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MASS SPECTRA OF HEAVY QUARKONIA AND B_c DECAY CONSTANT FOR STATIC SCALAR-VECTOR INTERACTIONS WITH RELATIVISTIC KINEMATICS

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We reproduce masses of the self-conjugate and non-self-conjugate mesons in the context of the spinless Salpeter equation taking into account the relativistic kinematics and the quark spins. The hyperfine splittings for the 2S charmonium and 1S bottomonium are also calculated. Further, the pseudoscalar and vector decay constants of the B_c meson and the unperturbed radial wave function at the origin are also calculated. We have obtained a local equation with a complete relativistic corrections to a class of three attractive static interaction potentials of the general form $V(r) = -Ar^{-\beta}+\kappa r^{\beta}+V_0$, with $\beta = 1$, $1/2$, $3/4$ decomposed into scalar and vector parts in the form $V_V(r) = -Ar^{-\beta} + (1-\epsilon)\kappa r^{\beta}$ and $V_S(r) = \epsilon\kappa r^{\beta} + V_0$; where $0 \leq \epsilon \leq 1$. We have used the shifted large-N-expansion technique (SLNET) to solve the reduced equation for the scalar ($\epsilon = 1$), equal mixture of scalar-vector ($\epsilon = 1/2$), and vector ($\epsilon = 0$) confinement interaction kernels. The energy eigenvalues are carried out up to the third order approximation.

Keywords: B_c meson; spin corrections; potential model; heavy quarkonia; shifted N-expansion technique; Bethe–Salpeter equation.

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1. Introduction

The spinless Salpeter (SS) equation represents a standard approximation to the Bethe–Salpeter equation.[1] Upon elimination of any dependence on timelike variables in a suitable manner, the Bethe–Salpeter (BS) equation reduces to the Salpeter equation.[2] Neglecting, furthermore, any reference to the spin degrees of freedom and restricting to positive energy solutions, one arrives at the SS equation, which is the correct tool to deal with the bound-state spectrum of $q\bar{q}$, $Q\bar{Q}$ and $Q\bar{q}$