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Strongly correlated superconductivity and quantum criticality[1]

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Doped Mott insulators and doped charge-transfer insulators describe classes of materials that can exhibit unconventional superconducting ground states. Examples include the cuprates and the layered organic superconductors of the BEDT family. I present results obtained from plaquette cellular dynamical mean-field theory. Continuous-time quantum Monte Carlo evaluation of the hybridization expansion allows one to study the models in the large interaction limit where quasiparticles can disappear. The normal state which is unstable to the superconducting state exhibits a first-order transition between a pseudogap and a correlated metal phase. That transition is the finite-doping extension of the metal-insulator transition obtained at half-filling. This transition serves as an organizing principle [1] for the normal and superconducting states of both cuprates [2] and doped organic superconductors [3]. In the less strongly correlated limit, these methods also describe the more conventional case where the superconducting dome surrounds an antiferromagnetic quantum critical point [4].
— [1] L. Fratino, P. Sémon, G. Sordi and A.-M.S. Tremblay An organizing principle for two-dimensional strongly correlated superconductivity Sci. Rep., 6, 22715 (2016). — [2] L. Fratino, P. Sémon, G. Sordi, and A.-M. S. Tremblay Pseudogap and superconductivity in two-dimensional doped charge-transfer insulators Phys. Rev. B 93, 245147 (2016) — [3] Charles-David Hébert, Patrick Sémon, and A.-M. S. Tremblay Superconducting dome in doped quasi-2d organic Mott insulators: A paradigm for strongly-correlated superconductivity Phys. Rev. B 92, 195112 (2015). — [4] Wei Wu, A.-M.S. Tremblay d-wave superconductivity in the frustrated two-dimensional periodic Anderson model Phys. Rev. X 5, 011019 (2015).

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