGHT PRODUCED BY THE ALS:



Infrared

Ultraviolet

Soft X-Rays

Hard X-Rays

OPTIMIZED FOR THIS RANGE

ALS UPGRADE (ALS-U):

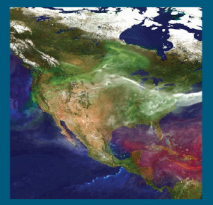
BRIGHTER, MORE FOCUSED X-RAY BEAMS

ALS-U

Fields of research:

ENERGY

EARTH & ENVIRONMENT

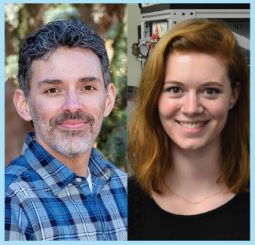


MATERIALS

BIOLOGY

CHEMISTRY

PHYSICS



David Macaluso and Maggie Boyd (University of Montana)

The peculiar behaviors of electrons in some nanoparticles enables their use in such applications as cancer treatment, advanced medical imaging, and quantum computing. Macaluso, Boyd, and their colleagues use the ALS to better understand and exploit these behaviors, exploring how they may be enhanced or inhibited in certain nanoparticle geometries and combinations, like gold nanoparticles encapsulated within carbon nano-cages.

Xiaoshan Xu (University of Nebraska–Lincoln)

We all want slimmer, lighter mobile phones, tablets, and laptops that last longer on a single charge. To this end, scientists are looking for materials that enable extremely compact forms of magnetic memory to operate on very low electrical currents. Xu's team uses the ALS to study such materials to learn how their crucial magnetic and electronic properties are linked.

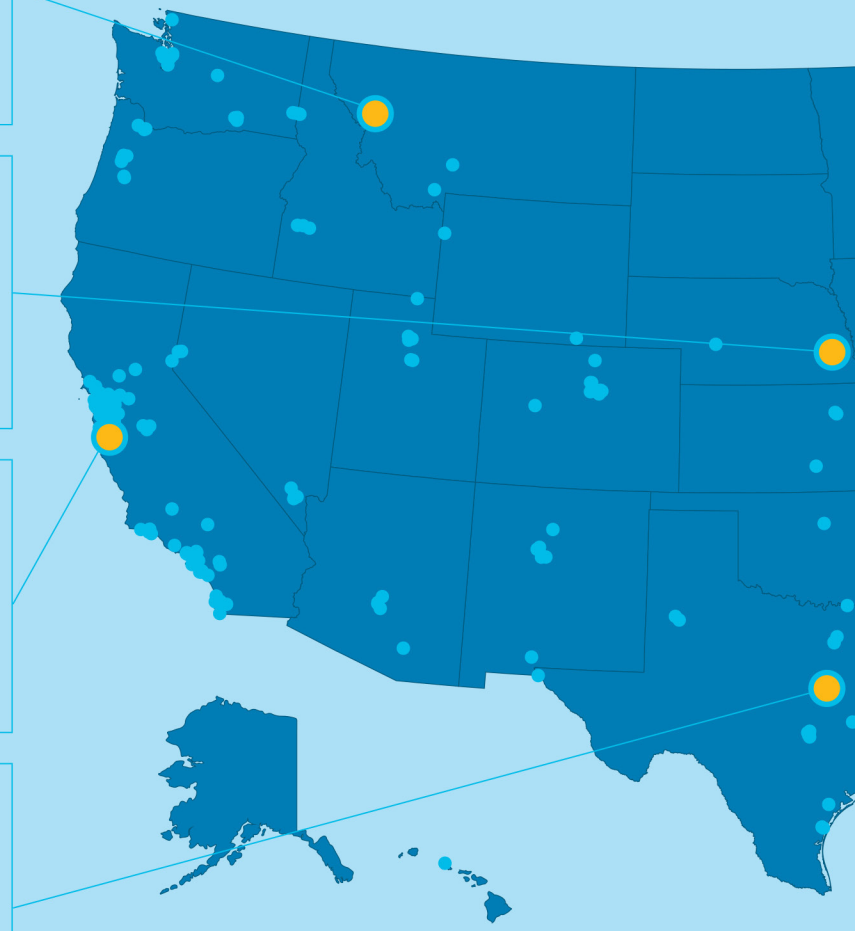
Megan Hoarfrost Beers (TE Connectivity Ltd.)

Conductive plastics with good electrical properties offer processing and cost benefits over metal alternatives, with uses ranging from automotive applications to data communications. Beers and her team use the ALS to optimize the formulation and manufacturing parameters of their metal–plastic composites to maximize electrical conductivity.

Kenneth Befus (Baylor University)

The conditions inside a volcano affect the nature of its eruptions, with major implications for the health and safety of nearby populations. To better understand these internal conditions, Befus and his colleagues use the ALS to analyze chips of rock from past eruptions, extracting their temperature and pressure history. The data can then be used to develop more accurate models of volcanic behavior.

