NWS18-2018-000112

Abstract for an Invited Paper
for the NWS18 Meeting of
the American Physical Society

Electron microscopy using structured electrons[1]

BENJAMIN MCMORRAN, University of Oregon

The phase of electron matter waves can be measured and manipulated in analogous ways to light optics. Phase contrast electron microscopy can be used to form images of electron-transparent materials and nanoscale fields, such as topological magnetic domains like Skyrmions in thin films. Nanofabricated diffractive optical elements for electrons provide new ways to measure and control the phase of free electrons. We are developing a scanning electron interferometry using gratings as coherent beamsplitters. We also use these diffractive holographic devices to structure the phase and intensity of the electron beam itself. For example, a forked grating can be used to imprint phase vortices onto the wavefunction of free electrons, giving them quantized orbital angular momentum. This new degree of control over the electron will provide new methods in electron microscopy applied to a wide range of specimens.

[1]This work was supported by the US Department of Energy, Office of Science, Basic Energy Sciences, under Award DE-SC0010466, and by the National Science Foundation under Grant No. 1607733.