QCD Sum Rules and Heavy Quark Systems in the Nuclear Medium ◇

P. Morath and W. Weise

QCD sum rules at finite density are used to evaluate in-medium mass shifts of mesons with one or two charmed quarks/antiquarks. We report on recent results for the J/ϕ and η_c in the nuclear medium and new results for D mesons. For this system, we mainly focus on the mass splitting between D^+ and D^- mesons.

◇ Work supported in part by BMBF project 06 TM 876 and GSI project TM WEIT

QCD Spectral Sum Rules and Spontaneously Broken Chiral Symmetry ◇

E. Marco and W. Weise

The gap $\Delta = 4\pi f_\pi \approx 1.2GeV$ of spontaneous chiral symmetry breaking is introduced as a scale delineating resonance and continuum regions in the QCD spectral sum rules for vector mesons. Basic current algebra results are easily recovered, and accurate sum rules for the lowest moments of the spectral distributions are derived. The in-medium scaling of vector meson masses finds a straightforward interpretation, at least in the narrow width limit.

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Resonances and Higher Twist in Polarized Lepton-Nucleon Scattering ◇

J. Edelmann, N. Kaiser, G. Piller, and W. Weise

We present a detailed analysis of resonance contributions as compared to effects of higher twist in the moments of the proton spin structure function g_1. For each of these moments, it is found that there exists a characteristic Q^2 region in which (perturbative) higher twist corrections coexist with (non-perturbative) resonance contribution of comparable magnitude.

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Random Matrix Theory and Chiral Logarithms ◇

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Recently, the contributions of chiral logarithms predicted by quenched chiral perturbation theory have been extracted from lattice calculations of hadron masses. We argue that a detailed comparison of random matrix theory and lattice calculations allows for a precise determination of such corrections. We estimate the relative size of the m log (m), m, and m^2 corrections to the chiral condensate for quenched $SU(2)$.

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Supercritical Confinement ◇

S. D. Bass

We review the theory and present status of the proton spin problem with emphasis on the transition between current quarks and constituent quarks in QCD.

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