Contribution ID: **52** Type: **not specified**

Regulated chiral gauge theory and the strong CP problem

Four-dimensional chiral gauge theory can be formulated as the boundary theory on a five-dimensional manifold in a manner that may be realized on a finite lattice. There are interesting features of these theories which defy a purely four-dimensional conception of universality. We find that QCD as embedded in a chiral gauge theory (the Standard Model) when regulated this way appears to suffer neither from a $U(1)_A$ problem nor a strong CP problem, with a central role played by fermion zeromodes localized far away in the fifth dimension. In this way it differs from conventional lattice QCD formulated as a stand-alone theory.

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