

**Atomically resolved neutron diffraction studies on the nanoscale:
New instrumentation for complex structural problems in physics, chemistry
and materials science.**

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Very wide Q-range neutron diffractometers, such as the Near and InterMediate Range Order Diffractometer (NIMROD) of the ISIS Pulsed Neutron and Muon Source, are a relatively new and powerful addition to the experimental toolkit available for the structural characterisation of complex systems [1]. These instruments have particular strengths for investigating materials such as nanoporous solids, nanoconfined fluids, nanostructured solutions and nanoparticles. When complemented by judicious use of isotopic labelling techniques and/or advanced experimental data driven atomistic modelling, this new neutron scattering instrumentation can deliver unprecedented insight into the details of intermolecular organisation in structurally complex systems [2]. In this talk, I will outline instrumentation and analysis techniques pioneered at ISIS that are currently helping to shape this research field. Throughout, I will illustrate the scientific value of the technology using a selection of recent highlights drawn from my research programmes investigating the structure and associated properties of nanostructured liquids [3] and solids [4].

[1] **NIMROD: The Near and InterMediate Range Order Diffractometer of the ISIS second target station.** D.T.Bowron, A.K.Soper, K.Jones, S.Ansell, S.Birch, J.Norris, L.Perrott, D.Riedel, N.J.Rhodes, S.R.Wakefield, A.Botti, M.-A.Ricci, F.Grazzi, M.Zoppi, *Review of Scientific Instruments* **81** 033905 (2010)

[2] **Combining wide-angle and small-angle scattering to study colloids and self-assembly.** K.J.Edler and D.T.Bowron, *Current Opinion in Colloid and Interface Science* **20** 227-234 (2015)

[3] **C₁₀TAB micelles in acidic solutions: counterion binding, water structuring and micelle shape.** D.T.Bowron and K.J.Edler, *Langmuir* **33** 262-271 (2017)

[4] **Density profile of nitrogen in cylindrical pores of MCM41.** A.K.Soper and D.T.Bowron, *Chemical Physics Letters* (2017) <http://dx.doi.org/10.1016/j.cplett.2017.03.060>