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Coexistence of antiferromagnetism and superconductivity within *t-J* model with strong correlations and nonzero spin polarization

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We study theoretically the coexistence of antiferromagnetism (AF) with superconductivity (SC) within the t-J model with the Zeeman term included [1]. The strong electron correlations are accounted for by means of the extended Gutzwiller projection method [2] within a statistically-consistent approach proposed recently [3]. The phase diagram on the band filling - magnetic field plane is obtained, and the system properties (magnetization curves, superconducting gaps, free-energy profiles) are analyzed for the fixed band filling $n = 0.97$. In this regime, the results resemble those observed recently in the heavy fermion systems $CeCo(In_{1-x}Cd_x)_5$ [4] and $CeRhSi_3$ [5]. Namely, (i) with the increasing magnetic field the system evolves from coexisting phase, through antiferromagnetic phase, towards the normal state with nonzero spin polarization (ferromagnetic state), and (ii) the onset of superconducting order suppresses partly the staggered moment. The superconducting gap has both the spin-singlet and the staggered-triplet components, a consequence of a coexistence of the superconducting state with antiferromagnetism.

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