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Ionic transport in subnanometric-thick films

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Nanofluidics is a booming research field considering fluidic transport - such as hydrodynamic, electrical or thermal transport – in nanoconfined liquids. At such scales, the ratio surface to volume is extremely large and transport properties are mainly governed by interactions with interfaces.

Whereas classical electrostatic interactions predict pretty well ionic transport for 1-10 nm thick nanochannels, some anomalous properties have been reported in the regime of ultraconfinement, below 1 nm, where a continuous description fails.

This is the regime we are investigating here. For that, the conductance of water soft films that condense spontaneously from undersaturated vapour on hydrophilic silica surfaces is measured with respect to their thickness. This thickness is modulated by the relative humidity above the substrate. Despite some aging effects, the measurements are very stable and reproducible. Scaling laws derived from continuous description fit well the results for large humidity, i.e. for thickness above 1 nm but fails below. These experimental results in strong confinement open the way to new transport descriptions in ultraconfinement.

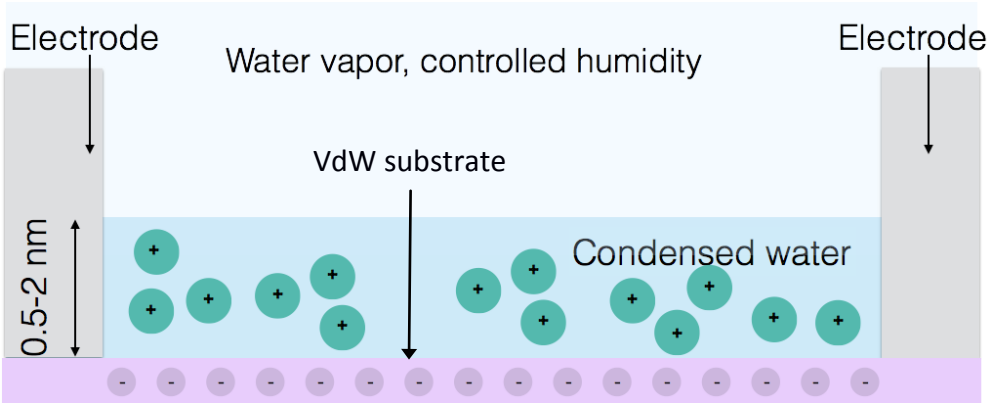

Figure 1: Schematic drawing of water soft film in Gouy-Chapman regime in contact with the electrodes