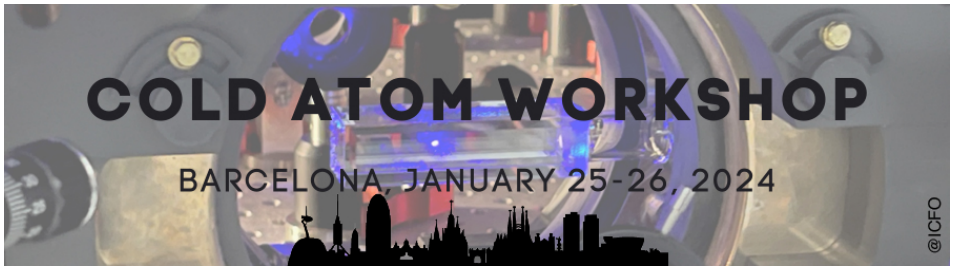

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Dysprosium density functional: A Quantum Monte Carlo based functional to study dipolar droplets and supersolidity

Thursday 25 January 2024 17:10 (20 minutes)

We present the Dysprosium density functional (Dy-DF), a density functional to describe droplet formation and supersolidity in dipolar systems.
Making use of quantum Monte Carlo we compute with accuracy the equation of state of ^{162}Dy. The quantum correlation energy contribution is used to modify the usual Lee-Huang-Yang term that accounts for quantum correlations in the widely used extended Gross Pitaievskii equation (eGPE).
To validate our functional we show that it reproduces the available experimental data for the minimum critical number of atoms needed to form a droplet.
Due to its critical nature, the prediction of this quantity is challenging and many theories only achieve a qualitative approximation. Furthermore, we show that our functional can be used also to study the BEC-supersolid transition in these systems. The Dy-DF functional outperforms the state-of-the-art eGPE description without increasing the computational cost.

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