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Kondo Physics and Strongly Correlated Superconductivity in Model Fullerene Conductors[1]

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The effects of electronic correlations on superconductivity are investigated by means of Dynamical Mean Field Theory (DMFT) in a model for alkali doped fullerenes. It is shown that the proximity to a Mott transition actually amplifies the s-wave phonon-mediated pairing mechanism built into the model. It leads to a superconduting pocket adjacent the Mott insulator with a superconducting gap which is huge in comparison with the corresponding BCS value.The physical properties of this strongly correlated superconductor are compatible with the experimental data available on fullerenes. Yet, contradicting the common belief for fullerenes, superconductivity in this model is not of the BCS-type nor is the normal state a conventional Fermi-liquid. We find on the contrary several aspects which rather resemble those of cuprate superconductors, such as an increase of Drude weight accompaning the onset of superconductivity. We identify the origin of these anomalies to the unconventional properties displayed by the Anderson impurity model for a C_{60}^{n-} molecule onto which the lattice model maps within DMFT. We also argue that this behavior should be common to other models that contain pairing mechanisms able to survive inside the Mott insulator, which translate within DMFT into impurity models where Kondo screening competes against an internal mechanism that tends to freeze the impurity in a low-spin state.

[1](in collaboration with M. Capone, L. De Leo, E. Tosatti and C. Castellani)