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Does the $t^{'}-t-J$ model catch the main features of the cuprates phase diagram? LEONARDO SPANU, MASSIMO LUGAS, FEDERICO BECCA, SANDRO SORELLA, International School for Advanced Studies and INFM Democritos National Simulation Center, Trieste — Using the Green's Function Monte Carlo Technique (GFMC), we investigate the effects of the $t^{'}$ interaction on the phase diagram of the $t-J$ model and its possible relevance for the physics of high-temperature superconductors (HTcS). In practice, we consider a very accurate guiding wave function including both magnetic and superconducting order parameters, as well as long-range Jastrow factors, in order to reproduce the correct low-energy spin and charge excitations. The $t^{'}$ interaction induces a suppression of the antiferromagnetic order parameter for hole concentration $\delta \sim 3-4\%$ (for $t^{'}=-0.2t$ and $J/t=0.2$), while the paramagnetic phase is characterized by an incommensurate peak in the spin structure factor. The inclusion of the $t^{'}$ term allows one to strongly suppress superconductivity at small doping, i.e., for $\delta < 6\%$. On the contrary, away from the antiferromagnetic phase, d-wave pairing correlations are enhanced up to the optimally doping region ($\delta \sim 20\%$) Our results then indicate that the $t^{'}-t-J$ model, though it is a very simple and crude approximation of realistic materials, is able to capture important properties of the HTcS phenomenology

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