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The spectrum of orbifold connected sums and collapsing

The Laplace operator on an orbifold is a non-negative self-adjoint operator on functions (or forms), and its spectrum is an orbifold invariant. Isospectral orbifolds are orbifolds whose Laplace spectra coincide. Though many geometric quantities, such as volume and dimension, are determined by the spectrum, it is known that there are pairs of isospectral orbifolds with different numbers and kinds of singular points. In particular, by the work of Rossetti-Schueth-Weildandt, there are isospectral pairs for whom the maximum order of the orbifold isotropy groups is different. The question of whether an orbifold with singular points can be isospectral to a manifold, i.e. an orbifold without singular points, is currently open. Generalizing work of Anné, Colbois, and Takahashi for manifolds, we study the behavior of the spectrum of a connected sum of orbifolds when one component of the connected sum is collapsed to a point. We use this to demonstrate that there are singular orbifolds and manifolds whose spectra are arbitrarily close to one another. In the process, we derive a Hodge-de-Rham theory for orbifolds.

Joint work with Emily Proctor and Chris Seaton