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Axion Phenomenology from Unquenched Lattice QCD

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We investigate the topological properties of $N_f = 2 + 1$ QCD with physical quark masses, both at zero and finite temperature. At zero temperature both finite size and finite cut-off effects have been studied by comparing the continuum extrapolated results for the topological susceptibility χ with the predictions from chiral perturbation theory. At finite temperature, we explore a region going from T_c up to around $4T_c$, where continuum extrapolated results for the topological susceptibility and for the fourth moment of the topological charge distribution are obtained. While the fourth moment converges to the dilute instanton gas prediction the topological susceptibility differs strongly both in the size and in the temperature dependence. This results in a shift of the axion dark matter window of almost one order of magnitude with respect to the instanton computation.

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