Nanofluidics : from fundamental trasport at nanoscale to application in energy harvesting and desalination

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Nanofluidics has emerged recently in the footsteps of microfluidics, following the quest for scale reduction inherent to nanotechnologies. By definition, nanofluidics explores transport phenomena of fluids at nanometer scales.
Why is the nanometer scale specific? What fluid properties are probed at nanometric scales? In other words, why does ‘nanofluidics’ deserve its own brand name?

In this course, we will explore the vast manifold of length scales emerging for fluid behavior at the nanoscale, as well as the associated mechanisms and corresponding applications.
We will in particular explore the interplay between bulk and interface phenomena. The limit of validity of the continuum approaches will be discussed, as well as the numerous surface induced effects occurring at these scales, from hydrodynamic slippage to the various electro-kinetic phenomena originating from the couplings between hydrodynamics and electrostatics. An enlightening analogy between ion transport in nanochannels and transport in doped semi-conductors will be discussed. Finally we will discuss the application of nanofluidic transport for energy harversting and water desalination