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Solution of the Nonrelativistic Radial Wave Equation of Hydrogen Atom Using the Green's Function Approach

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Abstract : This work aims to develop a systematic numerical technique which can be easily extended to many-body problem. The Lippmann Schwinger equation (integral form of the Schrodinger wave equation) is solved for the nonrelativistic radial wave of hydrogen atom using iterative integration scheme. As the unknown wave function appears on both sides of the Lippmann Schwinger equation, therefore an approximate wave function is used in order to solve the equation. The Green's function is obtained by the method of Laplace transform for the radial wave equation with excluded potential term. Using the Lippmann Schwinger equation, the product of approximate wave function, the Green's function and the potential term is integrated iteratively. Finally, the wave function is normalized and plotted against the standard radial wave for comparison. The outcome wave function converges to the standard wave function with the increasing number of iteration. Results are verified for the first fifteen states of hydrogen atom. The method is efficient and consistent and can be applied to complex systems in future.

Keywords : Green's function, hydrogen atom, Lippmann Schwinger equation, radial wave
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