Enhancement of Superconductivity induced by electronic correlation in a model for doped fullerenes

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We study by means of Dynamical Mean Field Theory (DMFT) a model for alkali doped fullerenes, in which the Jahn-Teller coupling between the electrons and the molecular vibrations is considered in the antiadiabatic limit (extreme dynamical Jahn-Teller effect). We first show that this model, with the inclusion of a realistic value of the local Coulomb repulsion U, can explain the non-magnetic insulating phase of the tetravalent compounds A_4C_{60} as a Mott-Jahn-Teller insulator [1].

Quite surprisingly, we find that the insulator undergoes, for $U = U_2$ a direct transition to a superconductor, which in turn becomes a normal metal for $U = U_1$, with $U_1 < U_2$ [2]. Even more unexpectedly, the amplitude of the superconducting gap in the region $U_1 < U < U_2$ reaches values which are orders of magnitude larger that those in the absence of any repulsion U. A detailed analysis within DMFT clarifies what are the crucial ingredients that give rise to this strong enhancement, and suggest to which extent these results may be relevant for the more interesting cases of A_3C_{60} and of the hole-doped fullerenes.

[1] M. Capone, M. Fabrizio, P. Giannozzi, and E. Tosatti, Phys. Rev. B **62**, 7619 (2000). [2] M. Capone, M. Fabrizio, and E. Tosatti, Phys. Rev. Lett. **86**, 5361 (2001)