Conference Pathwise Stochastic Analysis and Applications
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James-Michael Leahy (Imperial College London)

On transport type rough fluid equations

We introduce a Hamilton-Pontryagin variational principle for fluid dynamics on rough paths in the first part of the talk. A fluid's advection is constrained to be the sum of a vector field that models coarse-scale motion and a rough (in time) vector field that parametrizes fine-scale motion. We derive a rough partial differential equation for the coarse-scale velocity as a consequence of criticality. By parametrizing the fine-scales of fluid motion with a rough vector field, we establish a flexible framework for stochastic parametrization schemes.

In the second part of the talk, we consider the rough Euler system for incompressible perfect fluids on the flat torus. We discuss local well-posedness in Sobolev spaces $W^{m,2}$ for integers $m > d/2 + 1$ and a Beale-Kato-Majda blowup criterion in terms of $L^1_t L^\infty_x$-norm of the vorticity. In dimension two, we establish global well-posedness.

This talk is based on joint work with Dan Crisan, Darryl Holm, and Torstein Nilssen.
