Superfluid theory of a gas of polarized dipolar Fermi molecules

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We present a superfluid theory of a polarized dipolar Fermi gas. Starting from a model dipolar molecule consisting of two atoms with positive charge and negative charge, we derive a dipole-dipole pairing interaction, which is valid for *all* the momentum region. This effective interaction is quite different from the previous one [1], which is *not* valid for the large momentum region. Using this pairing interaction, we show that the resulting BCS gap equation is not suffered from the well-known ultraviolet divergence, without employing any regularization method. This is also in contrast to case using the previous dipolar interaction, where one needs to regularize the momentum-dependent interaction to eliminate the ultraviolet divergence. Using this cutoff-free BCS theory, we identify the symmetry of the pairing state realized in this system. We also discuss the deformation of the Fermi surface, originating from the anisotropic dipole-dipole interaction [2].

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