2756
doi:10.1017/S1431927622010376
Microsc. Microanal. 28 (Suppl 1), 2022

Adventures in 4D-STEM - Underpinned by the Legacy of JCH Spence

J. Etheridge[1,2*], W. Chao[2], B. Esser[2], W. Li[2], T. Petersen[1] and C.L Zheng[3]

[1.] Monash Centre for Electron Microscopy, Monash University, VIC, Australia.
[2.] Dept of Materials Science and Metallurgy, Monash University, VIC, Australia.
[3.] State Key Laboratory of Surface Physics and Dept of Physics, Fudan University, Shanghai, China.
* Corresponding author: joanne.etheridge@monash.edu

The power of scanning transmission electron microscopy using pixelated detectors, so-called "4D-STEM", is underpinned in many ways by the pioneering work of John Spence, starting with his contributions to convergent beam electron diffraction [1,2,3,4], point projection images and spatial coherence [5], to his foundation work on STEM lattice images [6] and coherent diffractive imaging [7]. (References are just examples of a great breadth of work in each area).

In this presentation, we explore and demonstrate the benefits of tuning the scattering of electrons within the specimen, in order to access targeted specimen information via 4D-STEM and related experiments. To do this, we make use of the parameters that can control the electron-specimen interaction, such as the incident electron wavefield and the specimen orientation, via careful configuration of the instrument optics. We will illustrate these approaches through applications to a variety of material examples, including perovskite-based structures that exhibit photo-active properties for solar cells or light emission, colossal magneto resistance, as well as functional nanostructured systems with semiconductor and photonic properties [8].

References:

[1] JCH Spence and JM Zuo in "Electron Microdiffraction" (Plenum Publishing Corporation, New York).
[2] JM Cowley and JCH Spence, Ultramicroscopy **2** (1979), p. 433.
[3] JM Cowley and JCH Spence, Ultramicroscopy **6** (1981), p. 359.
[4] JM Zuo and JCH Spence, Philosophical Magazine **A68** (1993), p. 1055.
[5] JCH Spence, W Qian and MP Silverman, Journal of Vacuum Science & Tech **A12** (1994), p. 542.
[6] JCH Spence and JM Cowley, Optik **50** (1978), p. 129.
[7] S Marchesini et al., Optics Express **11** (2003), p. 2344.

[8] The authors acknowledge funding from the Australian Research Council project grant numbers DP160104679, DP200103070, and infrastructure grants for the Titan[3] 80-300 FEG-TEM (LE0454166) and the Spectra Phi FEG-TEM (LE170100118) and are grateful for access to the facilities and expert staff at the Monash Centre for Electron Microscopy.