

Mardi 10 juin à 14 h 00

Institut de Mécanique des Fluides de Toulouse

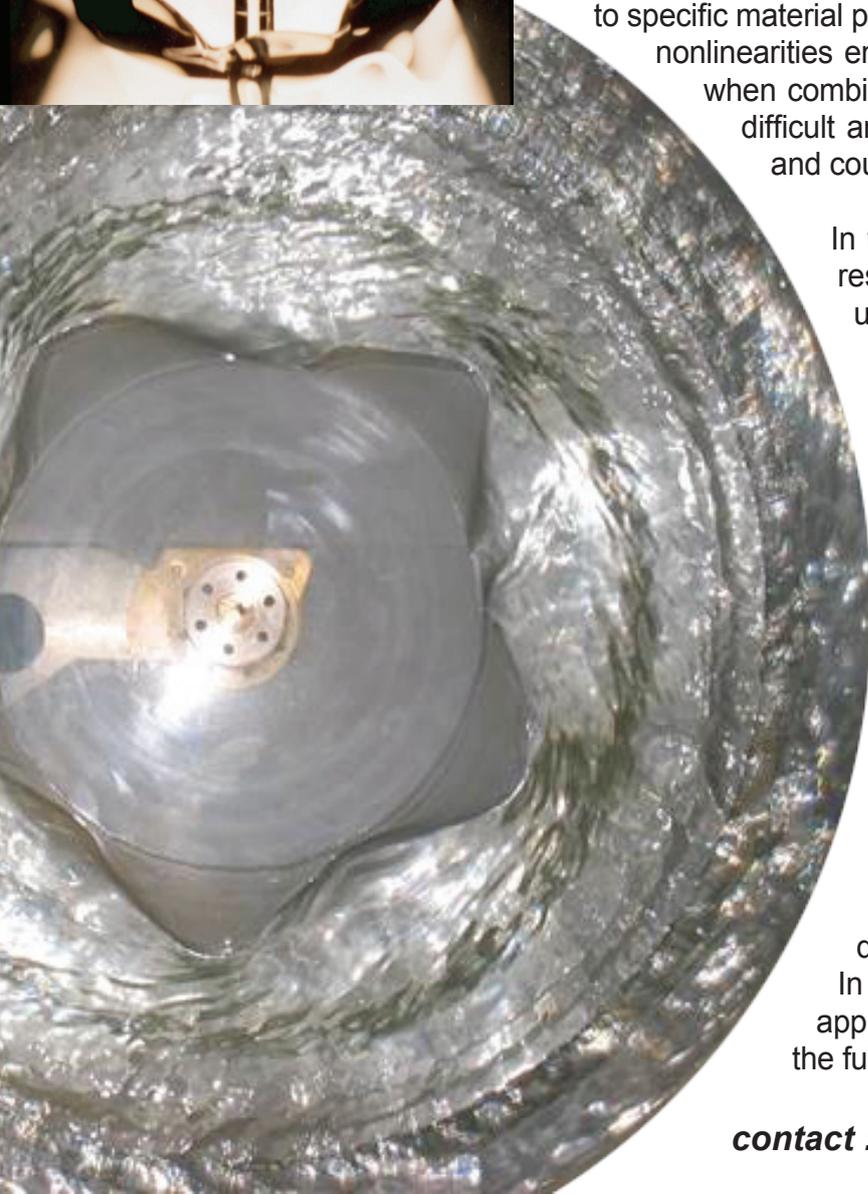
Amphithéâtre Nougaro - Allée du Pr. Camille Soula, Toulouse

The Power of Fluid Mechanics

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Fluid mechanics is a powerful scientific field spanning an unusually broad range of length scales and scientific disciplines. It is applied at length scales ranging from galaxies down to single molecules, even inside the atomic nucleus, and in fields ranging from hydraulic engineering to physics and biology. The main reason is that the Euler and Navier-Stokes equations are basically conservation laws with minimal reference to specific material properties and thus of very universal validity. The nonlinearities encountered in the Euler equations, in particular when combined with free surfaces, makes fluid mechanics difficult and challenging and has led to many surprising and counter-intuitive results.



In the talk I shall present some results on recent research topics, where I have learnt something unexpected. The first will be a case from macroscopic free surface fluid mechanics, where a stationary fluid flow generates sharp corners and spontaneously breaks the axial symmetry. Moving down in scale I shall discuss the millimetric bio-fluid flows generated in the violent and precise attacks made by ambush feeding copepods in the ocean. Next I shall discuss current ideas on the internal flows of water and solutes in trees, where the basic scales are micro/nanonmetric. Surprisingly, fluid mechanics can determine how the important structural length scales are set by the macroscopic length scales of the tree. Finally, moving at least by way of analogy, to subatomic length scales, I shall discuss the beautiful, quantum-like behaviour of bouncing drops, discovered by Couder and collaborators. In particular, I shall argue that this “realistic” approach to quantum mechanics cannot capture the full range of quantum mysteries.

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