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Hidden Mott transition and large-U superconductivity in the two-dimensional Hubbard model FEDERICO BECCA, LUCA FAUSTO TOCCHIO, SANDRO SORELLA, IOM - Consiglio Nazionale delle Ricerche and International School for Advanced Studies (SISSA) — We consider the one-band Hubbard model on the square lattice by using variational and Green's function Monte Carlo methods, where the variational states contain Jastrow and backflow correlations on top of an uncorrelated wave function that includes BCS pairing and magnetic order. At half filling, where the ground state is antiferromagnetically ordered for any value of the on-site interaction U, we can identify a hidden critical point U_{Mott}, above which a finite BCS pairing is stabilized in the wave function. The existence of this point is reminiscent of the Mott transition in the paramagnetic sector and determines a separation between a Slater insulator (at small values of U), where magnetism induces a potential energy gain, and a Mott insulator (at large values of U), where magnetic correlations drive a kinetic energy gain. Most importantly, the existence of U_{Mott} has crucial consequences when doping the system: we observe a tendency to phase separation into a hole-rich and a hole-poor region only when doping the Slater insulator, while the system is uniform by doping the Mott insulator. Superconducting correlations are clearly observed above U_{Mott}, leading to the characteristic dome structure in doping.

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