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Math 253 - Differential Geometry Seminar

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Three scary math tales

Abstract:

Small KAM perturbations of integrable systems which are entropy expansive. One of the greatest achievements in Dynamics in the XX century is the KAM Theory. It says that after a small perturbation of a non-degenerate completely integrable system it still has an overwhelming measure of invariant tori with quasi-periodic dynamics. What happens outside KAM tori remains a great mystery. It is easy, by modern standards, to show that topological entropy can be positive. It lives, however, on a zero measure set. We are now able to show that metric entropy can become infinite too, under arbitrarily small C^∞ perturbations, answering an old-standing problem of Kolmogorov. Furthermore, a slightly modified construction resolves another long standing problem of the existence of entropy non-expansive systems. In these modified examples positive metric entropy is generated in arbitrarily small tubular neighborhoods of one trajectory. Joint with S. Ivanov and Dong Chen.

Metric approximations of length spaces by graphs with uniformly bounded local structure. How well can we approximate an (unbounded) space by a metric graph whose parameters (degrees of vertices, lengths of edges, density of vertices etc) are uniformly bounded? We want to control the ADDITIVE error. Some answers are given (the most difficult case is \mathbb{R}^2) using dynamics and Fourier series. Joint with S. Ivanov.

On Busemann's problem on minimality of flats in normed spaces for the Busemann-Hausdorff surface area. Busemann asked if regions in affine subspaces of normed spaces are area minimizers with respect to the Busemann-Hausdorff measure. This has been known for long for hyperplanes (codim=1), this is a classic result in Convex Geometry. Sergei Ivanov and me were able to prove this for 2-dimensional subspaces.

Host: Lei Ni

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