PHYSICAL MATHEMATICS SEMINAR

Active and driven wave-propelled interfacial particles

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ABSTRACT:

When an asymmetric floating body is internally or externally vibrated, the self-generated capillary wavefield can lead to steady propulsion or rotation. In this talk, I will discuss several related and recently discovered systems that leverage this driving mechanism. On a vibrating fluid substrate, freely floating particles are shown to self-propel along straight paths, rotate in place, or move along curvilinear trajectories, depending sensitively on the particle asymmetries and driving parameters. Such particles interact at a distance through their mutual wavefield, and exhibit a rich array of multi-body dynamics. I will also present our work on the "SurferBot": a centimeter-scale robotic device that self-propels along a fluid interface using an onboard vibration motor. Overall, these highly accessible and tunable macroscopic systems serve as a novel platform for exploring active and driven matter interacting in fluid environments.

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BIO:

Daniel M. Harris is an Assistant Professor of Engineering at Brown University in the Fluids and Thermal Sciences group. Before joining Brown, Dan was a Postdoctoral Research Associate and Lecturer at the University of North Carolina at Chapel Hill in the Department of Mathematics. Dan received his B.S. in Mechanical Engineering from Cornell University in 2010 and his Ph.D. in Applied Mathematics from MIT in 2015.

Dan's primary research interests are in interfacial phenomena, microfluidics, and transport phenomena. His research involves an integrated experimental and theoretical approach. Dan has also received numerous awards for his scientific visualizations, including being selected as the winner of the 2016 NSF/Popular Science Visualization Challenge in Photography, as well as several prizes from the American Physical Society's Gallery of Fluid Motion and Gallery of Soft Matter.

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