Seminar

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Institute for Plasma Research

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Title: Eigensolution of the various potentials and its application in different fields

Speaker: Dr. Kaushal Purohit
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Date: 3rd November 2023 (Friday)

Time: 03.30 PM

Venue: Seminar Hall, IPR

Abstract:

The exact or approximate solutions of Schrodinger, Dirac, and Klein–Gordon equations can be solved analytically or numerically to offer us a lot of information about a physical system. Because of their importance in plasma physics, nuclear and particle physics, statistical physics, solid-state physics, quantum field theory, and molecular physics, researchers are interested in solving these types of equations in both relativistic and non-relativistic realms. Since the last decade, many researchers have been working to solve the diverse physical potentials in two or three dimensions under the influence of the magnetic field and the Aharanov-Bohm flux field for both realms.

The solutions of both relativistic and non-relativistic wave equations are of great importance and interest in physical and chemical sciences since the solution to such equations provides the conceptual understanding of quantum mechanical systems. Schrodinger wave equation constitutes a non-relativistic wave equation while Dirac and Klein-Gordon equations constitute relativistic wave equations. Some potentials can be studied using arbitrary physical constant parameters, while others are used in molecular physics to study diatomic molecular systems' rotational and vibrational energies Some of the well-known diatomic molecular potentials are Morse, Tietz Wei, Teitz Hua, Poschl Teller, Screened Kratzer, Manning-Rosen, and many others. Recently, the application of bound state solutions to study partition function thermodynamic and thermomagnetic properties has aroused the interest of many researchers because of its applications, especially in physical sciences. First in order to evaluate the partition function, the energy eigenequation is presented in a closed and compact form to enhance the simplicity of mathematical calculations. Many potentials have been employed to study partition function and thermodynamic properties of quantum mechanical systems. Most of these potentials include Deng-Fan Eckart Potential, general molecular potential, exponential type molecular Potential, modified Mobius Square Potential, modified Yukawa potential, hyperbolic Hulthen plus hyperbolic exponential inversely quadratic Potential, mixed hyperbolic Poschl-Teller Potential, and many others.

Our proposed combined potentials are screened cosine Kratzer potential (SCKP), Hulthen-screened cosine Kratzer potential (HSCKP), Extended Hulthen-Yukawa with Inverse Square and Coulombic Term plus Ring Shape Potential (EHYIC-RSP), modified Yukawa-Kratzer potential (MYKP), Attractive Radial Potential plus Class of Yukawa Potential (ARPCYP), and linear plus modified Yukawa Potential (LIMYP). Approximate or exact solutions of the Schrodinger, Dirac, and Klein-Gordon equations with some typical potentials. These hypothetical models have sparked a lot of curiosity since they provide us a glimpse into the quantum mechanical systems. To solve the various potentials, a variety of strategies are available. These methods are the asymptotic iterations Method (AIM), the ansatz method, the Nikiforov-Uvarov (NU) method, the factorizations method, the formula method, and the supersymmetric quantum mechanics (SUSYQM). In addition, there are a number of quantization approaches that can be used to deal with potential problems. Wentzel-Kramers-Brillouin (WKB) quantization method, supersymmetric WKB (SWKB) quantization technique, exact/improved quantization rule (EQR/IQR), the Qiang–Dong proper quantization rule can be applied to any completely solvable potential to generate energy eigenvalues.