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Machine Learning Modular Forms in String Theory

Over the last two decades, automorphic forms have emerged as encoders of the mathematical principles underlying the organization of information and microstates in quantum gravity. Perhaps their most significant appearance in this context lies in the counting of black hole microscopic states. The detection and classification of modular forms—and the analysis of their modular properties—thus offer promising pathways to a deeper understanding of quantum black holes.

In this talk, I will demonstrate how the search for modular symmetries relevant to quantum gravity is highly amenable to ML techniques. I will present preliminary results in this direction by developing ML protocols for classifying modular and Jacobi forms and report on the efficacy of the neural nets employed. I will conclude with remarks on potential applications to black hole microstate counting.

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