The Role of the Coulomb Interaction in Quasi-Two-Dimensional Superconductors

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Abstract

A large variety of superconducting materials belongs to the family of layered conductors, often denoted "quasi-two-dimensional" superconductors. Due to their anisotropic transport properties, new electronic collective modes appear at *low* energy that coexist with the well-known optical plasmon mode. Their existence is related to the unusual dynamic screening of the Coulomb interaction found in layered materials. We show that an additional channel for pairing is provided by the screened Coulomb interaction in layered superconductors. We demonstrate that this electronic pairing mechanism is dominant in metal-intercalated nitride halides. Furthermore, the Coulomb-interaction contribution to superconducting pairing is found to be significant, though not dominant, in some layered organics. The case of high-T_c superconductors and Cobalt oxides is also briefly discussed in this context. The theory emphasizes the necessity to take into account the screened *inter*layer Coulomb interaction for a proper description of the superconducting state of "quasi-two-dimensional systems".