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Learning the Landscape: Differentiable Frameworks for String Theory

Wednesday 10 December 2025 09:00 (45 minutes)

String theory naturally gives rise to vast, high-dimensional datasets, yet systematic investigations of this landscape has long been impeded by the complexity of moduli spaces, quantum corrections, and the vastness of flux configurations. In this talk, I present new differentiable frameworks for string compactifications that combine automatic differentiation, and ML-based inference to construct and analyse four-dimensional effective theories. These pipelines enable controlled moduli stabilisation, incorporate strong coupling corrections, and allow efficient searches for phenomenologically relevant vacua, including regimes with small cosmological constant and rich axion sectors. By integrating analytic insights with scalable computational tools, this approach transforms the study of the string landscape into a quantitative and data-driven enterprise, opening new avenues for connecting quantum gravity to observable physics.

Presenter: Dr SCHACHNER, Andreas (Cornell University)