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Bound State Solutions of the Yukawa Potential in the frame of the Greene and Aldrich Approximation.

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Abstract

The development of methods devoted to obtain ℓ - state solutions of exponential-type potentials, has been extensively considered since the analytical solutions contain all the necessary information of the quantum system under study. At this regard, some well known exponential-type potentials proposed as models of diatomic molecules, with various approximations to the centrifugal barrier, has been already considered by using different procedures; Nikiforov-Uvarov, asymptotic iteration, SUSY-QM, the path integral approach, numerical calculations and others methods. In this work, by using a class of mutiparameter exponential-type potential, obtained by means of the canonical transformation method applied to the hypergeometric DE, we show the study of bound state solutions of the Yukawa potential by using the Green and Aldrich approximation for the centrifugal term. The proposed method is by far simpler that procedures developed with the same purpose. Moreover, our algorithm accepts other kind of approximations to the $1/r^2$ term as well as the treatment of specific exponential potentials that can be obtained directly by a proper selection of the involved parameters. That is, instead to solve a given exponential-type potential with a specialized method, the energy spectra and wavefunctions are obtained as particular case from the proposal.

Keywords: Bound states, centrifugal term, point canonical transformation, Schrödinger equation.