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Exact Energy Spectrum and Expectation Values of the Inverse Square Root Potential Model

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Abstract : In this work, the concept of the extended Nikiforov-Uvarov technique is discussed and employed to obtain the exact bound state energy eigenvalues and the corresponding normalized eigenfunctions of the inverse square root potential. With expressions for the exact energy eigenvalues and corresponding eigenfunctions, the expressions for the expectation values of the inverse separation-squared, kinetic energy, and the momentum-squared of the potential are presented using the Hellmann Feynman theorem. For visualization, algorithms written and implemented in Python language are used to generate tables and plots for l-states of the energy eigenvalues and some expectation values. The results obtained here may find suitable applications in areas like atomic and molecular physics, chemical physics, nuclear physics, and solid-state physics.

Keywords : Schrodinger equation, Nikoforov-Uvarov method, inverse square root potential, diatomic molecules, Python programming, Hellmann-Feynman theorem, second order differential equation, matrix algebra
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