# Dense Superfluid Neutron Matter with Generalized Skyrme Interaction and Spin-Triplet Pairing without Ferromagnetic Instabilities

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Dense superfluid neutron matter (relevant to physics of neutron star cores) at sub- and supranuclear densities (in the range $0.3\ n_0 < n < 2.5\ n_0$, where $n_0 = 0.17\ \mathrm{fm}^{-3}$ is nuclear density) with the Skyrme effective forces and spin-triplet p-wave pairing of the $^3He-A$ type in the presence of a strong magnetic field is studied within the framework of non-relativistic generalized Fermi-liquid theory. General formula (valid for arbitrary parametrization of the Skyrme forces) is derived for magnetic susceptibility of superfluid neutron matter at zero temperature and it is specified then for generalized BSk18 parametrization [1] of the Skyrme interaction. As it is known most of the Skyrme forces (and in particular all previous variants of BSk parameterizations) predict spin instabilities in normal neutron matter beyond the saturation nuclear density. At the same time we have obtained for the model of superfluid neutron matter with new generalized BSk18 parametrization that such phase transition to ferromagnetic state does not occur neither at subnuclear nor at supranuclear densities, i.e., the paramagnetic susceptibility is not divergent, but it is non-monotone function of density which attains maximum at the density $n_m(BSk18) \approx 1.64\ n_0$. Thus, the high-density ferromagnetic instability is removed in neutron matter with BSk18 parametrization of the Skyrme forces not only in normal but also in superfluid state with spin-triplet pairing.

[1]N. Chamel, S.Goriely, and J.M. Pearson, Phys. Rev. **C 80**, 065804 (2009).