ARNAUD TRIAY, Ceremade - Université Paris-Dauphine
Derivation of the dipolar Gross-Pitaevskii energy

The Gross-Pitaevskii theory effectively describes the ground state and the evolution of a dilute and ultracold gas of bosons. A very vast literature exists on the derivation of this theory from the principles of quantum mechanics, nevertheless it remains a challenging task is to address the case of non-positive interactions such as dipole-dipole potentials. We will present how, by using the so-called quantum de Finetti theorem, we can we show the convergence of the ground state and of the ground state energy of the (linear) N body Hamiltonian towards those of the dipolar GP functional. The latter, in addition to the usual cubic nonlinearity, has a long range dipolar term $K \star |u|^2|u|^2$. Our results hold under the assumption that the two-particle interaction is scaled in the form $N^{3\beta-1}w(N^\beta x)$ for some $0 \leq \beta < \beta_{max}$ with $\beta_{max} = 1/3 + s/(45+42s)$ where s is related to the growth of the trapping potential. arXiv:1703.03746