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Probing the Spectroscopy and Electromagnetic Structure of Heavy Meson within the Light-Front Quark Model

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The study of hadron by means of QCD is still unable to answer the unsolved puzzle; the hadron structures, especially those of heavy mesons. Hence, a comprehensive investigation of the 1S, 2S, and 3S states of heavy pseudoscalar (P) and vector (V) mesons for charmonia ($c\bar{c}$), bottomia ($b\bar{b}$), and charm-bottom ($c\bar{b}$) is strongly required. By employing the light-front quark model (LFQM) based on variational analysis, the harmonic oscillator (HO) basis as the trial wave function is used to study some properties of mesons. In this thesis, the QCD-motivated effective potential, i.e., the screening potential plus hyperfine interaction, is considered. First, the mass spectra of 1S, 2S, and 3S state P and V heavy mesons are computed and the suitable model parameters are obtained by using variational principle. Then, the corresponding decay constant and radiative M1 transition of the P and V mesons are also computed. Finally, the result of our calculation is compared with the available experimental data as well as other theoretical predictions.

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