

## Spectral asymptotics for Dirac operators

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The Dirac operator, introduced by Atiyah and Singer, is a first-order elliptic differential operator on certain Riemannian manifolds called spin. I will first outline the asymptotics of its spectrum (as an unbounded operator in  $L^2$ ) on closed manifolds; then I will discuss some non-compact examples. For (asymptotically) hyperbolic manifolds of finite volume, for a large class of spin structures the spectrum is made only of eigenvalues, like in the closed case. I will also provide a class of examples where there do not exist  $L^2$  eigenvalues.

Lecture 1. Spin group, spin manifolds, Dirac operator. General elliptic theory via pseudo-differential operators.

Lecture 2. Complex powers, trace-class operators, the Weyl law for eigenvalues on compact manifolds.

Lecture 3. The Weyl law for the Dirac operator on finite volume hyperbolic manifolds; absence of eigenvalues on infinite volume hyperbolic manifolds.

### Bibliography

- 1) Berline, Getzler, Vergne: Heat kernels and Dirac operators.
- 2) arXiv:math/0310075 Weyl laws on open manifolds Sergiu Moroianu
- 3) arXiv:math/0701635 The Dirac spectrum on manifolds with gradient conformal vector fields Andrei Moroianu, Sergiu Moroianu