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Ray-Singer analytic torsion and Toeplitz operators

Abstract: Real analytic torsion is a spectral invariant of a compact Riemannian manifold equipped with a Hermitian vector bundle, that was introduced by Ray-Singer in 1971.

Ray and Singer conjectured that for unitarily flat vector bundles, this invariant coincides with the Reidemeister torsion, a topological invariant. This conjecture was established by Cheeger and Mueller, and extended by Mueller for unimodular flat vector bundles, and by Bismut-Zhang to arbitrary flat vector bundles.

In this talk, we explain first the theory of Toeplitz operators associated with a positive line bundle. We show then how Toeplitz operators appear naturally in the study of the asymptotic properties of cohomology and of the Ray-Singer analytic torsion associated with a family of flat vector bundles.

In the case of arithmetic quotients, the asymptotics of the Ray-Singer analytic torsion give informations about the size of the torsion elements in the cohomology group.