The linear response of electron systems with the pairing instabilities – the flow equation study

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We address the linear response of the electron system with the pairing instabilities using non-perturbative framework of the continuous unitary transformation technique. For the case of the Bose-Einstein condensed pairs we have analytically derived the BCS result, which in the static and long wavelength limit accounts for the Meissner effect. We next apply our treatment to the mixture of the non-condensed (preformed) pairs interacting with the mobile electrons through the charge-exchange Andreev scattering. We determine the leading contributions to the current-current response function, expressing the vertices by the set of the corresponding flow equations. Our study indicates that the residual diamagnetic behavior detected by the torque magnetometry well above the transition temperature [L. Li *et al*, Phys. Rev. B **81**, 054510 (2010)] can originate from the noncondensed preformed pairs.