

PHYSICAL MATHEMATICS SEMINAR

Tailoring tails in Taylor dispersion: How boundaries shape chemical delivery in microfluidics

DANIEL HARRIS

University of North Carolina, Chapel Hill

ABSTRACT:

We present the results of an investigation of the dispersion of a passive scalar in laminar shear flow through rectangular and elliptical channels. We show through Monte Carlo simulations, asymptotic analysis, and laboratory experiments that the cross-sectional aspect ratio of the channel sets the longitudinal asymmetry of the resulting tracer distribution at long times. Thin channels (aspect ratio $\ll 1$) generate distributions with sharp fronts and tapering tails, whereas thick channels (aspect ratio ~ 1) produce the opposite effect. In addition, our analysis allows us to define a golden aspect ratio which separates thin from thick channels, the value of which is remarkably similar for both the rectangular ducts and the elliptical pipes. Our findings could potentially be useful in a number of microfluidic applications, some of which will be discussed.

This work is joint with Manuchehr Aminian, Francesca Bernardi, Roberto Camassa, and Rich McLaughlin of the UNC Joint Fluids Lab.

TUESDAY, NOVEMBER 1, 2016

2:30 PM

Building 4, Room 257

*Reception following in Building 2, Room 290
(Math Dept. Common Room)*

<http://math.mit.edu/seminars/pms/>