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Department of Physics
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Drops Oleoplane, Dance, and Explode on Lubricated Surfaces

by

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Join Zoom Meeting: <https://128.pl/p03Vk>



ALL INTERESTED ARE WELCOME

Abstract

In 2011, Wong, Aizenberg, and co-workers introduced the innovative concept of infusing a solid surface with a thin oil film to eliminate contact-line pinning [1]. The invention of this new material class—lubricated surfaces—has since revolutionized the design of super-repellent surfaces, with important anti-fouling and heat transfer applications.

In this talk, I will explore three intriguing phenomena observed on these surfaces. First, I will describe how drop mobility arises from a thin oil film beneath the drop, enabling it to oleoplane—a form of levitation analogous to car hydroplaning on wet roads. This behaviour is deeply connected to classic problems in fluid dynamics, such as the Landau-Levich-Derjaguin film and the Bretherton problem [2]. Next, I will discuss how condensing drops can exhibit spontaneous collective motion, "dancing" across the surface, a unique example of active matter system fuelled entirely by condensation [3]. Finally, I will delve into the spontaneous occurrence of Coulomb explosions in evaporating drops [4]. Together, these topics highlight the rich, interdisciplinary connections between droplet physics and broader fields in soft matter physics and electrohydrodynamics.

1. T.-S. Wong, ..., J. Aizenberg, "Bioinspired self-repairing slippery surfaces with pressure-stable omniphobicity," *Nature* (2011)
2. **D. Daniel**, ..., J. Aizenberg, "Oleoplaning droplets on lubricated surfaces", *Nature Physics* (2017)
3. M.Lin, ..., **D. Daniel***, "Emergent collective motion of self-propelled condensate droplets", *Phys. Rev. Lett.* (2024).
4. M. