International Research Journal of Pure and Applied Physics
Vol.6, No.1, pp.18-19, September 2019
___Published by ECRTD-UK
ISSN 2055-009X(Print), ISSN 2055-0103(Online)

CORRIGENDA

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ABSTRACT: *This paper contains the corrections to the version of our paper "Bound-states solutions of the radial Schrödinger equation for a Gaussian potential within the framework of the Nikiforov-Uvarov method" published in International Research Journal of Pure and Applied Physics,* ***6****(1) 1-7. (2019)*
KEYWORDS: gaussian potential well, parabolic potential well, parametric nikiforov-uvarov method, radial schrodinger equation.

INTRODUCTION

In our paper [1] we mentioned that the Ricatti-Pade technique [2] was used instead of can be used to find eigenenergies of the Quantum Gaussian Potential for large well depths. Also, we noticed derivation mistake for the eigenvalue (Eq. (21)) and wave-function (Eq. (22)) relations arising from the three dimensional radial Schrodinger equation with a truncated Gaussian potential well (Eq. (4)). The truncated Gaussian potential well is a fair approximation to the Gaussian potential well for very small radial distance ($r \ll 1$) [3]. We note that the radial distance has three degrees of freedom (x, y, z) but our derivation did not yield a 3-D energy equation. Equation (21) for s-wave $(l = 0)$ is similar to the 1-D parabolic (harmonic oscillator) potential well but shifted by a finite potential depth V_0. It is worth mentioning that the 1-D eigenenergies for the s-wave $(l = 0)$ which were unintentionally obtained in [1] were compared with the 1-D eigenenergies obtained for the Gaussian potential well in [4] and [5]. To correct the mistake, we start from Eq. (18) given in [1].

$$\psi''(s) + \frac{1/2}{s}\psi'(s) + \frac{\left[-\frac{\rho^2}{2\hbar}s^2 + \frac{\epsilon s}{2} - \frac{l(l+1)}{4}\right]}{s^2}\psi(s) = 0. \tag{1}$$

Where the notations ρ and ϵ are given [1]

$$\rho = \sqrt{\frac{\hbar}{V_0 \alpha m}}, \; \epsilon = \frac{E + V_0}{\hbar V_0 \alpha} \tag{2}$$

Now comparing Eq. (1) with Eq. (6) in Ref. [1], we found

$$\gamma_1 = \frac{\rho^2}{2\hbar}, \; \gamma_2 = \frac{\epsilon}{2}, \quad \gamma_3 = \frac{l(l+1)}{4}, \quad \lambda_1 = \frac{1}{2}, \quad \lambda_2 = \lambda_3 = 0 \tag{3}$$

Using the parametric constants given in Eq. (9) of Ref. [1] we obtain

$$\lambda_5 = 0,\quad \lambda_4 = \frac{1}{4},\ \lambda_6 = \frac{\rho^2}{2\hbar},\ \lambda_7 = -\frac{\epsilon}{2},\ \lambda_8 = \left[\frac{\left(l+\frac{1}{2}\right)}{2}\right]^2,\ \lambda_9 = \frac{\rho^2}{2\hbar},\ \lambda_{10} = (l+3/2)\,,\ \lambda_{11} = 2\sqrt{\frac{\rho^2}{2\hbar}},\ \lambda_{12} = 1/2(l+1),\qquad \lambda_{13} = -\sqrt{\frac{\rho^2}{2\hbar}}. \quad (4)$$

The respective energy spectrum and eigen-function equations [6] are given as

$$\lambda_2 n - \lambda_5(2n+1) + (2n+1)\left(\sqrt{\lambda_9} + \lambda_3\sqrt{\lambda_8}\right) + \lambda_3 n(n-1) + \lambda_7 + 2\lambda_3\lambda_8 + 2\sqrt{\lambda_8\lambda_9} = 0 \quad (5)$$

$$\psi_n(s) = s^{\lambda_{12}}\, e^{\lambda_{13}s} L_n^{\lambda_{10}-1}(\lambda_{11}s) \quad (6)$$

Substituting Eqs. (3) and (4) with the notations in Eq. (2) into Eq. (5) we obtain the exact 3-D energy equation for the truncated Gaussian potential well.

$$E_{nl} = \sqrt{\frac{2\hbar^2 V_0\alpha}{m}}\left\{\left(2n + l + \frac{3}{2}\right)\right\} - V_0, \quad (7)$$

The wave function for the truncated Gaussian well is obtained using Eq. (6)

$$\psi_{nl}(s) = N_n s^{\lambda_{12}}\, e^{\lambda_{13}s} L_n^{\lambda_{10}-1}(\lambda_{11}s) = N_n s^{(l+1)/2} e^{-\sqrt{\frac{\rho^2}{2\hbar}}\,s}\, L_n^{(l+1/2)}\left(2\sqrt{\frac{\rho^2}{2\hbar}}\ s\right), \quad (8)$$

Were $L_n^{(l+1/2)}\left(2\sqrt{\frac{\rho^2}{2\hbar}}\ s\right)$ is the associated Laguerre polynomial

The exact 3-D energy spectrum for the truncated Gaussian potential (Eq. (7)) is similar to the three dimensional energy relation of the isotropic harmonic oscillator or parabolic potential well but shifted by a finite well depth V_0. Equation (7) is identical to the respective Eqs. **(**4) and (10) reported in Refs. [3] and [7].

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