Physics
AT QUEENS COLLEGE

Colloquium Notice

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A New Broken Symmetry: Hidden (Hastatic) Order in URu2Si2

The development of collective long-range order by means of phase transitions occurs by the spontaneous breaking of fundamental symmetries. Magnetism is a consequence of broken time-reversal symmetry, whereas superfluidity results from broken gauge invariance. The broken symmetry that develops below 17.5 kelvin in the heavy-fermion compound URu2Si2 has long eluded such identification. Here we show that the recent observations of Ising quasiparticles in URu2Si2 results from a spinor order parameter that breaks double time-reversal invariance, mixing states of integer and half-integer spin. Such "hastatic" order hybridizes uranium-atom conduction electrons with Ising 5f2 states to produce Ising quasiparticles; it accounts for the large entropy of condensation and the magnetic anomaly observed in torque magnetometry. Hastatic order predicts a tiny transverse moment in the conduction-electron sea, a collosal Ising anisotropy in the nonlinear susceptibility anomaly and a resonant, energy-depedent nematicity in the tunnelling density of states. We also discuss the microscopic origin of hastatic order, identifying it as a fractionalization of three-body body bound-states into integer spin fermions and half-integer spin bosons.
Work done with Piers Coleman and Rebecca Flint.
References: PC, P. Coleman and R. Flint Nature 493, 421 (2013)
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Monday
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Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326