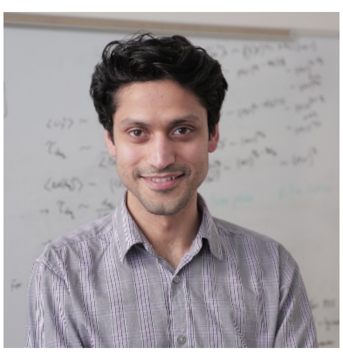
JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

FALL 2021 CEAFM VIRTUAL SEMINAR SERIES

"Shape-Dependent Particle Transport and Rotations in Wavy and Turbulent Flows"

Presented by Prof. Nimish Pujara
University of Wisconsin-Madison
Department of Civil and Environmental Engineering
Hosted by Rui Ni (MechE)

Particles of different shapes and sizes are commonly found suspended in wavy and turbulent flows in the environment. Examples include sediment, microplastics, and planktonic organisms. Here, we consider the dynamics of non-spherical particles in dilute concentrations in order to understand their transport and coupling to the flow. In one line of investigation, we focus on rotations of non-spherical particles in homogeneous turbulence using both numerical simulations and laboratory experiments. Both approaches show a power law scaling of particle angular velocity with particle size. Additionally, the numerical results show that particle rotations can be quantitatively predicted solely from particle alignment with the fluid vorticity, while the laboratory results show that particle inertia lowers the average rotation rate and makes the distribution more intermittent. In another line of investigation, we focus on the transport of inertial particles in wavy flows. From theory, we find that horizontal particle drift is reduced relative to the Stokes drift of fluid parcels and that particle settling is enhanced relative to the terminal settling velocity in quiescent fluid. The theory shows excellent agreement with numerical simulations and reasonable agreement with laboratory experiments.



Nimish Pujara was an undergraduate at Cambridge University and obtained his doctorate at Cornell University from the School of Civil and Environmental Engineering. After a postdoctoral position at UC Berkeley, he joined the Department of Civil and Environmental Engineering at University of Wisconsin – Madison as a faculty member. He now leads a group that pursues research in fluid mechanics with the aim of improving understanding of various environmental processes.

Friday, October 1, 2021 at 3:00 PM
https://wse.zoom.us/j/93762992307