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On Exactly Solvable Two-Body Problem in Two-Dimensional Quantum Mechanics

It is well known that exactly solvable models play an extremely important role in many fields of quantum physics. After the discovery of graphene in 2004 the study of a few particle systems in novel 2D materials became very important [1]. We consider two particles problem in three-dimensional (3D) coordinates space that are exactly solvable for a given central two-particle interaction *V(r)* and find the analytical solution with the same potential in two-dimensional (2D) space. The Schrodinger equation is applied to a 2D problem of two mass points confirmed in a circle, trapped in magnetic field, interacting via Kratzer potential, modified Kratzer potential, Coulomb potential, exponential potential, Yukawa potential, and Morse potential.

In the framework of the Nikiforov-Uvarov method [2] we transform Schrodinger equations with the corresponding potential into a second order differential equation via transformations of coordinates and particular substitutions into equations of the hypergeometric-type. The solution for wave functions is obtained in terms of special functions such as a hypergeometric function, confluent hypergeometric function, and solutions of the Kummer's, Laguerre's, and Bessel's differential equations.

We obtained exact analytical expressions for energy eigenvalues and eigenfunctions. Comparison is made between the two- and the three-dimensional cases. Interesting aspects of the solutions unique to the 2D cases are discussed.

[1]. R. Ya. Kezerashvili, Few-Body Systems in Condensed Matter Physics, Few Body Syst. A **60**, 52 (2019).
[2] A. F. Nikiforov and V. B. Uvarov, Special Functions of Mathematical Physics. A Unified Introduction with Applications. Springer Basel AG, 1988.

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