

Triboelectricity in Sliding Water Drops: The Hydrovoltaic Effect

Water drops on a hydrophobic and electrically insulating substrate can generate electric potentials of kilovolts upon sliding for just a few centimeters. Despite many decades of research, the peculiar effect of spontaneous electrification in moving drops is far from being understood. In my group, we have developed tools to precisely determine the voltage of the tiny Nanocoulomb drop charges. In addition, we developed an electrostatic model that explains the relationship between the high drop voltages and the electrostatic double layer at the drop-substrate interface.

The aim of this project is to find the factors that determine the efficiency of the charge separation process. You will develop new measurement tools to investigate the influence of different factors such as drop speed, surface chemistry and sample geometry. I am looking for a motivated personality that likes to work, communicate and think between the disciplines of Physics, Chemistry and Engineering.

The project is funded by the German Science Foundation and is embedded in the SPP focus program 2171 “Dynamic Wetting of Flexible, Adaptive, and Switchable Surfaces”.

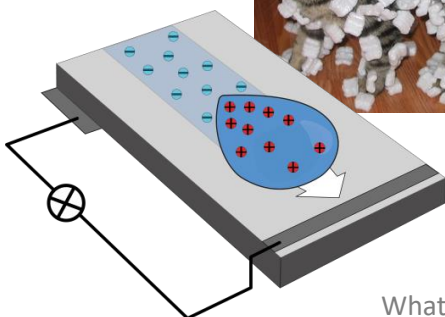
Your tasks:

- Development of an experimental setup to control drop speed, drop size, etc.
- Surface preparation on flat substrates and inside tubes
- Numerical simulations of the charging process

Further reading:

Stetten et al. *Slide electrification: Charging of surfaces by moving water drops* *Soft matter* **15**, 8667 (2019).

Li et al. *Spontaneous charging affects the motion of sliding drops* *Nature Physics* **18**, 713 (2022).



What do this cat and a sliding water drop have in common?

Both charge up electrically through friction.

https://en.wikipedia.org/wiki/Triboelectric_effect

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