

Title of the presentation:

Hyperfine spin splittings, decay and radiative transitions of S-waves bottomonium in the non-relativistic quark model

Authors:

André Aimé Atangana Likéné^{1,2} and Germain Hubert Ben-Bolie^{1y}

Affiliations:

¹Laboratory of Atomic, Molecular and Nuclear Physics, Department of Physics, Faculty of Science, University of Yaounde I, P.O. Box 812, Yaounde, Cameroon.

²The Nuclear Technology Section (NTS), Institute of Geological and Mining Research, P.O. Box 4110, Yaounde, Cameroon.

Abstract

In this research, one interests to investigate the spectra and dynamical properties of bottomonium S-states in the presence of non-compact extra dimensions of space. From the experimental point of view, this study was motivated on the one hand by the fact that the search for extra dimensions of space with CMS and ATLAS detectors of LHC has recently experienced interesting advances. On the other hand, we were stimulated by the recent progress in the observation of new states of bb meson. From the view point of mathematics, we were motivated to carry out an analytical study of the problem using the Laplace transform method. Indeed, contrary to other methods, this one makes it possible to easily obtain the analytical solutions of the Schrodinger equation with complex terms in the potential. Using the latter method, the N-dimensional radial Schrodinger equation is solved for the Cornell potential which is extended to include a harmonic oscillator term and the spin-spin interaction term. The energy eigenvalues have been obtained in the N-dimensional space, as well as the corresponding wave functions. The present theoretical results are employed to analyze few properties of bottomonium S-waves up to 4S state. We evaluated the masses of bb states, hyperfine splittings, pseudoscalar and vector decay constants, Leptonic, digamma and digluons decay widths, and magnetic dipole transitions of S-states of bottomonium. The effect of the dimensionality number is studied on the masses, as well as the dynamical properties of bottomonium states. We find that, the mass of bb quark increases with increasing dimensional number. In addition, the present model reproduces well the dynamical properties of bottomonium states, which are found to be in good agreement with experimental data and improved in comparison with previous theoretical studies. A discussion is also made on the possible observation of some missing states of bb quark such as 3^1S_0 . To complete our study, the Regge trajectories of pseudoscalar and vector states of bb quark, and the predicted radial probability densities were plotted for ground and 2 radially excited S-waves of bottomonium states.

Keywords: Schrodinger equation; extra dimensions; bottom quark; spin-spin interaction; Cornell potential; hyperfine spin splittings; decay width; radiative transitions.

¹Corresponding author: aandreaime@yahoo.fr . Phone (Direct):+237-6-9742-7891

^{1y}gbenbolie@yahoo.fr

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