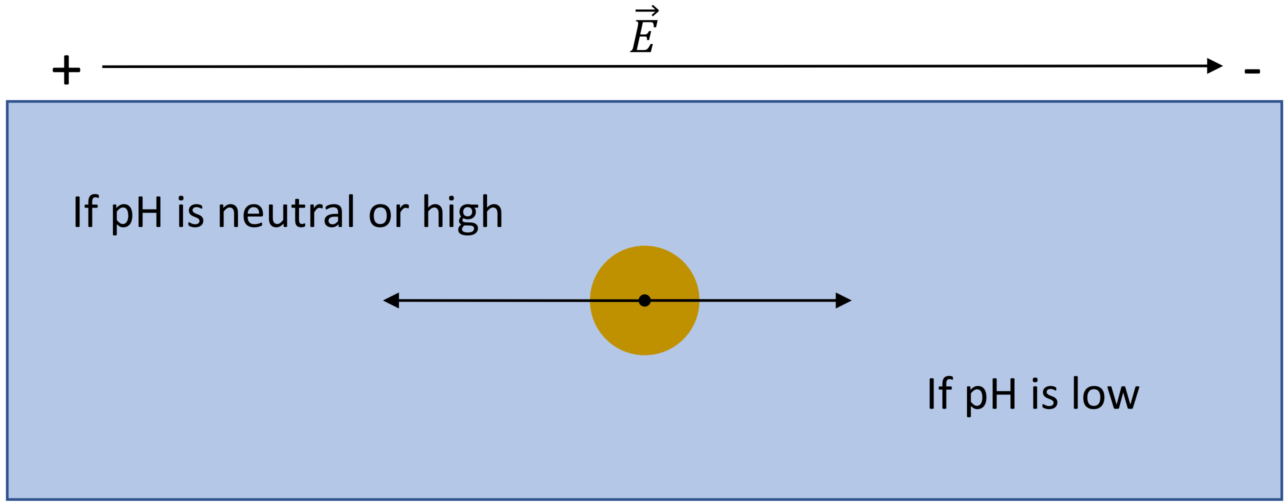
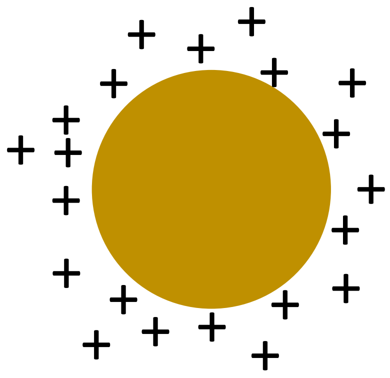
Movement of uncharged particles in the electrostatic field

