Holographic reconstruction from electron diffraction patterns: true atom images of thousands of atoms

CARSTEN WESTPHAL, TOBIAS LUEHR, Fakultaet Physik, Otto-Hahn-Str. 4, 44221 Dortmund, Germany — After its discovery in the early 70ies of the last century x-ray photo-electron diffraction (XPD) has been very successfully applied for the characterization of crystalline systems and adsorbate structures later. The emitted electron wave contains the full spatial information of the atoms’ arrangement around the emitter atom. However, a holographic reconstruction yielding a 3-dimensional image of the investigated structure was with the exception of a very few special cases rarely successful. In most cases, the reconstruction contained strong image distortions due to the strong anisotropic scattering characteristics in the electron-atom interaction. Here, we present a new approach from angle-resolved diffraction patterns recorded at electron kinetic energies above 10 keV for the first time. The new reconstruction scheme is a direct method for revealing the crystal structure without any further information. We present spatial images of different crystal systems showing thousands of atoms at their correct location.