工学系研究科専攻間横断型教育プログラム
「機械システム・イノベーション」

GMSI

最先端融合科学イノベーション
教育研究コンソーシアム

東京大学 THE UNIVERSITY OF TOKYO

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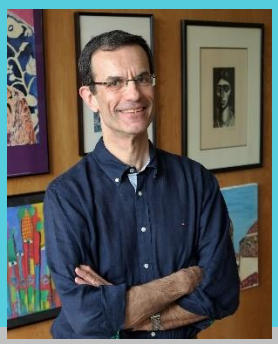
From water trampolining to ice jumping: Physics and nanoengineering of materials with intrinsic extreme icephobicity



Professor Dimos Poulikakos

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日 時: 2017年3月14日(火) 13:00－14:00
場 所: 東京大学工学部2号館 3F 232講義室

Spontaneous removal of discrete condensed matter from solids is of extreme importance in nature and in a broad range of technologies, e.g. self-cleaning, anti-icing, and condensation. Despite progress, the understanding of phenomena leading to such behavior, combined with rational surface design promoting their manifestation, remain a challenge.

In this lecture I will show how water droplets resting on superhydrophobic surfaces in a low-pressure environment can self-remove through sudden spontaneous levitation and subsequent trampoline-like bouncing behavior, i.e. sequential droplet-substrate collisions with restitution coefficients greater than unity, despite complete surface rigidity, seemingly violating the second law of thermodynamics. I will show that trampoline bouncing results from the combined effect of droplet vaporization, vapor flow in the surface texture, and substrate adhesion leading to a forced, underdamped, mass-spring-damper system behavior. Due to the high-vaporization rates experienced by droplets, and the inherently associated significant cooling, recalescent freezing can occur. We show how increasing vaporization —triggered suddenly by recalescent freezing— has a strong boosting effect and can spontaneously remove surface icing (by levitating or even launching away generated icy drops) the moment they freeze. This work is an important step toward understanding inherent physical phenomena of droplet-surface interactions manifesting themselves at conditions promoting vaporization and shows how surface texturing aware of such phenomena alone, can prohibit water droplet retention on surfaces, also when they freeze.

主催: 東京大学大学院工学系研究科「機械システム・イノベーション」プログラム（GMSI）
「最先端融合科学イノベーション教育研究コンソーシアム」（CIAiS）

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