

Geometrically similar 3-manifolds

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This talk is motivated by a variant of Mark Kac's question about hearing the shape of a drum. To what extent do geometric invariants, such as the lengths of geodesics, determine the hyperbolic metric on a manifold, specifically a knot complement?

There are several known ways to produce hyperbolic 3-manifolds that isospectral (i.e. have exactly the same spectrum of geodesic lengths) but not isometric. All known constructions of of this sort involve finite covers of the same base manifold, leading Reid to ask whether this is a necessary feature. That is, are isospectral manifolds necessarily commensurable?

I will describe an effective way to build pairs of hyperbolic 3-manifolds that are not commensurable but have the same closed geodesics up to length L , where L is as large as one likes. This involves a new commensurability criterion, based on pairs of pants, which can be effectively verified using SnapPy.

This is joint work with Christian Millichap.