## Keynote Lecture

**KN07**

*Precession Electron Diffraction*

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The strong Coulombic interaction between a high energy electron and a thin crystal film gives rise to electron diffraction patterns encoded with information that is remarkably sensitive to the crystal potential. That exquisite sensitivity can be advantageous, for example in the determination of local symmetry and bonding, but can also be problematic in that in general the dynamical scattering inherent in electron diffraction prohibits the use of conventional crystallographic methods to recover structure factor phase information and solve unknown structures. One way to reduce this problem is to use precession electron diffraction (PED), introduced 20 years ago [1] as the electron analogue of Buerger's X-ray technique, in which the electron beam is first rocked in a hollow cone above the sample and then de-rocked below, the net effect of which is equivalent to precessing the sample about a stationary electron beam. PED is now used almost routinely as a starting point to solve crystal structures that cannot be solved for a variety of reasons using x-ray or neutron methods. In this keynote lecture we explore why the PED technique has been successful for structure determination, focussing on the PED geometry, the variation of intensities with precession angle and specimen thickness, and how this 'mimics' kinematic behaviour, and the use of unconventional structure solution and refinement approaches [2]. New acquisition geometries will be discussed that rely on tilt series of PED patterns to yield a more complete 3D data set. The lecture will focus on how PED has been used also as a method for nanoscale orientation mapping [3], providing more information than conventional electron diffraction and a robust method with which to determine local crystallographic orientation. By scanning the beam, accurate orientation images can be derived from series of PED patterns and, by combining with tomographic methods, sub-volume orientation information is also available.

***[1]*** *R. Vincent and P.A. Midgley, Ultramicroscopy, 1994, 55, 271-282.,* ***[2]*** *A.S. Eggeman and P.A. Midgley, Advances in Imaging and Electron Physics, 2012, 170, 1-63,* ***[3]*** *E.F. Rauch, M. Veron, J. Portillo et al, Microscopy and Analysis, 2008, 22(6), S5–S8*

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