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Pole-skipping and chaos in D3-D7 brane systems

In this work, we analyse the pole-skipping phenomena of finite temperature Yang-Mills theory with quark flavors which is dual to D3-D7 brane systems in bulk. We also consider the external electric field in the boundary field theory which is dual to the world volume electric field on the D7 brane. We work in the probe limit where the D7 branes do not back-react to the D3 brane background. In this scenario, we decode the characteristic parameters of the chaos namely, Lyapunov exponent λ_L and butterfly velocity v_b from the pole-skipping points by performing the near effective horizon analysis of the linearised Einstein equations. Unlike pure Yang-Mills, once charged quarks with a background electric field are added into the system, the characteristic parameters of the chaos show non-trivial dependence on the quark mass and external electric field. We have observed that λ_L and v_b decreases with increasing electric field. We further perform the pole-skipping analysis for the gauge invariant sound, shear, and tensor modes of the perturbation in the bulk and discuss their physical importance in the holographic context.

Field of contribution

Theory

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