A National Scientific Resourc



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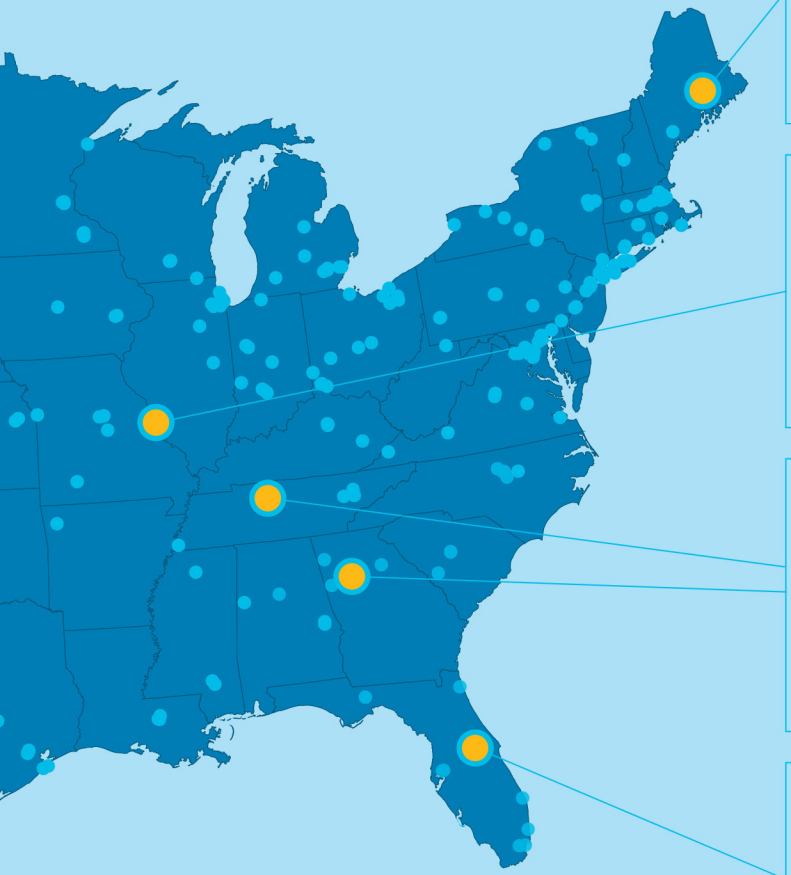


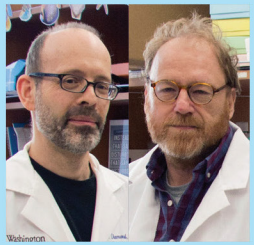
- Locations of recent ALS users' home institutions
- Representative examples of user science

Rob Meulenberg (University of Maine)

Energy grids supplied by sunlight and wind need batteries to help even out supply and demand. "Flow" batteries that store energy in circulating liquids are attractive because they can discharge quickly over many cycles. However, the amount of energy they store is limited. Meulenberg's team uses the ALS to study chemical changes in the liquids as they circulate, informing the design of batteries with greater capacity.

Michael Diamond and Daved Fremont (Washington University in St. Louis)

The Zika virus is a mosquito-borne pathogen recently linked to serious birth defects—microcephaly—in infants in South and Central America and the United States. Groups led by Fremont and Diamond rely on the ALS to help them understand how human antibodies attach to Zika proteins (like a three-dimensional puzzle) to prevent infection and halt the spread of this disease.

