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Orbital-selective Mott physics and the phase diagram of iron-based superconductors

The strength and the role of electron-electron correlations in iron-based superconductors remain debated. We argue that the solution of the debate lies in the orbital-selective character of the correlations, with some orbitals being significantly more correlated than others. This reconciles conflicting evidences and accounts for the dependence of the effective mass on doping and on the specific material using the case of electron- and hole-doped BaFe2As2 [1] as a compass.

The orbital-selective Mott scenario also establishes a novel link between the iron-based superconductors and the cuprates. Indeed it is shown that the degree of correlation of the iron-based materials is mainly controlled by the distance from a d5 Mott insulator which would be obtained doping one hole per iron atom.

We also discuss how the Hund's coupling influences the tendency towards a nematic ordering [2] and the role of selective correlations on the superconducting instability [3]. We finally discuss the connection between Hund's physics and charge instabilities and its possible relevance to some iron-based materials [5]

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[4] L. Fanfarillo, A. Valli and M. Capone, in preparation
[5] A. Isidori, M. Berovic, L. Fanfarillo, L. de' Medici, M. Fabrizio and M. Capone, in preparation