1151-60-248 **Sam Punshon-Smith*** (punshs@brown.edu), **Jacob Bedrossian** and **Alex Blumenthal**.

Rigorous results on passive scalar turbulence in stochastic fluid mechanics.

I will survey some recent results with collaborators Jacob Bedrossian and Alex Blumenthal on the long-time evolution of a passive scalar advected by various stochastic fluid models including the stochastic Navier-Stokes equations forced with non-degenerate white-in-time noise. Specifically I will discuss how using tools from random dynamical systems and ergodic theory one can prove that the Lagrangian flow has a positive Lyapunov exponent (known as Lagrangian chaos) and how this can be used to prove almost sure exponential mixing of passive scalars uniformly in the diffusivity parameter. This in turn implies optimal (in the time scaling) enhanced dissipation of passive scalars by the stochastic Navier-Stokes equations. As an application to passive scalar turbulence, we are able to give rigorous proofs of Yaglom's law and Batchelor's power spectrum at finite Reynolds number (the Batchelor regime). (Received August 19, 2019)