QPhysics
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Colloquium Notice

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Magnetic field-induced superconductivity: A unique interplay between magnetic and superconducting orderings.

The complex interplay between magnetism and superconductivity is a central topic in condensed matter physics due to increasing evidence indicating that unconventional superconductivity (SC) occurs in the vicinity of magnetically ordered states. The experimental observations inspired models proposing "magnetically mediated" SC pairing in the proximity of magnetic quantum-criticality in a variety of systems, ranging from heavy Fermion-intermetallics to high- T_C superconductors [1]. In this context, the report of magnetic field-induced superconductivity (FISC) [2,3] in the magnetic layered organic conductor l-$(BETS)_2FeCl_4$ constitutes, perhaps, an unique example of a cooperative interaction between both types of orderings, where field-induced ferromagnetism becomes the essential ingredient for stabilizing SC at low temperatures and at very high magnetic fields in an otherwise antiferromagnetic insulator. Here we will briefly revise the current status of organic superconductivity as well as the discovery and the properties of the FISC state. We will show that its phase-diagram can be well described in terms of the so-called Jaccarino-Peter effect [4] if the quasiparticle nature of the charge carriers is also taken into account. The resulting phase diagram suggests the existence a 2-D Larkin-Ovchnikov-Farrel-Fulde "textured" superconducting sub-phase which only recently has been claimed to exist in the $CeCoIn_5$ compound [5]. The discovery of FISC in an organic compound has lead to interesting developments in the area of nanotechnology [6] and we suggest that it may lead to technological applications.

[1] See for example, A.V. Chubukov, D. Pines, and J. Schmalian, cond-matt/ **0201140** and references therein.
[2] S. Uji *et al.,* Nature (London) **410** , 908 (2001).
[3] L. Balicas *et al.* , Phys. Rev. Lett. **87** , 67002 (2001).
[4]V. Jaccarino and M. Peter, Phys. Rev. Lett. **9** , 290 (1962).
[5] H. A. Radovan *et al.* , Nature, **425** (6953), 51 (2003): A. Bianchi *et al.* ,Phys. Rev. Lett. **91** , 187004 (2003).
[6] M. Lange *et al.* , Phys. Rev. Lett. **90** , 197006 (2003).

Wednesday
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Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326