ANALYTICAL STUDY OF QUANTUM DEFORMATION EFFECTS ON CaF AND BaH MOLECULES IN (ANTI)-DE SITTER SPACES WITH APPLICATION TO QUANTUM COMPUTING

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Abstract

This work presents an analytical study of the Schrödinger equation in de Sitter (dS) and anti-de Sitter (AdS) spaces for the pseudoharmonic oscillator (PHO) potential. Using the extended uncertainty principle (EUP) and the Nikiforov–Uvarov method, we derive exact energy eigenvalues and eigenfunctions for diatomic molecules.

The study is focused on CaF and BaH, two polar molecules of particular interest for quantum computing because of their strong dipole moments, controllable rovibrational states, and long coherence times. Our findings reveal that quantum deformation in curved space-times produces non-uniform shifts in the bound-state spectrum, with possible level inversions at critical deformation parameters. These modifications may alter ground state definitions and influence the robustness of molecular qubits.

The results provide both fundamental insights into deformed quantum mechanics and practical implications for quantum technologies based on cold diatomic molecules.

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