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Investigating spontaneous SO(10) symmetry breaking in type IIB matrix model

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Non-perturbative formulations are essential to understand the dynamical compactification of extra dimensions in superstring theories. The type IIB (IKKT) matrix model in the large-N limit is one such conjectured formulation for a ten-dimensional type IIB superstring. In this model, a smooth space-time manifold is expected to emerge from the eigenvalues of the ten bosonic matrices. When this happens, the SO(10) symmetry in the Euclidean signature must be spontaneously broken. The Euclidean version has a severe sign-problem since the Pfaffian obtained after integrating out the fermions is inherently complex. In recent years, the complex Langevin method (CLM) has successfully tackled the sign problem. We apply the CLM method to study the Euclidean version of the type IIB matrix model and investigate the possibility of spontaneous SO(10) symmetry breaking. In doing so, we encounter a singular-drift problem. To counter this, we introduce supersymmetry-preserving deformations with a Myers term. We study the spontaneous symmetry breaking in the original model at the vanishing deformation parameter limit. Our analysis indicates that the phase of the Pfaffian induces the spontaneous SO(10) symmetry breaking in the Euclidean type IIB model.

Session

Beyond the Standard Model

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