Quarkonium Dynamics in Phase Space

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Since the groundwork published by Torres-Vega and Frederick, the Quantum Phase Space Representation (QPSR) has been explored as a method for solving a multitude of physical systems and describing phenomena. Most recently, Valentino A. Simpao has developed a method, the Heaviside Operational Ansatz, to solve the Time Dependent Schrodinger Equation (TDSE) in the QPSR, but there are still no general, direct methods to solve the Time Independent Schrodinger Equation in the QPSR. There is also no current formulation of quarkonium in phase space. In this paper, we describe the strong interactions of non-relativistic heavy quarks using the Cornell potential, and present a scheme to solve for the phase space wave function and its energy eigenvalues using the Nikiforov-Uvarov method. This solution can be generalized for any two-particle system with a scleronomic potential made up of polynomial and reciprocal terms. These results are compared to experimental results and other theoretical models. We also analyze the behavior of these wave functions, which suggest a correlation between radial momentum and the upper limit of existence in charm-anticharm meson.

Awards Won:
Third Award of $1,000