Electrophoretic mobility of oil

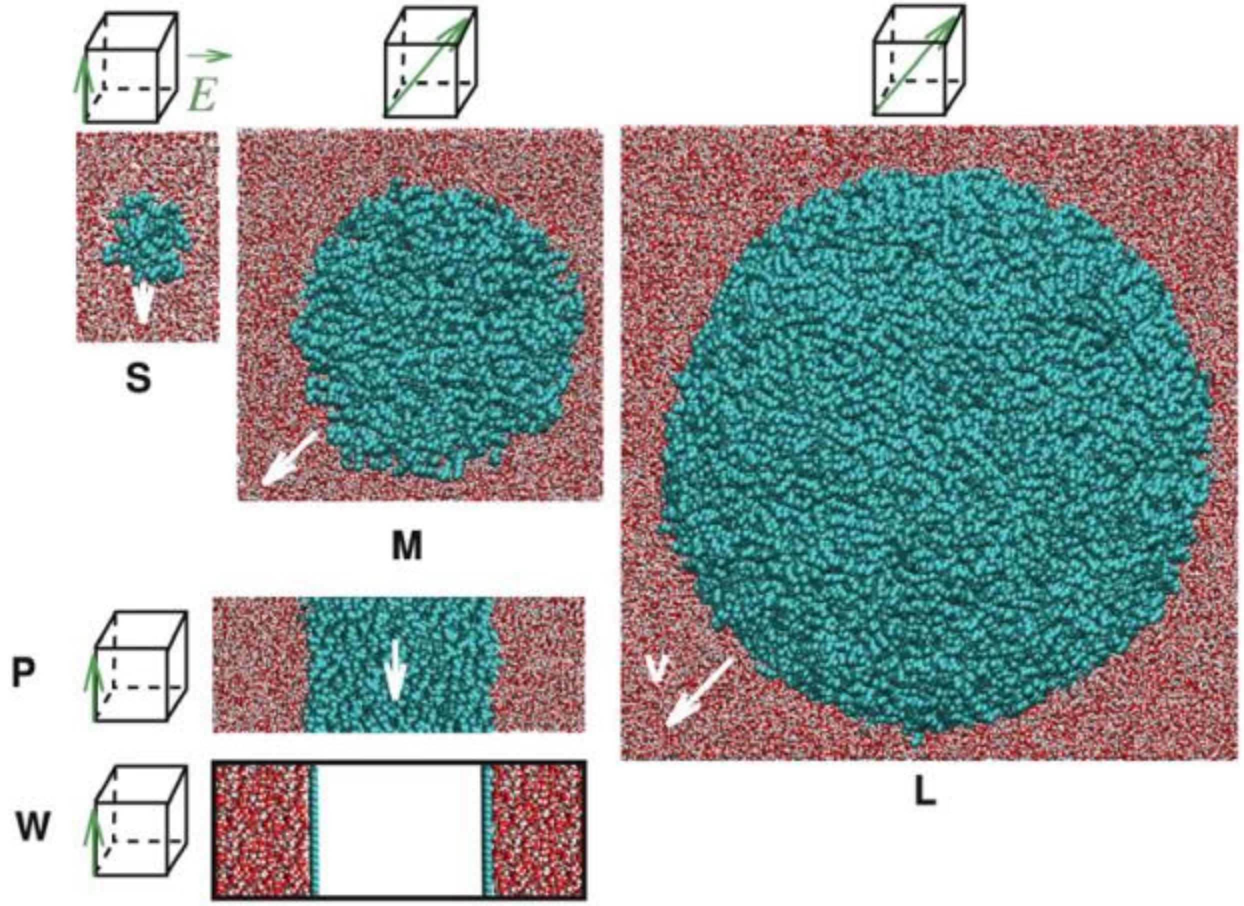
- Oil droplets in pure water show different mobilities depending on the pH
- Attributed to the adsorption of OH^- or H_3O^+ ⟶ surface charge
- Point of zero charge is at pH=6, but at that point there is negative mobility





