

Strongly correlated disorder and the procrystalline state

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The observation of structured diffuse scattering in the diffraction pattern of a material is characteristic of the presence of structural disorder that is not random but correlated. This talk will consider cases of particularly strongly-correlated disorder that arise from local rules that—even if observed strictly—do not by themselves require long-range periodicity. Probably the best known example is the 2-in-2-out hydrogen-bonding rule of ices, but the talk will explore how such a concept might be generalised well beyond ices. We argue that these so-called ‘procrystalline’ states [1] are conceptually distinct from conventional crystals, modulated phases, or quasicrystals. The talk will conclude with a discussion of the interesting physical properties of procrystalline materials, including the emergence of bulk polarisation in ferroelectric perovskites [2] and spin-glass formation in molybdate pyrochlores [3].

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