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Rigidity of Riemannian embeddings of discrete metric spaces

Abstract:

Let M be a complete, connected Riemannian surface and suppose that S is a discrete subset of M. What can we learn about M from the knowledge of all distances in the surface between pairs of points of S? We prove that if the distances in S correspond to the distances in a 2-dimensional lattice, or more generally in an arbitrary net in R^2, then M is isometric to the Euclidean plane. We thus find that Riemannian embeddings of certain discrete metric spaces are rather rigid. A corollary is that a subset of Z^3 that strictly contains a two-dimensional lattice cannot be isometrically embedded in any complete Riemannian surface. This is a joint work with B. Klartag.