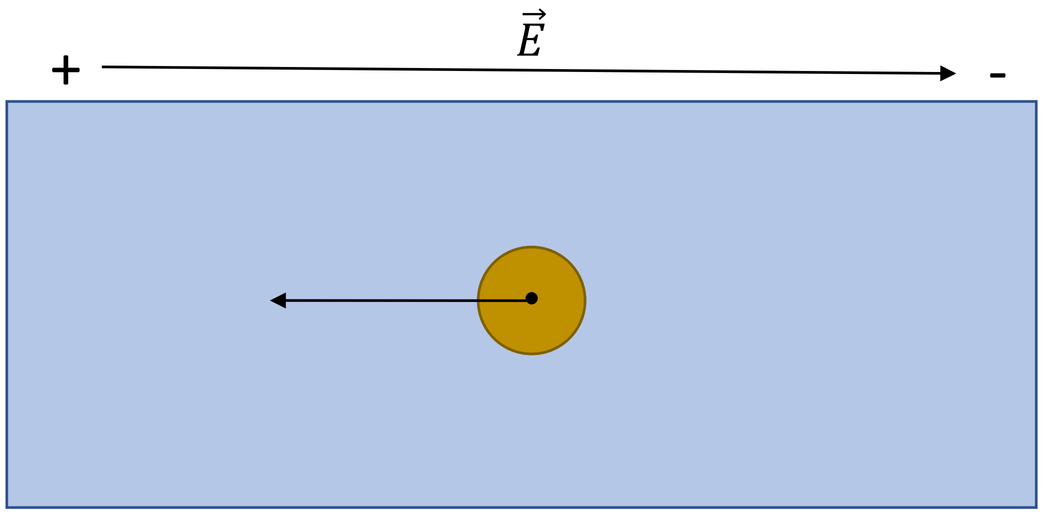
Electrophoretic mobility of oil

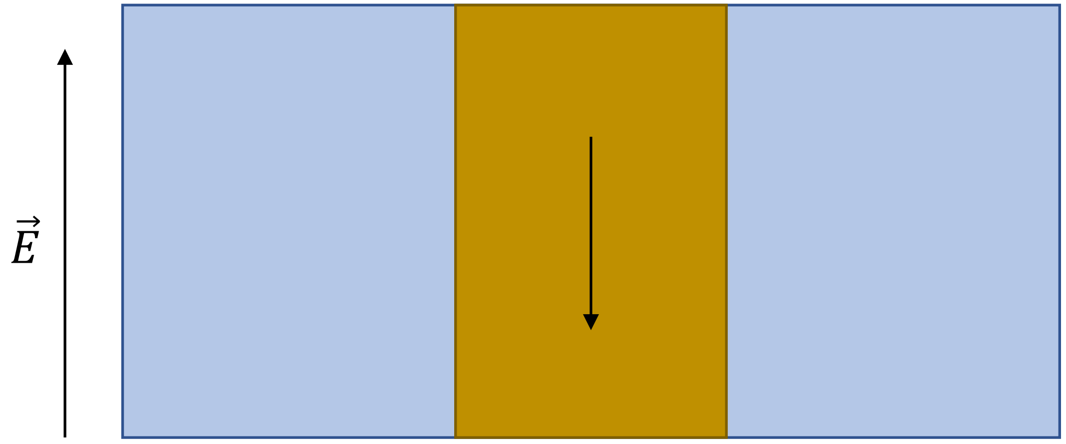
- Heptane droplet/slab in water
- Hydropobic wall in water
- Complete absence of ions
- Electric field



Electrophoretic mobility of oil

- Oil droplets migrate in the negative field direction
- Slab moves tangential to the interface
- Electrostatic potential of oil phase? → positive



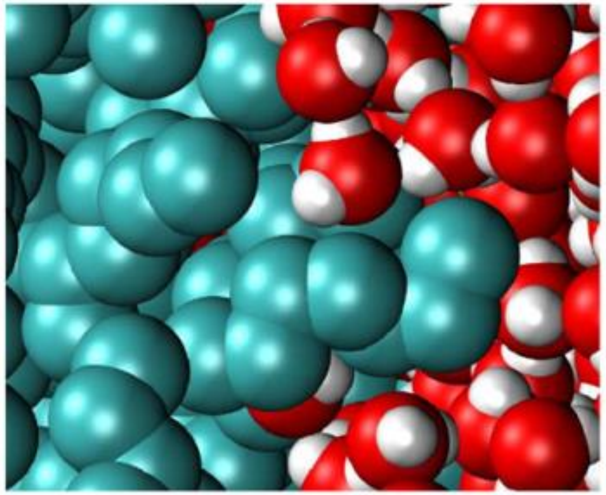


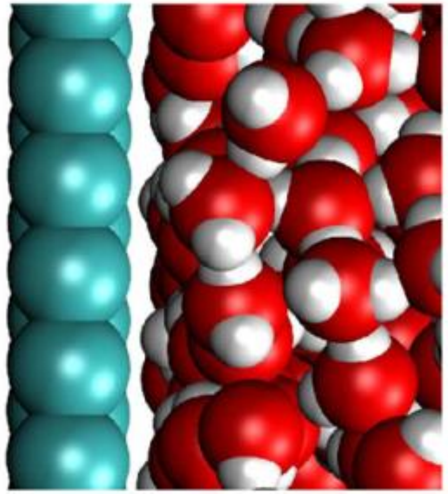
Electrophoretic mobility of oil

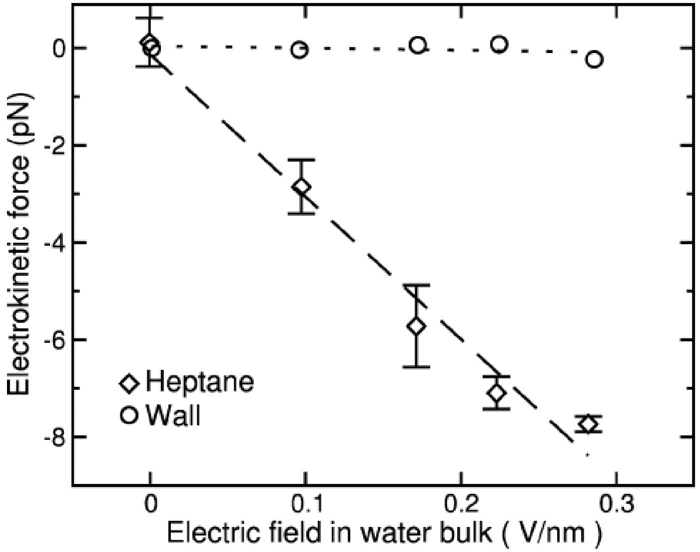
- Mobility contributions:

