Nuclear Bound States of ω Mesons $^\diamond$

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Models based on chiral $SU(3) \times SU(3)$ symmetry and vector meson dominance suggest an attractive potential for the ω meson in a nuclear medium. We discuss the feasibility of producing nuclear bound states of ω mesons using $(d,^3He)$ and pion-induced production on selected nuclear targets.

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Quantum Chaos and QCD at Finite Chemical Potential

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We investigate the distribution of the spacings of adjacent eigenvalues of the lattice Dirac operator. At zero chemical potential μ, the nearest-neighbor spacing distribution $P(s)$ follows the Wigner surmise of random matrix theory both in the confinement and in the deconfinement phase. This is indicative of quantum chaos. At nonzero chemical potential, the eigenvalues of the Dirac operator become complex. We discuss how $P(s)$ can be defined in the complex plane. Numerical results from an $SU(3)$ simulation with staggered fermions are compared with predictions from non-hermitian random matrix theory, and agreement with the Ginibre ensemble is found for $\mu \approx 0.7$.

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J/ψ and η_c in the Nuclear Medium: QCD Sum Rule Approach $^\diamond$

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We investigate the masses of the lowest $c\bar{c}$ states, the J/ψ and η_c, in nuclear matter using QCD sum rules. Up to dimension four, the differences between the operator product expansions in vacuum and in medium arise from the density-dependent change in the gluon condensate and from a new contribution proportional to the nucleon expectation value of the twist-2 gluon operator. Both terms together give an attractive shift of about 10 MeV to the J/ψ and η_c masses in nuclear matter.

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Model Independent Constraints from Vacuum and In-Medium QCD Sum Rules $^\diamond$

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We discuss QCD sum rule constraints based on moments of vector meson spectral distributions in the vacuum and in a nuclear medium. Sum rules for the lower moments of these spectral distributions do not suffer from uncertainties related to QCD condensates of dimension higher than four. We exemplify these relations for the case of the ω meson and discuss the issue of in-medium mass shifts from this viewpoint.

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