

Exact Boson-Fermion duality on a 3D Euclidean Lattice

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The idea of statistical transmutation plays a crucial role in descriptions of the fractional quantum Hall effect. However, a recently conjectured duality between a critical boson and a massless 2-component Dirac fermion extends this notion to gapless systems. This duality may shed light on highly non-trivial problems such as the half-filled Landau level, the superconductor-insulator transition, and surface states of strongly coupled topological insulators. We describe the duality in a non-perturbative fashion using an exact UV mapping of partition functions on a 3D Euclidean lattice. Our approach is purely analytic and has the advantage of being simple and exact.