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Conformal magnetic effect in scalar QED

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Quantum polarization effects associated with the conformal anomaly in a static magnetic field background may generate a transverse electric current in the vacuum of massless particles (either bosons or fermions). The current may be produced either in an unbounded curved spacetime or in flat spacetime in a physically bounded system. In both cases, the magnitude of the electric current is proportional to the beta-function associated with the renormalization of electric charge. We investigate the electric current density induced by the magnetic field in the vicinity of a Dirichlet boundary in lattice scalar QED. We show that the electric current, generated by this "conformal magnetic effect at the edge" (CMEE), is well described by the conformal anomaly in the symmetry–unbroken phase. In the symmetry–broken phase, the anomalous current becomes the usual Meissner current generated by the superconducting condensate.

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