Plenary Talk PLV II Mon 14:00 HSZ 01

New directions in electromagnetic field mapping in materials in the transmission electron microscope — •Rafal E. Dunin-Borkowski — Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons, Forschungszentrum Jülich, 52425 Jülich, Germany

Transmission electron microscopy has been revolutionized in recent years, both by the introduction of new hardware such field-emission electron guns, aberration correctors and in situ stages and by the development of new techniques that take advantage of increased computational speed and the ability to control and automate modern electron microscopes. In this talk, I will describe how electron microscopy can be used to obtain quantitative information about not only local variations in microstructure and composition in materials, but also magnetic fields and charge density distributions with close-to-atomic spatial resolution. When combined with model-based iterative reconstruction, electron tomography and in situ techniques, this information can be obtained quantitatively, in three dimensions, as a function of temperature, with high temporal resolution and in the presence of applied fields, light and reactive gases. I will present results obtained from studies of magnetization distributions in individual magnetic nanocrystals and three-dimensional magnetic solitons in geometrically-confined structures, from measurements of electric fields in nanoscale materials and from studies of electron-light-matter interactions. I will conclude with a personal perspective on directions for the future development of transmission electron microscopy, which may require radical changes to the design of electron microscopes.