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Topological insulators and the QCD vacuum: the theta parameter as a Berry phase HARRY THACKER, Univ of Virginia — There is considerable evidence, based on large N_c chiral dynamics, holographic QCD, and Monte Carlo studies, that the QCD vacuum is permeated by discrete quasivacua separated by domain walls across which the local value of the topological θ parameter jumps by $\pm 2\pi$. This scenario is realized in a 2-dimensional U(1) gauge theory, the CP^{N-1} sigma model, where a pointlike charge is a domain wall, and θ describes the background electric flux and the polarization of charged pairs in the vacuum. The transition between discrete θ vacua occurs via the transport of integer units of charge between the two spatial boundaries of the domain. We show that this screening process, and the role of θ as an order parameter describing electric polarization, are naturally formulated in terms of Bloch wave eigenstates of the Dirac Hamiltonian in the background gauge field. This formulation is similar to the Berry phase description of electric polarization and quantized charge transport in topological insulators.

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