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*Counting Invariants for Calabi-Yau Threefolds*

A Calabi-Yau threefold is a complex oriented three-dimensional projective manifold. Ideally, one expects various counting problems on a Calabi-Yau threefold to yield finite numbers, but in reality, this leads to difficult intersection theory problems on highly singular moduli spaces. For example, one could count curves of a certain type inside the Calabi-Yau threefold, or vector bundles, or even derived category objects of a certain type on it. The latter type of counting problem, known as Donaldson-Thomas theory, exhibits a symmetry in the deformation/obstruction theory, which leads to the fact that the counting invariant is a weighted Euler characteristic of the moduli space. The subtlety is in the weight, which is an invariant of the singularity of the moduli space. This observation has lead to many advances in Donaldson-Thomas theory.