**Wetting of Metamaterial Surfaces**

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**Project Description**

It seems intuitively obvious that when we stretch a material it becomes thinner. However, our intuition is not always correct. It is possible to design materials which when stretched also become fatter. Such materials are used to create, for example, a filter that can be defouled of particles by stretching and curtains, which contain the blast from an explosion. Nonetheless, how their surfaces interact with water – their wetting properties - has never been studied. Since we cannot escape water – from raincoats and car windscreens to ships and pipes – these unusual material properties may offer new possibilities providing we can understand and use them. Our group’s interest is in smart surfaces such as those inspired by the Lotus leaf which are super water repellent and stay clean in dirty water, and the *Nepenthes* pitcher plant whose surface is so slippery ants and other insects simply aquaplane into its digestive chamber. We try to understand and apply new surface concepts.

The types of research questions this PhD will address about these new materials include:

* How do the properties of super water-repellent and super-slippery surfaces change?
* How does droplet friction and motion change?
* How does impact and rebound of droplets change?
* What do these properties mean for physical applications for heat and mass transfer from evaporation and condensation to icing?

**Project Training and Development**

The PhD research student will use soft lithography, 3D printing, textured surface designs and hydrophobic and hydrophilic coatings to create new materials. To characterize surfaces and droplet interactions Scanning Electron Microscopy (SEM), confocal microscopy, contact angle goniometry and high-speed video imaging will be used together with Python for laboratory interfacing and integration. The project will use an experimental “conceive, design, build, test” approach and be guided by analytical theory and modelling. The balance between experimental work and theory/modelling can be adjusted depending on the interest of the PhD research student. The PhD will complement work on a UK EPSRC grant and may involve a short (few months) period or visits to collaborators in Germany.