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The arithmetic of resurgent topological strings

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Factorially divergent power series naturally arise as perturbative expansions in quantum theories but do not uniquely determine the original functions due to hidden non-analytic terms. In favourable circumstances, these terms can be systematically understood within the framework of resurgence. Growing evidence indicates that this is the case for topological string theory. In this talk, I will discuss the resurgence of the strong and weak coupling limits of the spectral traces of a toric Calabi-Yau threefold, which are captured by the free energy of the refined topological string on the same background. In the case of the spectral trace of local P^2, a remarkable arithmetic structure unfolds, revealing an exact strong-weak resurgent symmetry exchanging the perturbative/non-perturbative sectors in the dual regimes. Guided by this example, I will propose a new perspective on the resurgence of particular formal power series, which are conjectured to possess specific summability and quantum modularity properties, leading us to introduce the general paradigm of modular resurgence. This talk is based on arXiv:2212.10606, 2404.10695, and 2404.11550.

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