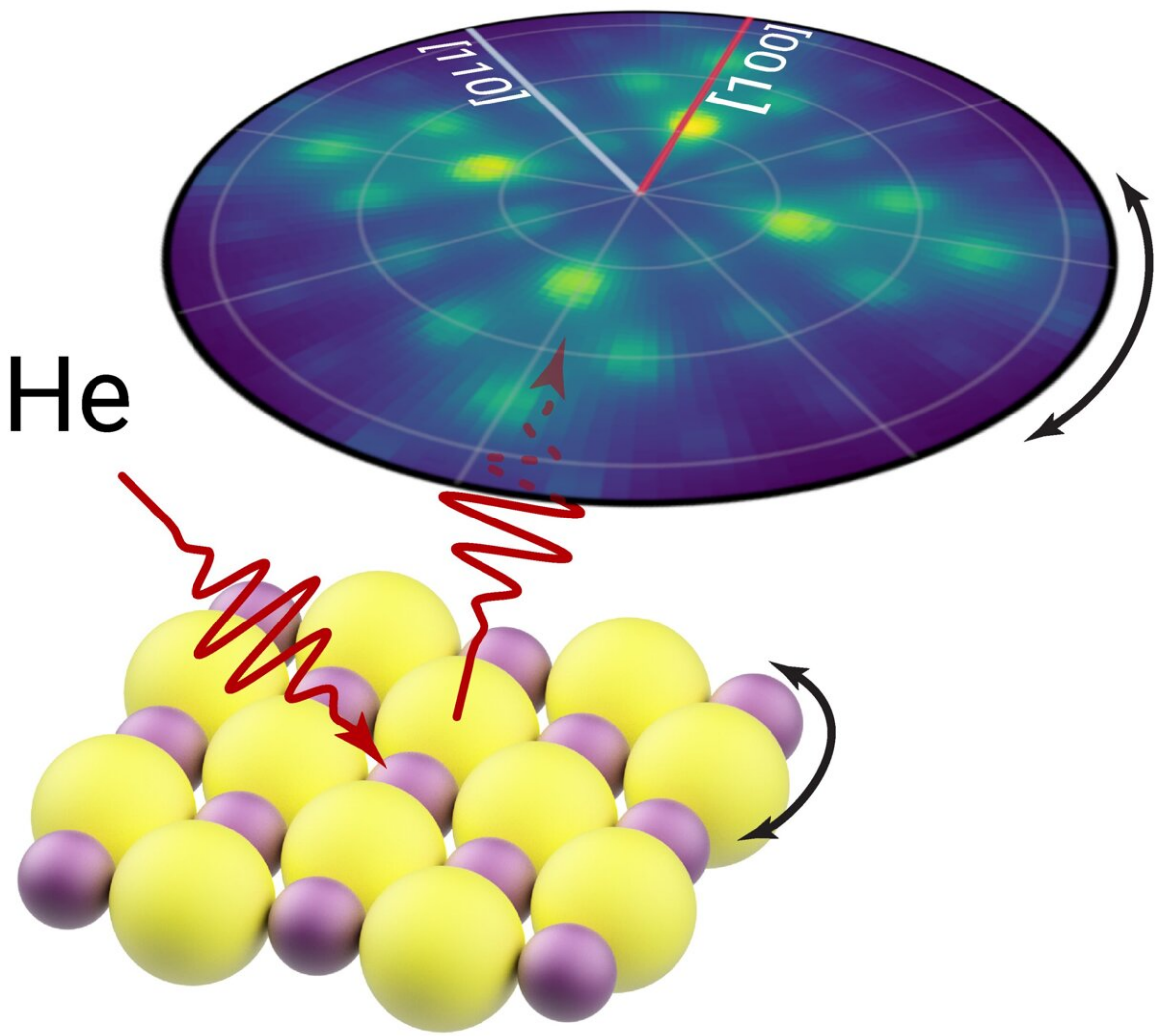
Collecting helium diffraction patterns in microscopic regions of samples

January 16 2024, by Ingrid Fadelli



Schematic representation of helium diffraction from a LiF surface, where a 2D diffraction pattern can be formed by varying both the sample rotation and outgoing detection angle. Credit: Matthew Bergin and Nick von Jeinsen.

Recent scientific advancements have opened new opportunities for the close observation of physical phenomena. Researchers at University of Cambridge and University of Newcastle recently introduced a new method to measure helium atom diffraction with microscopic spatial resolution.

This method, outlined in a paper in *Physical Review Letters*, allows physicists to study electron-sensitive materials and better understand their morphology using helium microdiffraction.

"The scanning helium microscope has been developed across several research groups for over a decade with a focus on improving the resolution of the instrument and studying technological and biological samples," Matthew Bergin, co-author of the paper, told Phys.org. "However, relatively little work had been done on using the matter wave aspect of the helium beam to study ordered surfaces with a scanning helium microscope."

The recent study by Bergin and his colleagues builds on one of their previous papers published in *Scientific Reports* in 2020. In this previous work, the researchers observed the signature of diffraction from a microscopic spot on a sample, yet they could not directly measure its underlying diffraction pattern.

In their new paper, they set out to continue their work in this area. Their study's underlying objective was to demonstrate that an atom-based matter wave could be used to form a diffraction pattern from spatially resolved regions of a surface.

"Due to the particle–wave duality of atoms, a helium beam directed at a lattice can behave like a wave and diffract from the periodic structure," Bergin said. "Thermal energy helium atoms possess such a low energy (