

Refined analytic torsion

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Abstract

For a representation of the fundamental group of a compact oriented odd-dimensional manifold we define a refinement of the Ray-Singer torsion associated to this representation. If the representation is acyclic then our new invariant is a non-zero complex number, which can be viewed as an analytic counterpart of the refined combinatorial torsion introduced by Turaev. The refined analytic torsion is a holomorphic function of the space of acyclic representation of the fundamental group. When the representation is unitary, the absolute value of the refined analytic torsion is equal to the Ray-Singer torsion, while its phase is determined by the eta-invariant. The fact that the Ray-Singer torsion and the eta-invariant can be combined into one holomorphic function allows to use methods of complex analysis to study both invariants. I will present several applications of this method. In particular, I will calculate the ratio of the refined analytic torsion and the Turaev torsion.