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Control of eigenfunctions on negatively curved manifolds

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Semiclassical measures are a standard object studied in quantum chaos, capturing macroscopic behavior of sequences of eigenfunctions in the high energy limit. They have a long history of study going back to the Quantum Ergodicity theorem and the Quantum Unique Ergodicity conjecture. I will speak about the work with Jin and Nonnenmacher, proving that on a negatively curved surface, every semiclassical measure has full support. I will also discuss applications of this work to control for the Schrödinger equation and decay for the damped wave equation.

Our theorem was restricted to dimension 2 because the key new ingredient, the fractal uncertainty principle (proved by Bourgain and myself), was only known for subsets of the real line. I will talk about more recent joint work with Athreya and Miller in the setting of complex hyperbolic quotients and the work in progress by Kim and Miller in the setting of real hyperbolic quotients of any dimension. In these works there are potential obstructions to the full support property which can be classified by Ratner theory and geometrically described in terms of certain totally geodesic submanifolds. Time permitting, I will also mention a recent counterexample to Quantum Unique Ergodicity for higher-dimensional quantum cat maps, due to Kim and building on the previous counterexample of Faure-Nonnenmacher-De Bièvre.

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