

PhD Position: Developing Solid-State NMR Methodology for the Investigation of Structural Aspects of Pharmaceutical Solids and Formulated Drug Products

Supervisor: Steven P. Brown (Physics)

The specific three-dimensional packing of a pharmaceutical molecule in the solid state determines key physical properties, notably bioavailability. As such, there is a pressing requirement in the pharmaceutical industry for the development of analytical techniques that are sufficiently powerful to characterise different solid-state forms of active pharmaceutical ingredients, including different polymorphs, hydrates and solvates, as well as co-crystals and amorphous dispersions, and, in particular, within formulated drug products.

Solid-state NMR is a rapidly developing analytical tool that has the advantage of applicability to powdered samples lacking long-range periodic order. In particular, the ^1H chemical shift has been shown to be very sensitive to key intermolecular interactions, notably, hydrogen bonding and aromatic π - π stacking, which direct the packing of organic molecules.

The project will involve the development of new advanced high-resolution homonuclear and heteronuclear ^1H solid-state NMR experiments for pharmaceutical solids that better identify close proximities (less than 4\AA) between pairs of hydrogen atoms or between a hydrogen atom and a carbon or nitrogen atom, so as to probe, for example, specific intermolecular interactions and packing arrangements. The development of new pulse sequences will be achieved by combining experiment with simulation, adopting approaches as employed in recent work.¹⁻⁴

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- (2) Tatton, A. S.; Pham, T. N.; Vogt, F. G.; Iuga, D.; Edwards, A. J.; Brown, S. P. *Crystengcomm* **2012**, *14*, 2654.
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For further information about applying contact Steven Brown (S.P.Brown@warwick.ac.uk) or IMR.CDT@warwick.ac.uk.

The Centre for Doctoral Training in Integrated Magnetic Resonance is a collaboration between researchers at the Universities of Warwick, St Andrews, Dundee, Southampton, Aberdeen and Nottingham.