LMS Seminar series 2024 – 25

Flow generation through buckling instability: from beach balls to microswimmers

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Date and Time: January 23, 2025 (2 – 3 pm)
Venue: Amphi Becquerel (Polytechnique)

Abstract

Buckling of elastic structures is an effective way to produce rapid motion in a fluid at any scale. Encapsulated microbubbles, which are currently used as ultrasound contrast agents, can deform and collapse under an external load from an acoustic wave. They reinflate when the pressure decreases. The shape hysteresis associated with this deformation cycle makes this simple object a good candidate to become an ultrasound controlled micro-swimmer. I will explore this possibility through experiments at macro and micro scales and numerical simulations. The coupling between the acoustic wave and the self-oscillation of the deformed shell leads to complex - sometimes chaotic - dynamics with direct consequences on the direction and efficiency of the swimming.

About the speaker

Gwennou Coupier is a CNRS research director at Laboratory of Interdisciplinary Physics in Grenoble, which he joined in 2006. He has been working on the dynamics of lipid vesicles and red blood cells in confined flows, with the aim to understand better the structure and rheology of blood in capillary networks. He is now interested in using elastic buckling instabilities to harvest energy for propulsion in fluids and is also working on foam-based systems for CO2 capture and conversion.

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