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Phase diagram of the $O(3)$ model from dual lattice simulations

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We simulated the asymptotically free two-dimensional $O(3)$ model at nonzero chemical potential through dual variables free of the sign problem. The system undergoes a quantum phase transition when μ reaches the particle mass (generated dynamically similar to QCD). The density follows a square root universal for repulsive bosons in one spatial dimension. We have also measured the spin stiffness, known to be sensitive to the spatial correlation length, in different scaling trajectories to zero temperature and infinite size. It points to a dynamical critical exponent $z=2$, which can be explained by particle worldlines. Comparisons to thermodynamic Bethe ansatz are shown as well.

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