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Wetting dynamics and flow over hairy surfaces

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Evolution has allowed many species to exhibit wetting and adhesive properties ideally adapted to their environment, leading for instance to super-hydrophobic properties [Fig. 1(a)-(b)]. Over the past decades, the design of superhydrophobic surfaces relied on different biomimetic methods, and micro-texturing. Although quite promising, the performances and robustness of the synthetic surfaces remain limited compared to their biological counterparts. In particular, one key aspect of biological systems has been neglected : the flexibility of the microstructure, called micro-hairs or cilia in natural systems. Such flexible structures can be passive, act as detectors of fluid motion or move under the active control, as observed for some insects.

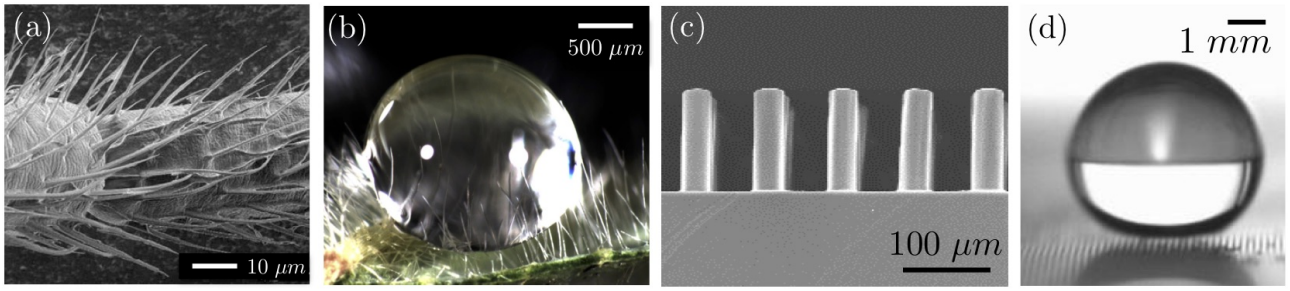

Figure 1: Hairy surfaces observed on (a) a leg of the insect *Mesoveilia* (Bernardino *et al.*, 2010) and (b) a Lady's mantle leaf (Barthlott *et al.*, 2010). (c) Example of synthetic hairy surface based on flexible PDMS cylinder and (d) drop sitting on such super-hydrophobic surface (Bolteau, 2018)

The aim of this project is to develop soft microstructured surfaces, as shown in Fig. 1(c) and provide a fundamental understanding of the fluid-microstructure interactions involved in wetting [Fig. 1(d)] and flow dynamics. Through experimental work, we will investigate the drop impact, wetting dynamics, and drag reduction of synthetic hairy surfaces. The experimental results will bring new insights into the role of hairs in biological systems and could lead to the design of new bio-inspired surfaces.

The internship will be carried out in the Mechanical Engineering department at the University of California at Santa Barbara (USA) and in collaboration with E. Barthel (ESPCI, France). The ideal applicant will have a strong taste for experimental studies and micro-fabrication.