

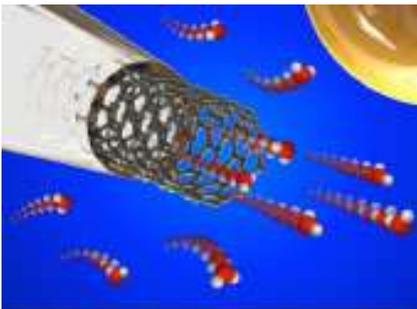
COLLOQUIUM DI FISICA

Giovedì 25 maggio 2017, ore 15.00
aula "A. Rostagni"

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Nanofluidics: fluid transport at the molecular scale

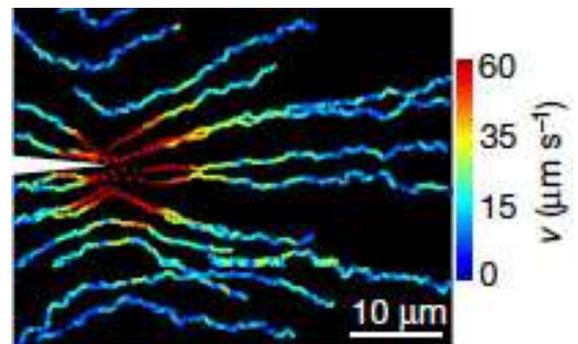


Nanofluidics is the frontier at which the continuum picture of fluid mechanics meets the atomic nature of matter. New models of fluid transport are expected to emerge from the confinement of liquids at the nanoscale, with potential applications in ultrafiltration, desalination and energy conversion [1-3]. Nevertheless, advancing our fundamental understanding of fluid transport on the smallest scales requires mass and ion dynamics to be ultimately characterized across an individual channel to avoid averaging over many pores. A major challenge for nanofluidics thus lies in building distinct and well-controlled

nanochannels, amenable to the systematic exploration of their properties.

In this context a system of particular interest is represented by individual Nanotubes : measurements and simulations have found that water moves through carbon nanotubes at exceptionally high rates owing to nearly frictionless interfaces [4,5]. These observations have stimulated interest in nanotube-based membranes, yet the exact mechanisms of water transport inside the nanotubes and at the water-carbon interface continue to be debated, because existing theories do not provide a satisfactory explanation for the limited number of experimental results available so far. This lack of experimental results arises because, even though controlled and systematic studies have explored transport through individual nanotubes, none has met the considerable technical challenge of unambiguously measuring the permeability of a single nanotube.

In this seminar we will revisit the current state of the art of nanofluidics and we will discuss how nanoassembling and manipulation offer new tool to investigate the fluid transport at a scale where the limit of the classic description is met [2]. We will finally present our recent studies on fluid transport in individual nanotubes and we will put them in the perspective of the new field of carbon nanofluidics [6].



- [1] L. Bocquet, E. Charlaix, *Chemical Society Reviews* **39**, 1073 - 1095 (2010)
- [2] D. Cohen-Tanudgi, J. Grossman, *Nanoletters* **12**, 3602-3608 (2012)
- [3] A. Siria *et al.*, *Nature* **494**, 455-458 (2013)
- [4] J.K. Holt *et al.*, *Science* **312**, 1034-1037 (2006)
- [5] K. Falk, F. Sedlmeier, L. Joly, R. R. Net, L. Bocquet, *NanoLetters* **10**, 4067 (2010)
- [6] E. Secchi, S. Marbach, A. Niguès, D. Stein, A. Siria, L. Bocquet, *Nature* **537** 210 (2016)