Order and disorder at the nanoscale : geometry, chemistry, topology

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Controlling the chemistry and the structure of materials is a key to understanding, tuning, and enhancing their properties. However, detailed structural and chemical characterization of materials in three dimensions, whether homogeneous or heterogeneous, remains challenging at the atomic and nanometer length scales. We have developed a panel of methods and approaches that combine new experimental solid-state NMR methods and DFT-based *in silico* modelling, which jointly enable characterization of chemical and geometrical order, as well as topology, in systems exhibiting either global order or disorder. We will illustrate those concepts with studies of both ordered and disordered materials, including homogeneous and heterogeneous materials as well as composite systems exhibiting nanoscale structures in the bulk or at their surfaces and interfaces.

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