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Fermion condensates in external magnetic field in low dimensions

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Abstract content

Summary

We study the electron propagator in lower dimensions. In the case of free electrons, it is well known that the propagator in momentum space takes the simple form $S_F(p) = 1/(\gamma \cdot p - m)$. In the presence of external electromagnetic fields, electron asymptotic states are no longer plane-waves, and hence the propagator in the basis of momentum eigenstates has a more intricate form. Nevertheless, in the basis of the eigenfunctions of the operator (\gamma\cdot \Pi)^2, where Π is the canonical momentum operator, it acquires the free form $S_F(p) = 1/(\gamma \cdot \overline{p} - m)$ where $\overline{P}$ depends on the dynamical quantum numbers. We construct the electron propagator in the basis of the $(\gamma \cdot \Pi)^2$ eigenfunctions for an external magnetic field of arbitrary spatial profile in (2+1) dimensional and for an external electric field in (1+1) dimensional with the use of this propagator. We calculate some relevant physical quantities such as the fermion condensate and the current density. Finally obtain the propagator explicitly for some particular cases.

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