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Probing the in- and out-of-equilibrium Chiral Magnetic Effects from lattice QCD

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In this work, we study the in- and out-of-equilibrium Chiral Magnetic Effects (CME) from lattice QCD simulations using two approaches. In the equilibrium approach, we consider a non-uniform magnetic background and show that local chiral magnetic currents appear as a response. We show that these currents average zero in the full volume, confirming that the total CME conductivity vanishes in equilibrium. This approach is based on the leading-order coefficient of the vector current in a chiral chemical potential expansion, which we extrapolate to the continuum limit. In the out-of-equilibrium approach, we give the first steps towards the extraction of the out-of equilibrium CME conductivity via temporal lattice correlation functions in a uniform magnetic background. We conclude by discussing possible implications of our findings to heavy-ion physics.

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