On behalf of the

Science College CMS
Vienna Computational Materials Laboratory
and Center for Computational Materials Science

we cordially invite you to the following seminar

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When Mott meets BCS. Strongly correlated superconductivity in fullerides and beyond

Electron-phonon superconductors and strongly correlated materials, including high-Tc cuprates, are usually believed to be two completely independent families. We show that this distinction is challenged by the properties of alkali-metal doped fullerides and that the properties of "expanded" members of the A3C60 family, like Cs3C60, can only be understood in terms of the interplay between phonon mediated attraction and strong correlations. Experiments in Cs3C60 draw a phase diagram which strikingly resembles that of cuprates as a function of doping: A dome-like behaviour of the critical temperature, followed by a transition to an antiferromagnetic Mott insulator [1,2].

Solving a realistic three-band model for fullerides using Dynamical Mean-Field Theory, we reproduce and understand the experimental phase diagram [4], showing that, despite the phononic nature of pairing, these materials belong to the class of "correlated superconductors", in which the effects of electron-electron repulsion is crucial to explain the high critical temperature. We propose several experimental tests of our scenario, among which: (i) a pseudogap in the normal phase; (ii) gain of kinetic energy and of zero-frequency optical weight at the onset of superconductivity, as in the cuprates.

We discuss the generality of our ideas, in relation to other families of high temperature superconductors, including the recently discovered potassium-doped picene[5].

[1] Y. Takabayashi et al., Science 323, 1585 (2009)
[2] A.Y. Ganin et al. Nature Materials 7 367 (2008)
[3] M. Capone, M. Fabrizio, C. Castellani, and E. Tosatti, Science 296, 2364 (2002)
[4] M. Capone, M. Fabrizio, C. Castellani, and E. Tosatti, Rev. Mod. Phys. 81, 943 (2009)
[5] R. Mitsuhashi et al. Nature 464. 76 (2010); G. Giovannetti and M. Capone, arXiv:1011.3308

Date: Monday, March 07, 2011 16:00

Location: Josef-Stefan-Hörsaal,
Strudlhofgasse 4, 3rd floor, 1090 Wien