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Electric and baryonic charge fluctuations from lattice QCD

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We calculate electric and baryonic charge fluctuations on the lattice. Results have been obtained with the highly improved staggered quark action (HISQ) and almost physical quark masses on lattices with temporal extent of $N_{\tau}=6,8,12$. Higher cumulants of the net-charge distributions are increasingly dominated by a universal scaling behavior, which is arising due to a critical point of QCD in the chiral limit. Considering cumulants up to the 6th order, we observe that they generically behave as expected from universal scaling laws, which is quite different from cumulants calculated within the hadron resonance gas model. Taking ratios of these cumulants, we obtain volume independent results that can be directly compared to the experimental measurements. Such a comparison will unambiguously relate the QCD transition temperature that has been determined on the lattice with, the freeze out temperature of the heavy ion collision at LHC and the 200 GeV RHIC run.

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