

Mathematical Physics

Exact solution of a 2D interacting fermion model

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We study an exactly solvable quantum field theory (QFT) model describing interacting fermions in 2+1 dimensions. This model provides an effective description of spinless fermions on a square lattice with local hopping and density-density interactions if, close to half filling, the system develops a partial energy gap. The necessary regularization of the QFT model is based on its relation to these lattice fermions. We use bosonization methods to diagonalize the Hamiltonian and obtain exact expressions for all fermion correlation functions. We discuss how, after appropriate multiplicative renormalizations, all short- and long distance cutoffs can be removed. As a non-trivial example, we compute fermion two-point functions and find that they have algebraic decay with exponents depending on the interaction strengths.

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