

High Pressure Workshop



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High-pressure total scattering using neutrons

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The majority of neutron total scattering experiments have been performed under ambient or variable-temperature conditions whereas comparatively little work has been carried out under high pressure. This is partly a consequence of the difficulties involved in accurately removing non-sample scattering contributions when using devices such as the Paris-Edinburgh press, which are required to deliver multi-GPa pressures.

The PEARL instrument at the ISIS Neutron and Muon Facility has a demonstrable track record in performing these measurements with non-crystalline samples where strain broadening is not an issue [1-3]. However there has been little work performed on crystalline materials as these usually require hydrostatic compression, achieved by the inclusion of a pressure-transmitting medium (PTM). The PTM can further complicate the analysis of pair distribution functions.

This talk will focus on the use of the unique gas-loading capability [4] at ISIS where argon is used as an 'invisible' PTM. Science examples will include the pressure-induced order-disorder transition in ammonium bromide [5] and the nature of correlated displacements in barium titanate under hydrostatic pressure [6].

- [1] H Playford, M Tucker and C Bull, *J. Appl. Crystallogr.*, 2017, **50**, 87-95
- [2] S Klotz *et al*, *J. Phys.: Condens. Matter*, 2005, **17**, S967-S974
- [3] P Salmon *et al*, *J. Phys.: Condens. Matter*, 2012, **24**, 415102
- [4] S Klotz *et al*, *High Pressure Res.*, 2013, **33(1)**, 214-220
- [5] N Funnell, C Bull, S Hull and C Ridley, *J. Phys.: Condens. Matter*, 2022, **34**, 325401
- [6] A Herlihy *et al*, *Phys. Rev. B*, 2022, **105**, 094114

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