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talk 10: Counting BPS black hole micro-states with (mock) modular forms

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A central problem in quantum gravity is to get a quantitative microscopic interpretation of the Bekenstein-Hawking entropy of black holes. In type II strings compactified on a Calabi-Yau manifold, BPS black hole microstates are realized by bound states of D-branes wrapped along complex submanifolds, or in mathematical terms by stable objects in the derived category of coherent sheaves. String dualities predict that suitable generating series of indices counting such stable objects (known as Donaldson-Thomas invariants) possess strong modular properties. I will explain recent progress in computing these BPS indices on compact Calabi-Yau manifolds such as the quintic threefold, using wall-crossing and relations to topological string theory and present strong evidence that modularity is indeed at work. Conversely, by assuming modularity one may compute topological string amplitudes at higher genus than before.

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