

HADRONIC STRING, CONFORMAL INVARIANCE AND CHIRAL SYMMETRY

J. ALFARO, L. BALART, A. A. ANDRIANOV, D. ESPRIU

Abstract

While it is clear that in some kinematic regime QCD can be described by an effective (as opposed to fundamental) string theory, it is not at all clear how this string theory should be. The "natural" candidate, the bosonic string, leads to amplitudes with the usual problems related to the existence of the tachyon, the absence of the adequate Adler zero, and massless vector particles, not to mention the conformal anomaly. The supersymmetric version does not really solve most of these problems. For a long time it has been believed that the solution of at least some of these difficulties is associated to a proper identification of the vacuum, but this program has remained elusive. We show in this work how the first three problems can be avoided, by using a sigma model approach where excitations above the correct (chirally noninvariant) QCD vacuum are identified. At the leading order in a derivative expansion we recover the nonlinear sigma model of pion interactions. At the next-to-leading order the $O(p^4)$ Lagrangian of Gasser and Leutwyler is obtained, with values for the coefficients that match the observed values. We also discuss some issues related to the conformal anomaly.