A pressure induced unconventional superconductor with possible half-quantum vortices

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Half-quantum vortices are known to exist in superfluid ^{3}He in an appropriately restricted geometry. If similar vortices could be made in superconductors this would provide a practical route for constructing a topological quantum computer. The talk will introduce half-quantum vortices and identify material parameters that might favour the special type of superconductivity needed to host them. I will then focus on a heavy-fermion material uranium gold. At ambient conditions this material, rather than being a superconductor has an interesting magnetic order on a triangular lattice while simultaneous displaying non-fermi liquid behaviour at low temperatures. Both magnetism and non-fermi liquid behaviour persist in magnetic field which is of interest in its own right.

The magnetic order is suppressed and uranium gold becomes superconducting under pressure. The superconductivity has large critical fields along all axes, exceeding the Pauli paramagnetic limit. The critical field also has an anisotropy compatible with a two component order parameter, consistent with the special type of superconductivity sought.