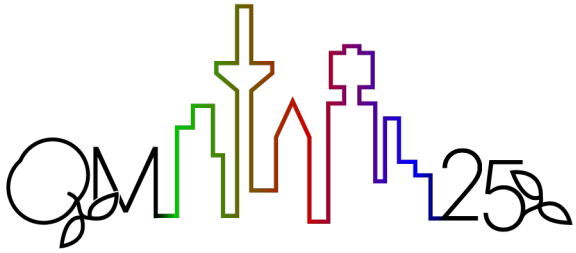

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Spectral sum rule and deconfinement transition in strongly-coupled QCD

The conventional weakly-coupled description of finite-temperature plasmas lead to the appearance of quasi-particles with thermal masses. By incorporating contributions from both the (chromo)electric scale gT and (chromo)magnetic scale g^2T, we establish thermal sum rules of quark spectral function for strongly-coupled QCD that respect Fermi-Dirac statistics as required by quantum mechanics. In sharp contrast to weakly-coupled theories, whose spectral functions consist of discontinuous zero-dimensional (singularities) and one-dimensional (branch cuts) non-analytic contributions from real energy, the derived spectral function for strongly coupled quarks features continuous but non-analytic contributions from complex energy. In light of the novel sum rules, we uncover an intrinsic QCD transition between a three-mode phase at small coupling and a one-mode phase at large coupling. This reflects the breaking and restoration of Lorentz symmetry in these regimes. The thermal mass vanishes at large coupling in line with phenomenological predictions from Dyson-Schwinger equations and gauge/gravity duality. This result provides new insights into the emergence and mechanism of the QCD transition.

Category

Theory

Collaboration (if applicable)

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