

Metamagnetism in ferromagnetic superconductors

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Since the discovery of superconductivity under pressure in the ferromagnet UGe₂, two other compounds have been discovered where superconductivity coexists in a non competitive way with ferromagnetism : URhGe and UCoGe. In the three materials, the critical field exceeds the Pauli limit and has unconventional behavior. For example, reentrant superconductivity around 12 T in URhGe and an upward curvature in UCoGe and UGe₂. To date, only resistivity measurements were available to study these phenomenon. I will present specific heat measurements under magnetic field and pressure in UGe₂ that confirm a bulk magnetic field enhancement of superconductivity. This feature is linked to ferromagnetic instabilities of different nature in the three compounds. Common points and differences will be presented. The occurrence of superconductivity near a quantum critical point of a ferromagnetic transition has been theoretically predicted and widely discussed. Nevertheless, the ferromagnetic transition becomes first order at low temperature, not only in UGe₂ but in all ferromagnets studied so far. I will also present a re-investigation of the metamagnetism associated to the first order ferromagnetic transition in UGe₂. It allows us to experimentally draw for the first time the wing-structure phase diagram of a ferromagnet, which has been predicted from theory. These results by Hall effect and resistivity measurements are not described by conventional critical end point picture but are required to include a change of Fermi surface.