Iron High-Tc Superconductors: Review and New Results in Superconducting Ladder $BaFe_2S_3$

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The field of iron-based high critical temperature superconductors continues attracting the attention of the Condensed Matter Physics community. I will review the main concepts in this field and compare against copper-based high-Tc superconductors. The exotic spin nematic regime of iron superconductors will be discussed [1], as well as other concepts such as frustration, self-organization, and the relevance of quenched disorder. In general, evidence is accumulating that these materials are more complex than early theories anticipated [2]. For this reason, in the second half of the presentation I will focus on new exciting results for the two-leg ladder compound $BaFe_2S_3$. This is the only member of the iron-based family that recently was reported to become superconducting (at high pressure) without having iron layers in its crystal structure [3]. Theoretical computational results for a two-orbital Hubbard model applied to both ladders and chains [4] will be discussed. They correctly reproduce the dominant magnetic order of $BaFe_2S_3$ and have revealed intriguing indications of pairing tendencies at intermediate/strong Hubbard couplings upon doping. Results for the dynamical spin structure factor of ladders will also be briefly discussed, time allowing [5].

[1] For recent results from our group see S. Liang et al., PRL 111, 047004 (2013), C. B. Bishop et al., PRL 117, 117201 (2016), and references therein.

[2] P. Dai, J. Hu, and E. Dagotto, Nat. Phys. 8, 709 (2012).

[3] H. Takahashi et al., Nat. Mater. 14, 1008 (2015); T. Yamauchi et al., PRL 115, 246402 (2015).

[4] N. D. Patel et al., PRB 94, 075119 (2016); N. D. Patel et al., PRB 96, 024520 (2017).

[5] A. Nocera et al., arxiv:1707.02626 (2017).