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Complexity in the spectra of graphs and strings

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Complexity plays a pivotal role across diverse fields, often emerging from spectral data and profoundly shaping system behaviour. As a first instance, we analyse the Fiedler eigenvalue of fiber graphs using the Laplacian Renormalisation Group, showing that its flow cannot be fully controlled by the spectral dimension, reflecting the graph's intrinsic structural richness. Moving from discrete networks to a continuous setting, we then examine one-loop scattering amplitudes in Type II string theories. We provide expressions for amplitudes at arbitrary mass level for a subset of states in the NS-NS sector, together with numerical evaluation of specific cases. Drawing on recent studies, we conjecture that these corrections are effectively captured by random matrix statistics, providing a signal of emergent complex dynamics.

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