Advancing neutron diffraction for accurate structural measurement of light elements at megabar pressures

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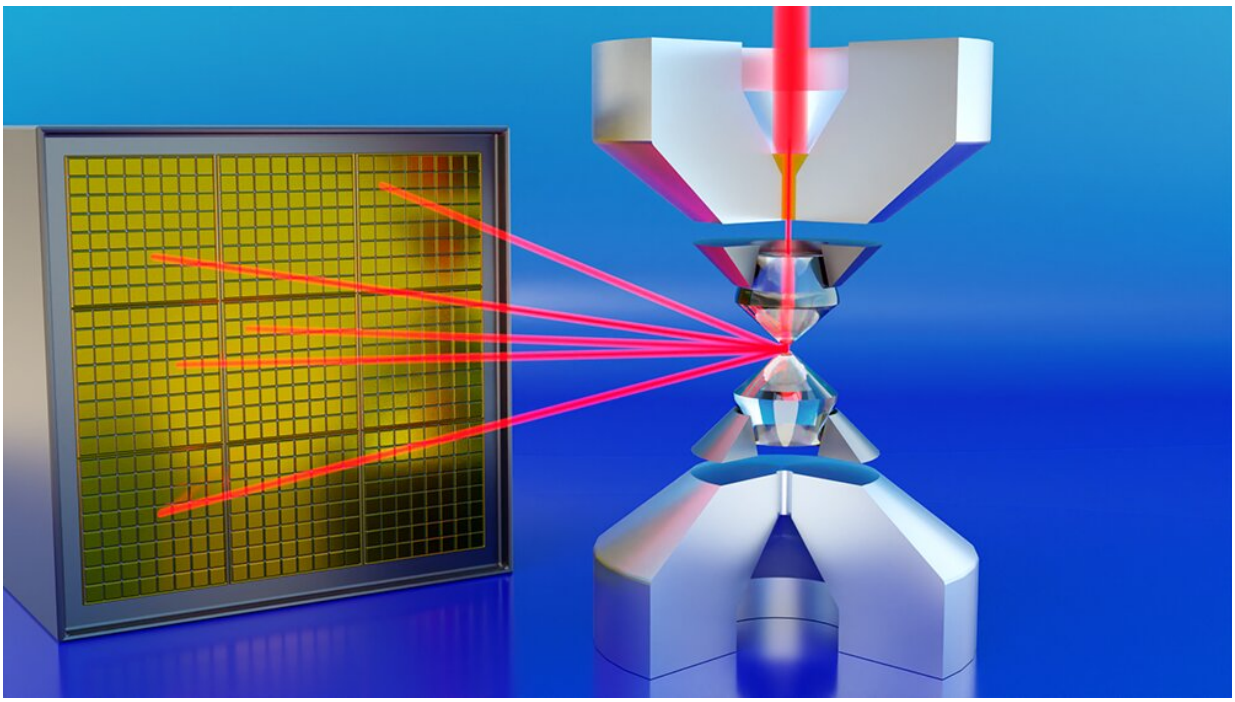

ORNL researchers used diamonds to compress materials to 1.2 million times ambient pressure and software to remove signal interference and extract data on pressure-induced atomic structures. Credit: Jill Hemman/ORNL, U.S. Dept. of Energy

For decades, scientists sought a way to apply the outstanding analytical

capabilities of neutrons to materials under pressures approaching those surrounding the Earth's core. These extreme pressures can rearrange a material's atoms, potentially resulting in interesting new properties.

A breakthrough resulted in 2022 when researchers at Oak Ridge National Laboratory's Spallation Neutron Source squeezed a tiny sample of material—sandwiched between two diamonds—to a record 1.2 million times the average air pressure at sea level, or approximately 1.2 megabar.

But this was only the start—they still had to produce useful data from the experiments.

Now those same scientists have implemented software that removes the signal interference affecting the neutrons as they pass through the diamonds before reaching the sample.

The research is published in the journal *Scientific Reports*.

"Researchers can now perform neutron experiments beyond 1.0 megabar and extract accurate data about extraordinary atomic structures of materials," said Malcolm Guthrie, computational instrument scientist at ORNL's SNAP beamline.

More information: Bianca Haberl et al, Advancing neutron diffraction for accurate structural measurement of light elements at megabar pressures, *Scientific Reports* (2023). DOI: 10.1038/s41598-023-31295-3

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