NANOSCIENCE COLLOQUIUM

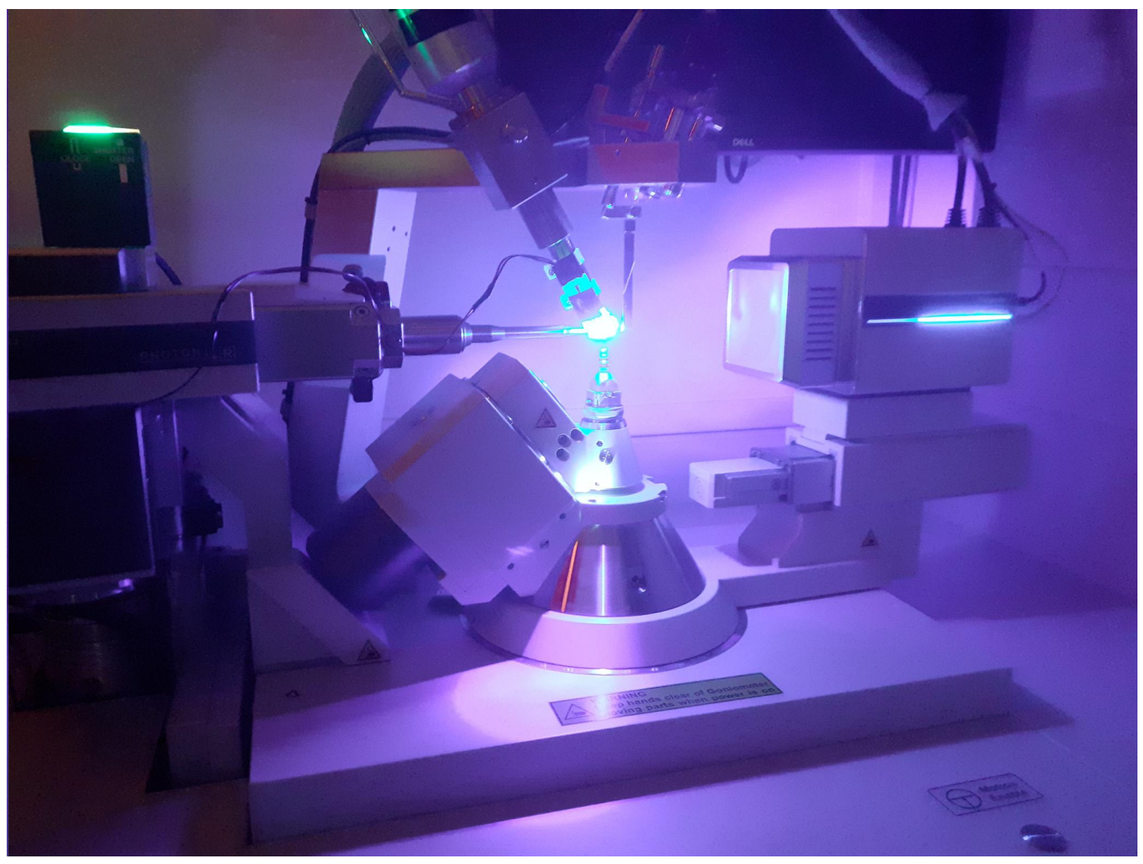
Dynamic X-ray diffraction for the design of functional photoswitches

Dr. Lauren Hatcher

Royal Society University Research Fellow, Cardiff University, School of Chemistry

ABSTRACT: Switchable crystalline materials are of great and continuing interest for a wide range of smart technologies, with applications including ultrafast electronics, data storage, sensors, molecular machines, solid-state cooling, and energy harvesting.[1-5] In-situ crystallographic studies are a crucial tool for understanding the key structure-property relationships that govern switching in these systems and there are now a wide range of in-situ methods developed for use both in the home X-ray lab and at synchrotron and X-ray Free Electron Laser (XFEL) facilities. Our group is particularly interested in studying photoswitchable crystals, and are designing a range of new photocrystallographic equipment for different in-situ experiment scenarios. These include time-resolved single-crystal X-ray diffraction studies, including stroboscopic pump-probe measurements using synchrotron radiation[6] and a bespoke instrument for time-resolved diffraction measurements in the home X-ray lab.

This presentation will discuss the breadth of our development work, illustrating with example studies of switchable crystals capable of high levels of single-crystal-to-single-crystal conversion. These include photoactive and electrically-switchable solid-state materials for pyroelectric applications.[7, 8] The talk will also introduce our work with in-situ X-ray diffraction methodologies, in collaboration with Diamond Light Source, using light and electric field cell equipment on Beamline I19.[9] We will also explore our recent success in developing new multi-crystal serial crystallography measurements for the study of small molecular crystal systems,[10] methods that are transferrable to other state-of-the-art ultrabright synchrotron and XFEL facilities around the globe.



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