

This project aims at investigating index theory problems at two different interrelated levels. First in the abstract setup of Connes spectral triples we will study the problem of finding a criterion for the meromorphic continuation property and thereby making the local index formula of Connes and Moscovici accessible to various applications. We present here a four step program that tackles this problem based on our experience with the spectral triple corresponding to a cross-product algebra.

The second part of our effort will be to bring back some of the techniques from noncommutative geometry to the study of singular spaces. Analysis on many reasonable singular spaces can be carried out by means of a desingularization in form of a Lie groupoid. A Lie groupoid has an algebra of pseudo-differential operators associated to it (though not necessarily via a spectral triple). We are interested in considering certain spectral triples on the algebra  $A$  of order zero pseudo-differential operators over a groupoid  $G$  representing a singular space and relate the corresponding abstract calculus of pseudo-differential operators with the existing groupoid based invariant calculus.

This idea is inspired by the work of R. Melrose, S. Moroianu, V. Nistor and E. Schrohe and others as mentioned in the proposal and our own experience with computing the cyclic cohomology for the cross-product spectral triple.