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Wigner - Weyl formalism and the propagator of Wilson fermions in the presence of varying external electromagnetic field

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We develop Wigner - Weyl formalism for the lattice models. For the definiteness we consider Wilson fermions in the presence of U(1) gauge field. The given technique reduces calculation of the two point fermionic Green function to solution of the Groenewold equation. It relates Wigner transformation of the Green function with the Weyl symbol Q_W of Wilson Dirac operator. We derive the simple expression for Q_W in the presence of varying external U(1) gauge field. Next, we solve the Groenewold equation to all orders in powers of the derivatives of Q_W . Thus the given technique allows to calculate the fermion propagator in the lattice model with Wilson fermions in the presence of arbitrary background electromagnetic field. The generalization of this method to the other lattice models is straightforward.

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