Nonadiabatic Superconductivity in Electron and Hole Doped Fullerenes

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The remarkable discovery of superconductivity with $T_c=117$ K in hole doped Fullerenes with lattice expansion has a profound impact for the field of high T_c superconductivity. In fact it strongly points to novel perspectives for a phonon based pairing. We argue that this new framework can be naturally identified with the concept of Nonadiabatic superconductivity. This new situation is realized when the coupling λ is not so large (in order to prevent the polaronic breakdown) but the ratio of phonon frequencies to Fermi energy the adiabatic parameter) is not negligible. This is precisely the case of the Fullerene compounds.
This framework requires the generalization of the theory of superconductivity beyond Migdal's theorem which we have developed in some detail in the past years. An additional element which is naturally arising in systems with small Fermi energy is an appreciable degree of electronic correlation which should also be considered. Within such a context we analyze all the superconducting data of electron and hole doped Fullerenes and we conclude that they provide a strong evidence for nonadiabatic pairing channels.
We also propose a number of predictions to be tested experimentally and some guidelines for the optimization of superconducting materials.