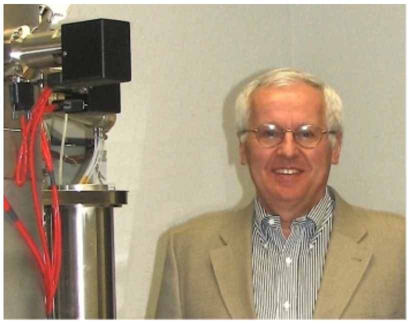

Atomic-resolution studies of materials by aberration-corrected scanning transmission electron microscopy

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Aberration-corrected scanning transmission electron microscopes (STEMs) are now able to form intense electron probes as small as 0.5 Å in diameter, and to image and spectroscopically analyze single atoms *in-situ*. Nion Co. has pioneered many of the underlying advances, by developing the first electron-optical aberration corrector that improved the spatial resolution of electron microscopes beyond 1 Å, and later by developing a new STEM that can acquire images and spectra from single atoms in many different types of materials, and to perform efficient atomic-resolution elemental mapping.

More recently, we have introduced a monochromated STEM system for electron energy loss spectroscopy (EELS), which has made vibrational spectroscopy possible at an energy resolution better than 10 meV, and a spatial resolution of a few nm [1]. It has also allowed us to probe biological samples with an aloof electron beam parked in the vacuum a few tens of nm from the sample, thus almost completely avoiding radiation damage [2].

This seminar will review the basic principles behind the new developments, illustrate them with experimental results from a variety of 3D and 2D materials, and discuss and illustrate especially inviting future directions.

1. O.L. Krivanek et al., Nature **514** (2014) 209-212, see also Nature **514** (2014) 177-178.
2. P. Rez et al., Nature Communications, to be published (2016).