Osmotic flows driven by evaporation and condensation in microfluidics and nanofluidics

**Laboratory:** Institut Lumière Matière
**In Cooperation With:** iLM
**Level:** M1 / M2
**Team(s):** Liquides et interfaces (C. YBERT/ C. COTTIN-BIZONNE)

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**Keyword(s):** nanofluidics / osmosis / microfluidics

**Scientific Context:**
Osmosis is a process fundamental to many natural and industrial processes, from turgor pressure in plants and mechanical balance in living cells to desalination of seawater, renewable energy conversion, and cooking or food preservation strategies. It is one of many coupled phenomena arising at surfaces, where a gradient of solute concentration generates bulk flow, however its physical origins remain unclear, especially in partial exclusion cases. Recently we have shown that micro/nano-fluidic systems containing aqueous solutions responded strongly to variations in external water vapor pressure (i.e. relative humidity) due to osmotic effects driven by condensation and evaporation of water. As a result, micro/nano-fluidic platforms coupled to vapor pressure cycles provide promising ways to probe the mechanisms of osmosis.

**Missions:**
At iLM, we fabricate original structures combining microfluidic channels and nanoscale permeable media with well-controlled geometrical and surface properties. The internship aims at characterizing osmotic flows and condensation-evaporation driven processes in such systems as a function of solute type, concentration, and physical interaction with the structure (e.g. screened electrostatics vs. steric). The project will also include analytical and numerical modeling (in collaboration with the Theory team at iLM) to support the experimental investigations.

**Outlooks:**
PhD thesis on this or related topics possible.