Microfluidic generation and optical manipulation of ultra-deformable droplets

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The generation and manipulation of monodisperse droplets in the atto- to nanolitre volume range within microfluidic environments have enabled a variety of applications, including the synthesis of advanced materials, diagnostic testing and drug delivery. In this context, carefully chosen surfactants can be used to lower the interfacial tension of oil/water interfaces down to values of a few hundreds of nN/m, thereby enabling the creation of ultra-deformable droplets. The optical manipulation of such droplets has unlocked an exciting portfolio of potential technological applications, such as the synthesis of asymmetric solid particles and the formation of three-dimensional nanofluidic networks. In this talk, the generation, manipulation and characterisation of ultralow interfacial tension oil-in-water droplets will be discussed. A microfluidic platform for the manufacturing of stable ultra-deformable droplets and for the characterisation of their mechanical properties will be presented. The use of holographic optical trapping for the construction of user-defined 3D nanofluidic networks consisting of femtolitre droplets connected by stable liquid nanothreads will also be discussed.

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Venerdì 29 gennaio 2016 – Ore 10.30 – Aula 32
Dipartimento di Ingegneria Meccanica e Aerospaziale
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