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Ground State Mass Spectrum for Scalar Diquarks with Bethe-Salpeter Equation

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Abstract: In this article, we study the structures of the pseudoscalar mesons π, K and the scalar diquarks U^a, D^a, S^a in the framework of the coupled rainbow Schwinger-Dyson equation and ladder Bethe-Salpeter equation with the confining effective potential. The u, d, s quarks have small current masses, and the renormalization is very large, the mass poles in the timelike region are absent which implements confinement naturally. The Bethe-Salpeter wavefunctions of the pseudoscalar mesons π, K, and the scalar diquarks U^a, D^a, S^a have the same type (Gaussian type) momentum dependence, center around zero momentum and extend to the energy scale about q^2=1 GeV^2, which happens to be the energy scale for the chiral symmetry breaking, the strong interactions in the infrared region result in bound (or quasi-bound) states. The numerical results for the masses and decay constants of the π and K mesons can reproduce the experimental values, and the ground state masses of the scalar diquarks U^a, D^a, S^a are consistent with the existing theoretical calculations. We suggest a new Lagrangian which may explain the uncertainty of the masses of the scalar diquarks.

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Key words: Schwinger-Dyson equation, Bethe-Salpeter equation, diquark, confinement

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