Static properties of an asymmetric impurity in a dipolar BEC

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To understand the relaxation dynamics in closed quantum systems, we investigate the interaction of a impurity with a quantum environment. We present a three-dimensional physical model in which the static impurity is introduced into a Bose-Einstein condensate of dipolar gas. The modified Gross-Pitaevskii equation is solved numerically employing the split-step Crank-Nicolson method. This allows us to calculate various properties of the static impurity, including self-energy and density. Additionally, we investigate the effects of asymmetry by deforming the impurity, leading to variations in density results. Exploring changes in the impurity's orientation for different deformation scenarios yields density results at various angles. The obtained density results reveal interesting non-uniform variations in response to these changes, demonstrating the between the impurity and the surrounding Bose-Einstein condensate of dipolar gas.

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