Understanding Drop Impacts on Hydrophobic and Microstructured Surfaces

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Impacts of Newtonian fluid droplets are ubiquitous in nature and of widespread importance in industry. The phenomenon is reasonably well understood for ideal conditions, such as perpendicular impact on to an atomically smooth solid surface, a deep pool, or a thin liquid layer. However, surface structure (roughness) on many length scales plays a key role in most applications, and the effects of structure on drop impact outcomes is not well understood. Roughness also plays a role in determining the surface wettability, and hydrophobic surfaces have particularly been of interest recently for potential applications. This presentation will discuss two experimental investigations which seek to systematically study the interplay between surface roughness, hydrophobicity and drop impact outcomes. Experiments combine traditional contact angle experiments for static wetting with high speed photography of drop impacts and various surface characterization techniques. The first study concerns industrial coatings designed to reduce ice adhesion, which were tested at low temperatures in addition to ambient lab conditions. The second is an ongoing systematic study of surfaces consisting of regular micropillars fabricated in polydimethylsiloxane using standard soft lithography methods.