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**Xia Chen\*** ([xchen@math.utk.edu](mailto:xchen@math.utk.edu)), Department of Mathematics, University of Tennessee, Knoxville, TN 37996, and **Tuoc Phan**. *Free energy in a mean field of Brownian particles*. Preliminary report.

We compute the limit of the free energy of the mean field generated by the independent Brownian particles interacting through a non-negative definite function. Our main theorem is relevant to the high moment asymptotics for the parabolic Anderson models with Gaussian noise that is white in time, white or colored in space. Our approach makes a novel connection to the celebrated Donsker-Varadhan's large deviation principle for the i.i.d. random variables in infinite dimensional spaces. As an application of our main theorem, we provide a probabilistic treatment to the Hartree's theory on the asymptotics for the ground state energy of bosonic quantum system. (Received February 14, 2016)