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The effect of charm quark on chiral phase transition in holographic QCD

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Studying the thermal QCD phase transition and the critical endpoint is crucial for understanding the hot environment relevant to the initial stage of heavy-ion collisions and the early universe. The nature of the QCD chiral phase transition in the limit of massless quarks has been a longstanding, open problem. The discrepancy between the lattice QCD estimation and the effective model results appears for the order of the chiral phase transition in the case of a multi-flavor system. In this talk, We present a study on the thermal chiral phase transition in a four-quark flavor system using the soft-wall holographic QCD model. Our study reveals that in the massless limit, the thermal chiral phase transition is of the second order in the four-quark flavor system. However, in the case of the massive charm quark and the massless light and strange quarks, the order of the phase transition changes to the first order. We also map the order of the phase transition on a phase diagram in the quark mass plane where the light- and strange-quark masses degenerate but differ from the value of the charm quark mass. Finally, we address the critical exponents related to the chiral phase transition.

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