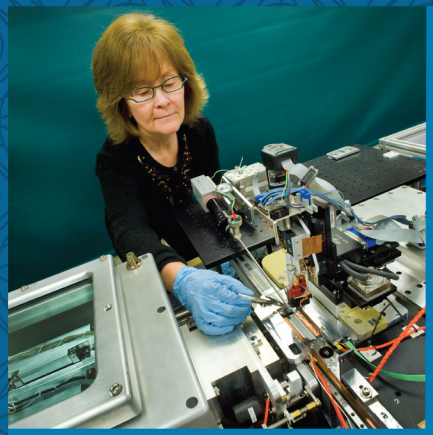


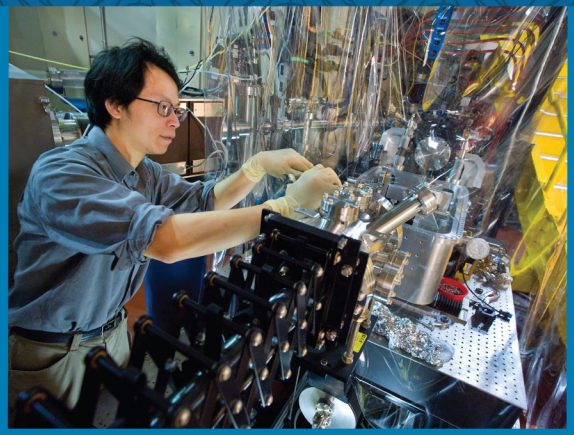
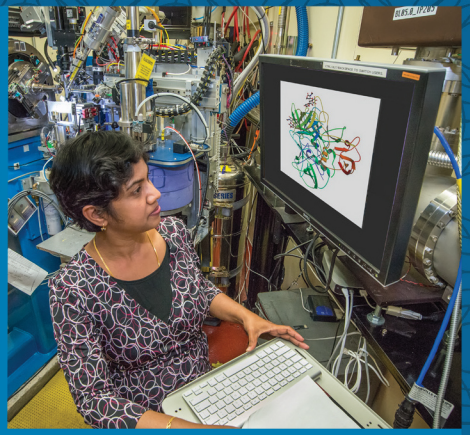
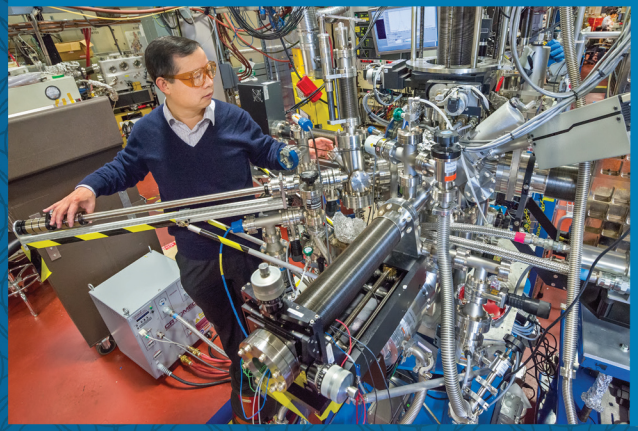
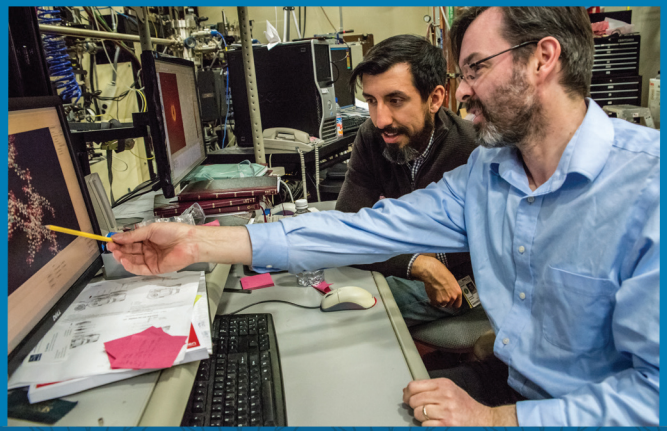
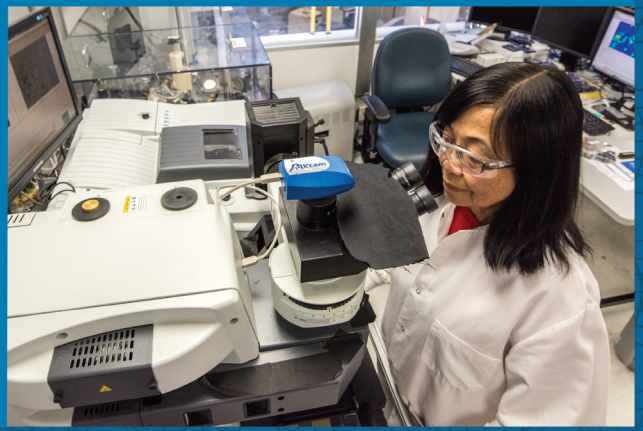
Marta Hatzell (Georgia Institute of Technology) and Kelsey Hatzell (Vanderbilt University)

Nitrogen is an essential ingredient in fertilizers and fuels. It's abundant in the air, but harvesting it consumes 1–2% of our global energy. Marta and Kelsey Hatzell use the ALS to explore the feasibility of a more efficient, environmentally friendly approach to transforming nitrogen in the atmosphere into useful feedstocks using a catalyst that requires only air, water, and light.

Candice Bridge and Kandyss Najjar (University of Central Florida)

If an assailant doesn't leave behind DNA or fingerprints, can cosmetic particles, transferred during an assault, be used to link the suspect to the victim or crime scene? Bridge and Najjar use the ALS to analyze the chemical composition of glitter (bits of colored foil or plastic) and shimmer (flecks of coated mica) in cosmetics to determine whether the particles came from similar sources.



For more information please visit **als.lbl.gov**

Prospective users: **sbailey2@lbl.gov, 510-486-7727**

General inquiries: **alscommunications@lbl.gov, 510-486-5484**

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U.S. DEPARTMENT OF ENERGY
Office of Science

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ADVANCED LIGHT SOURCE

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