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Local CP-violation in quark gluon plasma: a lattice study.

We study local CP-odd properties of the non-Abelian vacuum induced by strong external magnetic fields. These properties can be probed by local chirality and electric currents of the light fermions in the gluonic background. We perform calculations in the quenched SU(3) lattice gauge theory with tadpole-improved Luscher-Weisz action and overlap fermions. The main results of the study are the following: (1) There are finite local fluctuations of the chirality growing with strength of the magnetic field. (2) We observe a spatial inhomogeneous distribution of the chirality –it is mostly localized on low dimensional defects (with d=2-3), exactly as fermionic zero-modes. (3) There are also fluctuations of the electromagnetic current of quarks along the field. Combining this with a finite conductivity of the vacuum (also measured during the study) we arrive to some lattice evidences of the Chiral Magnetic Effect (CME).
Finally, I'll describe a field-theoretic interpretation of our results using a two-component superfluid model, where the axial current is carried by an axion-like excitation of the superfluid condensate.

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