    electrophoretical force + frictional force

- Interface roughness is required for electrophoretic force





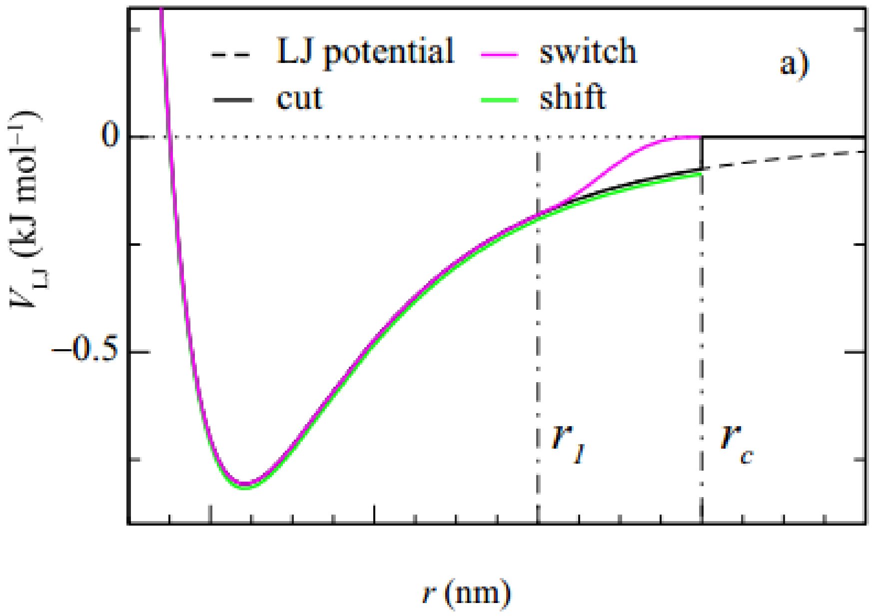


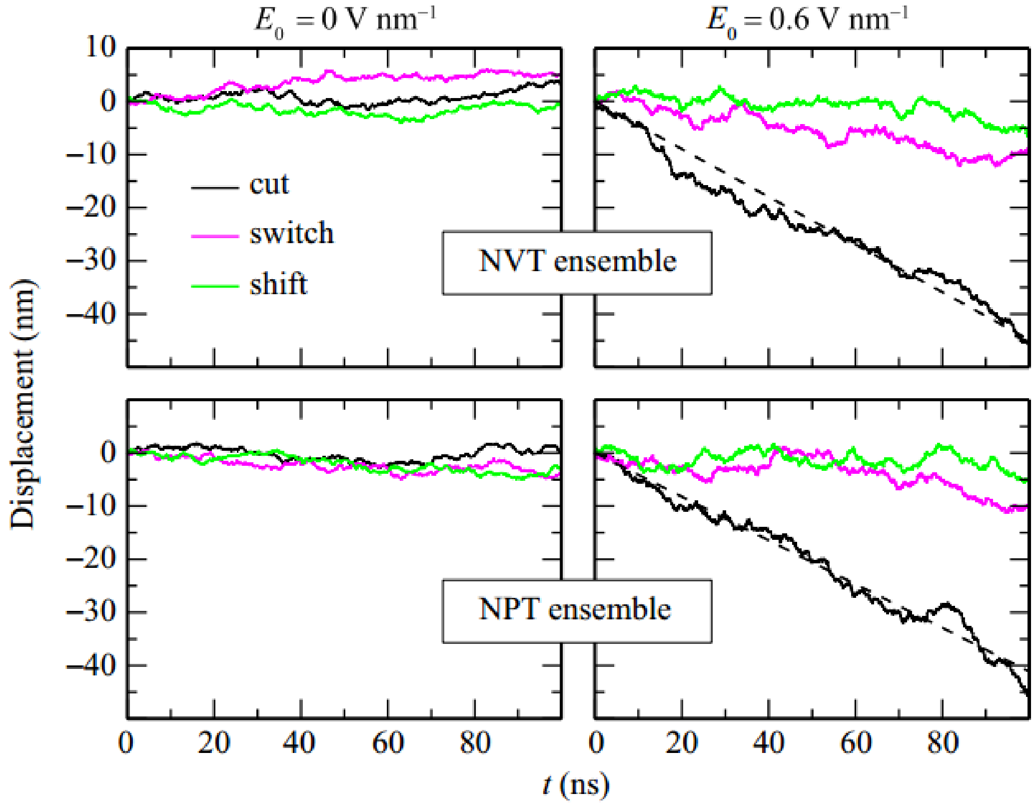
Electrophoretic mobility of oil - Conclusions

