



Contribution ID: 34

Type: Talk

Scaling results for charged sectors of near conformal QCD

Monday, 29 July 2024 15:15 (20 minutes)

We provide the leading near conformal corrections on a cylinder to the scaling dimension of the lowest-lying fixed isospin charge Q operators defined at the lower boundary of the Quantum Chromodynamics conformal window:

$$\tilde{\Delta}_Q = \tilde{\Delta}_Q^* + \left(\frac{m_\sigma}{4\pi\nu} \right)^2, \quad Q^{\frac{\Delta}{3}} B_1 + \left(\frac{m_\pi(\theta)}{4\pi\nu} \right)^4 Q^{\frac{2}{3}(1-\gamma)} B_2 + \mathcal{O}\left(m_\sigma^4, m_\pi^8, m_\sigma^2 m_\pi^4 \right)$$

Here $\tilde{\Delta}_Q/r$ is the classical ground state energy of the theory on $\mathbb{R} \times S_r^3$ at fixed isospin charge while $\tilde{\Delta}_Q^*$ is the scaling dimension at the leading order in the large charge expansion. In the conformal limit $m_\sigma = m_\pi = 0$ the state-operator correspondence implies $\tilde{\Delta}_Q = \tilde{\Delta}_Q^*$.

The near-conformal corrections are expressed in powers of the dilaton and pion masses in units of the chiral symmetry breaking scale $4\pi\nu$ with the θ -angle dependence encoded directly in the pion mass. The characteristic Q -scaling is dictated by the quark mass operator anomalous dimension γ and the one characterizing the dilaton potential Δ . The coefficients B_i with $i = 1, 2$ depend on the geometry of the cylinder and properties of the nearby conformal field theory.

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Session Classification: Theoretical developments

Track Classification: Theoretical Developments