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Υ and η_b mass shifts in nuclear matter and the nucleus bound states

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We estimate, for the first time, the Υ and η_b mass shifts in symmetric nuclear matter. The estimate for the Υ is made using an SU(5) effective Lagrangian, studying the BB, BB^*, and B^*B^* meson loop contributions for the self-energy. As a result, we include only the BB meson loop contribution as our minimal prediction. As for the η_b, we include only the BB^* meson loop contribution in the self-energy to be consistent with the minimal prediction for the Υ mass shift. The in-medium masses of the B and B^* mesons appearing in the self-energy loops are calculated by the quark-meson coupling model. Form factors are used to regularize the loop integrals with a wide range of the cutoff mass values. A detailed analysis on the BB, BB^*, and B^*B^* meson loop contributions for the Υ mass shift is made by comparing with the corresponding DD, DD^*, and D^*D^* meson loop contributions for the J/Ψ mass shift. Based on the analysis for the Υ, our prediction for the η_b mass shift is made on the same footing as that for the Υ, namely including only the BB^* meson loop. The Υ mass shift is predicted to be -16 to -22 MeV at the symmetric nuclear matter saturation density with the cutoff mass values in the range 2000 - 6000 MeV using the ΥBB coupling constant determined by the vector meson dominance model, while the η_b mass shift is predicted to be -75 to -82 MeV with the SU(5) universal coupling constant determined by the ΥBB coupling constant and for the same range of the cutoff mass values. Furthermore, we present some initial results for the Υ- and η_b-nucleus bound states for some nuclei.

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