- Mobility in the absence of ions should be zero, but simulations show negative mobility
- Electrophoresis does not only reflect charge or electrophoretic potential of the droplet
- Mobility is attributed to partial charges of the atoms
- If true, electrophoretic experiments could me misleading

Electrophoretic mobility of oil - Explanation

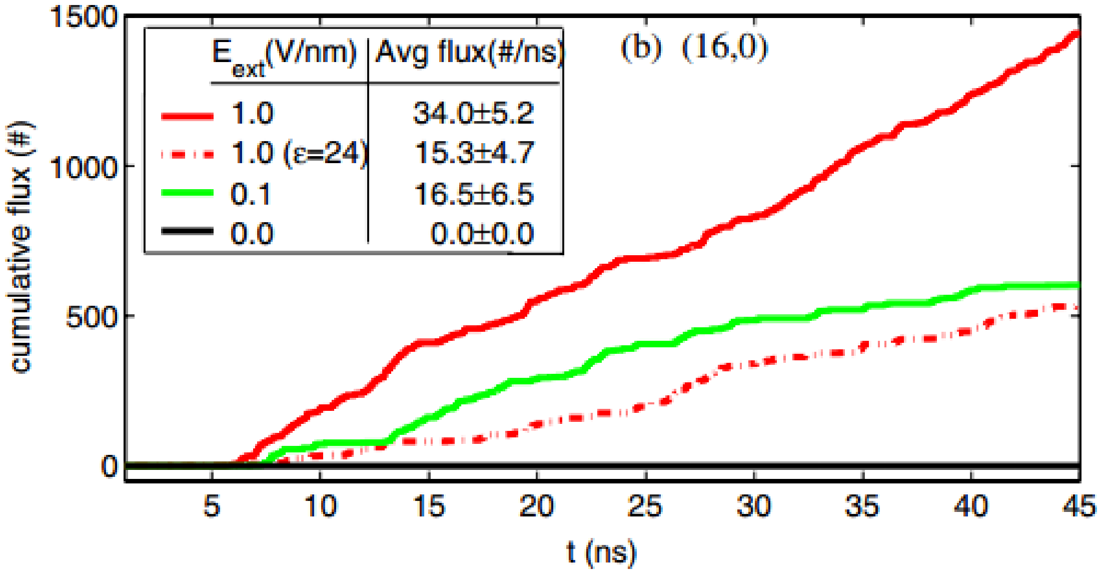
- Mobility only appears when using simple truncation method for LJ forces.

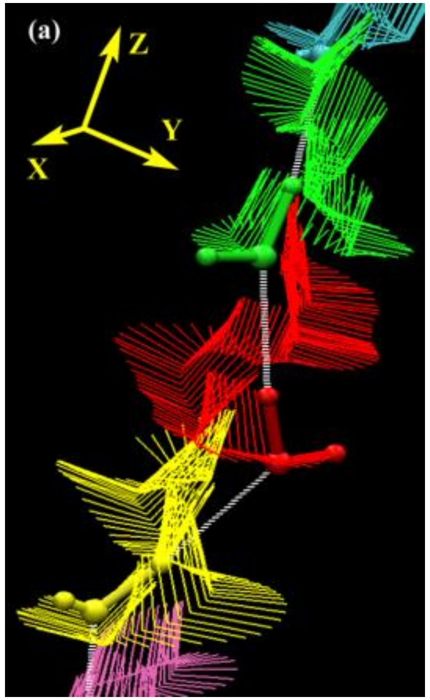




Water flow on carbon nanotubes

- Water oriented along one direction by aplying an external field
- Flux in the direction of the aligned water dipoles





Water flow on carbon nanotubes

- When using shift approach instead of truncated forces for LJ, mobilities dissapear.
- In LAMMPS, flux dissapears for smaller rc