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Multicritical Behavior in a Three-Dimensional Gross–Neveu Model with Staggered Fermions

Tuesday 4 November 2025 18:00 (1h 30m)

We study the phase diagram of massless staggered fermions with two distinct four-fermion couplings, U and U' , on a three-dimensional Euclidean lattice using the fermion-bag Monte Carlo method. The model exhibits three distinct phases: a massless fermion phase, a symmetry-broken massive phase with a fermion bilinear condensate, and a symmetric massive phase where fermions acquire mass without spontaneous symmetry breaking. We find that a nonzero U introduces an intermediate symmetry-breaking phase, turning the direct exotic transition at $U=0$ into two conventional critical lines: a mean-field (Gross–Neveu–type) transition between the massless and broken phases, and a 3D XY transition between the broken and symmetric massive phases. Our results suggest these critical lines may meet at a multicritical point with enhanced symmetry.

Parallel Session (for talks only)

Theoretical developments and applications beyond Standard Model

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