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Metric Convergence of Spectral Triples on the Sierpinski Gasket and other Fractal Curves

Many important physical processes can be described by differential equations. The solutions of such equations are often formulated in terms of operators on smooth manifolds. A natural question is to determine whether differential structures defined on fractals can be realized as a metric limit of differential structures on their approximating finite graphs. One of the fundamental tools of noncommutative geometry is Connes' spectral triple. Because spectral triples generalize differential structure, they open up promising avenues for extending analytic methods from mathematical physics to fractal spaces. The Gromov-Hausdorff distance is an important tool of Riemannian geometry, and building on the earlier work of Rieffel, Latremoliere introduced a generalization of the Gromov-Hausdorff distance that was recently extended to spectral triples. The Sierpinski gasket can be viewed as a piecewise C^1-fractal curve, which is a class of fractals first formulated by Lapidus and Sarhad for their work on spectral triples that recover the geodesic distance on these spaces. In this talk, we will motivate and describe how their framework was adapted to our setting to yield approximation sequences suitable for metric approximation of spectral triples on piecewise C^1-fractal curves.