# Time-Independent Variational Approach to Bose-Einstein Condensate in Trapped Dipolar Gases

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**Abstract:** In this work, we intend to use the variational method to determine the ground-state properties of a non-uniform dipolar Bose gas at zero temperature beyond the mean-field approximation. Two cases will be studied in detail based on of established variational approach to superfluid hydrodynamics [1,2]. In the first, by means of a Gaussian Ansatz, we seek to study the ground-state energy and stability. We find that stability depends crucially on the scattering length parameter and the geometry of the external trapping potential, both can be experimentally varied. In the second case, by means of a Thomas-Fermi Ansatz, we seek to study the energy and the Thomas-Fermi radius, which also depend on the scattering length parameter. In both cases, our results are in good agreement with theoretical results found in the literature on the subject.

[1] Aristeu R. P. Lima and Axel Pelster, Phys. Rev. A **84**, 041604(R) (2011).

[2] Aristeu R. P. Lima and Axel Pelster, Phys. Rev. A **86**, 063609 (2012).

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