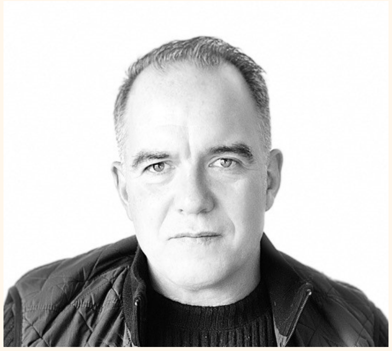
Oct 30, 2025

Time: 2:30 - 4:00 PM
Location: CBB 104

Hydrodynamic quantum analogs



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ABSTRACT:

Since Yves Couder's discovery in 2005 that droplets may self-propel along the surface of a vibrating liquid bath, numerous studies have shown that these walking droplets exhibit features previously thought to be exclusive to the microscopic, quantum realm. The walking droplet system represents a macroscopic realization of wave-particle duality, and of a pilot-wave dynamics of the form proposed for microscopic quantum particles by Louis de Broglie in the 1920s. Experimental and theoretical results allow us to explore its potential and limitations as a quantum analog, and so redefine the boundary between classical and quantum. Theoretical descriptions of the hydrodynamic system allow us to forge links with existing quantum pilot-wave theories. Fledgling, trajectory-based descriptions of quantum dynamics, informed by the hydrodynamic system, are explored. Particular attention is given to illustrating how the non-Markovian droplet dynamics give rise to features taken as evidence of quantum nonlocality in their microscopic counterparts

BIOGRAPHY:

John Bush is a Professor of Applied Mathematics at MIT. Having completed his BSc in Physics at the University of Toronto, he went on to Harvard for his PhD in Geophysics, then the University of Cambridge for postdoctoral research at DAMTP. He joined the faculty of MIT in 1998, was tenured in 2004 and is the Director of the Applied Mathematics Laboratory. His research may be described as Physical Applied Mathematics, the application of mathematics with a view to elucidating mechanism and so better understanding the physical world. His research began in geophysics, but then shifted towards surface-tension-driven phenomena and their applications in biology. For the past fifteen years, beyond some COVID-inspired work on the fluid mechanics of disease transmission, his research has been focused on hydrodynamic quantum analogs.