

Ondrej L. Krivanek – The importance of the candidate's work and its impact in the Czech Republic and abroad

Starting in the late 1970s, Ondrej L. Krivanek designed a series of electron energy loss (EEL) spectrometers and imaging filters, first as an assistant professor at Arizona State University and a consultant to Gatan Inc., and later as director of R&D at Gatan. These became highly successful, with over 500 installations world-wide. He also co-authored, with Channing Ahn, the EELS Atlas, now a standard reference for electron energy loss spectroscopy, pioneered the design and use of slow-scan CCD cameras for electron microscopy, and developed efficient microscope aberration diagnosis and tuning algorithms. He also initiated the development and designed the first user interface of DigitalMicrograph, which went on to become the world's leading electron microscopy image acquisition and processing software. The imaging filters he designed were corrected for second order aberrations and distortions, and he next took up the correction of third order aberrations, a key problem in electron microscopy. Following an unsuccessful application for funding in the US, he applied, successfully, for support to the Royal Society (jointly with L. Michael Brown FRS and Andrew Bleloch). He then took an unpaid leave of absence from Gatan to develop an aberration corrector for a scanning transmission electron microscope (STEM) in Cambridge UK, together with Niklas Dellby and others. In 1997, this led to the first STEM aberration corrector that succeeded in improving the resolution of the electron microscope it was built into. Also in 1997 and with Niklas Dellby, he started Nion Co., where they produced a new corrector design. In 2000 this corrector became the first commercially delivered electron microscope aberration corrector in the world (to IBM TJ Watson Research Center), and soon after delivery it produced the first directly interpretable sub-Å resolution images obtained by any type of an electron microscope. Nion correctors delivered to Oak Ridge National Laboratory produced the first directly interpretable sub-Å resolution electron microscope images of a crystal lattice and the first EEL spectra of single atoms in a bulk solid. Nion has since progressed onto designing and manufacturing whole scanning transmission electron microscopes that have produced many further world-leading results, such as atomic-resolution elemental mapping and analytical imaging in which every individual atom is resolved and identified. In 2013, Nion introduced a new design of a monochromator for STEM that allowed the first demonstration of vibrational/phonon spectroscopy in the electron microscope, and can now reach 3 meV energy resolution at 20 kV. Used in tandem with the new Nion energy loss spectrometer, the monochromator has led to many revolutionary results. These include a 2016 demonstration of damage-free vibrational spectroscopy of different hydrogen environments in a biological material (Guanine), 2019 demonstrations of atomic resolution imaging using the phonon signal and of detecting and mapping an amino acid different in just one ^{12}C atom being substituted by ^{13}C (isotopic shift), and a 2020 detection of the vibrational signal from a single Si atom.