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Charged particles in QED with C* boundary conditions I

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In order to calculate QED corrections to hadronic quantities by means of lattice simulations, a coherent description of electrically-charged states in finite volume is needed. In the usual periodic setup, Gauss' law and large gauge transformations forbid the propagation of electrically-charged states. A possible solution to this problem, which does not violate the axioms of local quantum field theory, has been proposed by Wiese and Polley, and is based on the use of C* boundary conditions.

We discuss the properties and symmetries of QED in isolation and QED coupled to QCD, with C* boundary conditions. We show that a certain class of electrically-charged states can be constructed in this setup in a fully consistent fashion, without relying on gauge fixing. This class of states covers most of the interesting phenomenological applications. We also calculate finite-volume corrections to the mass of stable charged particles and show that these are much smaller than in non-local formulations of QED.

This is the first of two consecutive talks on the subject.

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