XIIth Quark Confinement and the Hadron Spectrum



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Chiral-Scale Perturbation Theory and the Renormalization Group

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Three-flavor chiral perturbation theory with t, b, c quarks decoupled tests the infrared limit of three-flavor QCD. The standard theory χPT_3 (before being unitarized) assumes that there is no infrared fixed point α_{IR} . If α_{IR} exists, we get chiral-scale perturbation theory χPT_{σ} about a scale-invariant theory where the quark condensate is also a scale condensate with nine Nambu-Goldstone (NG) bosons: a massless 0^{++} dilaton σ ($f_0(500)$) in the real world) as well as π, K, η . The effective Lagrangian for χPT_{σ} is the standard one modified by σ -dependent terms and factors required to give the correct scaling dimensions, and can be systematically extended to include higher-order and electroweak corrections. The most important result is a neat explanation of the $\Delta I = 1/2$ puzzle for kaon decays; we propose to test it on the lattice via $K \to \pi$ with both on shell.

Summary

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