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The AI Revolution for Quantum Fields and Strings: A Case Study

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In this talk, I will provide a brief overview of the pioneering works since 2017 that introduced machine learning techniques into research in quantum field theory, string theory, and related areas of theoretical physics. I will then explain how more advanced generative AI methods can be used to explore configuration spaces in complex geometry, which in turn give rise to various phases and dynamical phenomena in quantum field theories realized in string theory. In particular, the talk will focus on a special family of four-dimensional supersymmetric gauge theories that exhibit phase transitions identified with Seiberg duality. The talk will conclude with a preview of the tools that advanced - and crucially explainable - AI can offer for the future study of quantum field theories and string theory, and more broadly for theoretical physics.