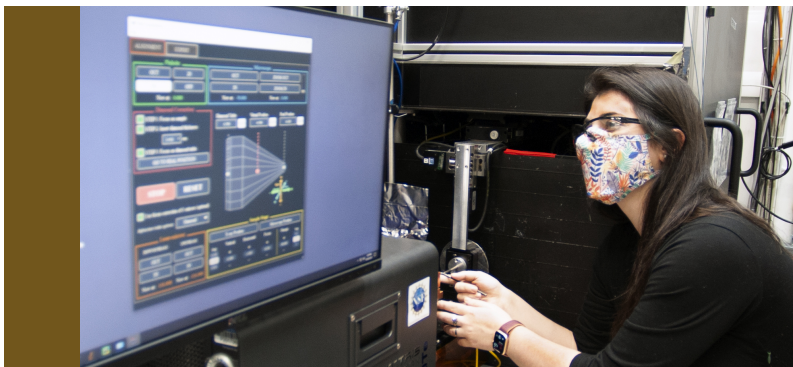


GEO & PLANETARY SCIENCE AT THE ADVANCED PHOTON SOURCE



Discoveries that extend from the center of our planet to the far reaches of space are made every day by researchers using the U.S. Department of Energy's Advanced Photon Source (APS) at Argonne National Laboratory.

Here are just a few examples.

Stella Chariton, beamline scientist with the University of Chicago's GSECARS collaborative access team at the APS, in the 13-ID-D research station.

- A layer of “hot,” electrically conductive ice could be responsible for generating the magnetic fields of ice giant planets like Uranus and Neptune according to research carried out at a GeoSoilEnviroCARS (GSECARS) x-ray beamline at the APS, which revealed the conditions under which two such superionic ices form.
- When a meteorite crashes into Earth, how does its impact alter the minerals found at the landing site and what can the short-lived physical and chemical changes created by these impacts teach us about the minerals existing at the high-temperature and -pressure conditions found deep inside Earth? Research at the Dynamic Compression Sector at the APS examined the crystal structure of silica mineral quartz under shock compression and challenged longstanding assumptions about how this ubiquitous material behaves under intense conditions.
- Hexagonal iron monosulfide (h-FeS), which is found in meteorites from the Moon or Mars and was first discovered in the Earth's crust, has a crystal structure with multiferroic properties that make it a candidate for new technologies. Researchers used the X-ray Science Division Inelastic X-ray &

Nuclear Resonant Scattering Group beamline at the APS to study h-FeS, providing insights about its potential for new multiferroic and spintronic materials.

- Neptune-like, water-rich exoplanets, which orbit a star outside the solar system, are common in our galaxy and are believed to be covered with a thick layer of water hundreds to thousands of miles deep, above a rocky mantle. Their composition is very different from Earth. Researchers carried out experiments at the HPCAT and GSECARS x-ray beamlines at the APS that provided one of the first mineralogy lab studies of these planets.
- Research partly conducted at GSECARS revealed that Earth's early atmosphere resembled that found on Venus today (97% carbon dioxide, 3% nitrogen, and some water vapor), but then evolved differently due to Earth's larger mass and greater distance from the Sun, providing a better understanding of the early evolution of our atmosphere and perhaps helping scientists identify planets that may host living organisms.

The Advanced Photon Source is a U.S. Department of Energy (DOE) Office of Science user facility operated for the DOE Office of Science by Argonne National Laboratory under Contract No. DE-AC02-06CH11357

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