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Hastatic Order in URu_2Si_2[1]

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The development of collective long-order via phase transitions occurs by the spontaneous breaking of fundamental symmetries. Magnetism is a consequence of broken time-reversal symmetry while superfluidity results from broken gauge invariance. The broken symmetry that develops below 17.5 K in the heavy fermion compound URu_2Si_2 has long eluded such identification. In this talk we show that the recent observation of Ising quasiparticles in URu_2Si_2 results from a spinor order parameter that breaks *double* time-reversal symmetry, mixing states of integer and half-integer spin. Such "hastatic order" hybridizes conduction electrons with Ising $5f^2$ states of the uranium atoms to produce Ising quasiparticles; it accounts for the large entropy of condensation and the magnetic anomaly observed in torque magnetometry. Hastatic order also results in a number of predictions for future experiment: a tiny transverse moment in the conduction sea, a collosal Ising anisotropy in the nonlinear susceptbility and a resonant energy-dependent nematicity in the tunneling density of states.

[1]Work done in collaboration with Piers Coleman and Rebecca Flint