

# Colloquium

University of Notre Dame  
Department of Mathematics

Anna Mazzucato - Pennsylvania State University

**Speaker:** Anna Mazzucato

Pennsylvania State University

**Will give a lecture entitled**

Mixing in fluids: irregular transport, enhanced dissipation, and applications

**Date:** Wednesday, January 31, 2024

**Time:** 4:00 PM

**Location:** 129 Hayes-Healy Bldg



**Departmental Tea:** Tea in Room 257 (lounge in Hurley Hall) at 3:30 p.m.

**Zoom URL:**



**Abstract:**

Stirring and mixing in fluids, specifically incompressible fluids, have important consequences on many physical and biological processes, from dispersal of pollutants to transport of nutrients. From a mathematical point of view, mixing can be studied in different contexts, from ergodic theory to homogenization. In this talk, I will present a quantitative approach to mixing that arises in the analysis of partial differential equations. In this context, mixing is related to irregular transport by non-Lipschitz vector fields and, when combined with diffusion, it may lead to enhanced dissipation. A variety of techniques have been employed in the literature to study these mechanisms, from geometric analysis to optimal transport to spectral theory and probability. I will first discuss examples of incompressible flows that mix optimally in time. Then, I will show how these examples lead to loss of regularity for solutions of transport equations. Lastly, I will discuss enhanced dissipation and examples of flows that lead to enhanced dissipation for advection-(hyper)diffusion equations using resolvent estimates.