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High-Resolution Electron Microscopy gets Cooler

Sub-Angstrom Imaging at Cryogenic Temperatures

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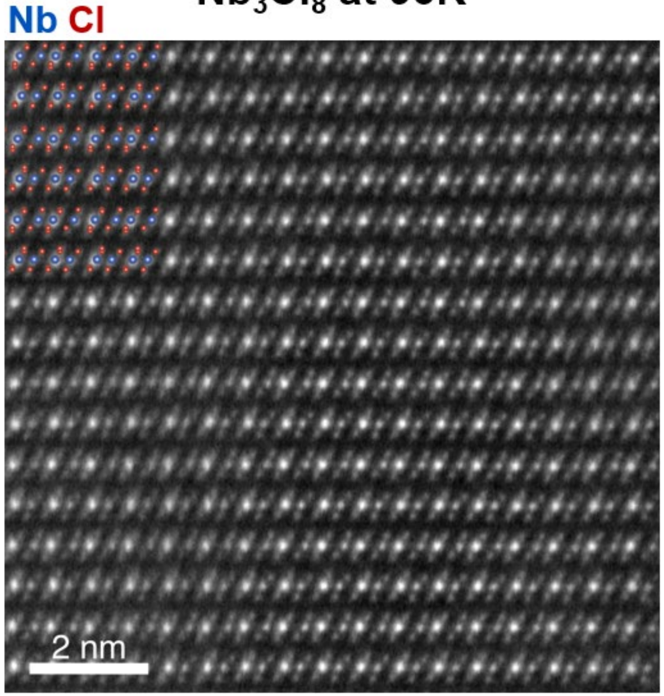
Today, sub-angstrom resolution scanning transmission electron microscopy (STEM) imaging is routinely achieved. In addition to resolving individual atomic columns in crystals, STEM performed at room temperature can be used to determine their positions with picometer precision which allows us to directly map local properties. Extending the reach of STEM to cryogenic temperatures will enable atomic-scale characterization of systems which were previously inaccessible in the electron microscope, such as electronic phases that emerge at low temperature.

Here, we have developed a new approach to register a series of STEM images which has been optimized for low signal-to-noise, cryogenic STEM data. Using this technique we have demonstrated the highest resolution cryo-STEM imaging reaching 0.72 Å at 300 keV near liquid nitrogen temperature. To benefit the broader scientific community, all source code and a graphical user interface are freely and publicly available. Our work enables application of the powerful tools of STEM characterization to low-temperature phases of matter, and will additionally be advantageous in registering and reconstructing a broad array of low signal-to-noise STEM datasets.

This high-resolution cryogenic imaging is available to PARADIM users through the PARADIM's electron microscopy user facility.

Cryo-STEM Imaging of Nb_3Cl_8 at 93K



Cryo-STEM provides a direct probe of a new range of electronic phases

B. Savitzky *et al.*, *Ultramicroscopy* **191** (2018) 56–65.