Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Electrostatic cloaking of surface structure for dynamic wetting[1]
JUNICHIRO SHIOMI, SATOSHI NITA, The University of Tokyo, MINH DO-QUANG, The Royal Institute of Technology (KTH), JIAYU WANG, YU-CHUNG CHEN, YUJI SUZUKI, The University of Tokyo, GUSTAV AMBERG, The Royal Institute of Technology (KTH) — Dynamic wetting problems are fundamental to the understanding of the interaction between liquids and solids. Even in a superficially simple experimental situation, such as a droplet spreading over a dry surface, the result may depend not only on the liquid properties but also strongly on the substrate-surface properties; even for macroscopically smooth surfaces, the microscopic geometrical roughness can be important. In addition, as surfaces may often be naturally charged, or electric fields are used to manipulate fluids, electric effects are crucial components that influence wetting phenomena. Here we investigate the interplay between electric forces and surface structures in dynamic wetting. While surface microstructures can significantly hinder the spreading, we find that the electrostatics can cloak the microstructures, i.e. deactivate the hindering. We identify the physics in terms of reduction in contact-line friction, which makes the dynamic wetting inertial force dominant and insensitive to the substrate properties. Reference: S. Nita, M. Do-Quang, J. Wang, Y. Chen, Y. Suzuki, G. Amberg, J. Shiomi, Electrostatic cloaking of surface structure for dynamic wetting, Science Advances, e1602202 (2017).

[1]This work was financially supported in part by, the Japan Society for the Promotion of Science, Swedish Governmental Agency for Innovation Systems, and the Japan Science and Technology Agency.

Junichiro Shiomi
The University of Tokyo

Date submitted: 10 Jul 2017 Electronic form version 1.4