

QUANTUM AND PHASE-SPACE DYNAMICS OF THE ANHARMONIC OSCILLATOR WITHIN THE DUNKL FRAMEWORK

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Abstract

In this talk, we explore the generalization of the anharmonic oscillator (Kerr medium) using the Dunkl derivative, which introduces a parity-dependent term that fundamentally modifies the underlying physical properties of the model. By formulating the Kerr Hamiltonian through the $su(1, 1)$ Lie algebra, we obtain its exact parity-dependent energy spectrum and analytically evaluate its non-linear quantum dynamics without the explicit interference of the reflection operator.

We will show that while the fundamental nonlinear revival period remains invariant, the Dunkl parameter modulates fractional revivals, enabling perfect state reconstructions at half-periods for specific deformation values. Furthermore, by evaluating the Dunkl-Husimi Q-function, we map the phase-space fragmentation of the wave packet. Unlike the standard Kerr medium, which produces balanced multicomponent states, the Dunkl deformation induces a strong parity-dependent angular anisotropy, resulting in the generation of asymmetric multicomponent states with nonuniform peak heights.