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APPROXIMATE SOLUTIONS OF THE D-DIMENSIONAL SCHRODINGER EQUATION WITH MULTIPARAMETER-TYPE POTENTIAL USING NIKIFOROV-UVAROV METHOD

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Dedicated to Prof. M.A. Pathan on his 75^{th} ***birth anniversary***

Abstract: The analytical solution to the Schrödinger equation in D-dimensions with multiparameter-type potential were obtained using Nikiforov-Uvarov method, and applying the pekeris approximation to the centrifugal term. For convenience,the equation are reduced to the hypergeometricform,where the energy eigen values and corresponding eigenfunction are obtained.The expectation values $\langle r^{-2}\rangle$, $\langle q+e^{2\alpha r}\rangle^{-1}$ and $\langle q+e^{2\alpha r}\rangle^{-2}$ are obtained in D-Dimension using Hellmann-Feynman Theorem.

Keywords: Schrodinger equation, multiparameter potential, Nikiforov-Uvarov method, Hellmann-Feynman Theorem.

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1. Introduction

The Schrodinger wave equation acts as the engine room of quantum mechanics. over the years and in recent times the exact solution of Schrödinger equation for some special physical potential has attracted so much interest. Some of these potential are the Hulthen potential, [1] the Rose- Morse potential, [2] the Morse potential, [3] the Eckart potential, [4] the five parameter exponential-type potential, [5] the Poschl-Teller potential, [6] Manning-Rosen potential [7] and others. The harmonic oscillator and Hydrogen atom problems are two exactly solvable potentials which have been investigated in N-dimensional quantum mechanics for any angular momentum . [8-10] These two problems are related and hence the resulting in second order differential equation has the normalized orthogonal polynomial function solution. [11] The analytical method have also been used to solve the wood-saxon and manning-rosen potential [12]. Different methods have been introduced in solving schrödinger equation for various potentials [13]. Among such