

# Supersymmetry decomposes the virtual bundle that underlies the elliptic genus

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## Abstract

The elliptic genus of a compact Calabi-Yau manifold  $Y$  is a weak Jacobi form of weight 0. It also arises as part of the partition function of appropriate  $N=(2,2)$  superconformal field theories, which then are viewed as “associated to” the Calabi-Yau manifold  $Y$ . If the theory enjoys extended supersymmetry, then the induced decomposition of the elliptic genus reveals additional structure, which so far lacks a geometric interpretation. An example of this are the so-called Mathieu Moonshine phenomena in the case where  $Y$  is a K3 surface.

We state and prove a novel decomposition of the virtual bundle which underlies the elliptic genus of K3 and discuss its properties. The decomposition is induced by the  $N=(4,4)$  supersymmetry of the associated superconformal field theories and is expected to generalize to other manifolds with special holonomy.