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(1+1) QCD & Transverse Quark States in a Flux Tube

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In order to describe the dynamics of particle production and hadron spectrum in a flux tube, we start with an action integral in QCD4 in (3+1)dimensional space-time with a confining scalar transverse interaction. Under the dominance of longitudinal motion of the valence quark-antiquark pair, the four dimensional space-time QCD4 can be compactified into QCD2 in (1+1) dimensional space-time [1]. The obtained action integral is found to govern massive fermion and gluon fields, with a relation between the coupling constant g(2D) in QCD2 and g(4D) in QCD4. The contribution to the quark and gluon masses due to the flux tube are derived. The coupling constants and the masses depend crucially on the excitation of the partons in the transverse degrees of freedom. The spectrum of transverse degrees of freedom in the flux tube are studied in detail. On basis of the obtained quark eigenstates of a tube, the gluon and fermion masses as well as 2D coupling constants, g(2D), are calculated. The relation of the obtained gluon mass to the spectrum of observable hadrons will be considered.

References

[1] A. V. Koshelkin and C. Y. Wong, Phys. Rev. v.D86, 125026 (2012).

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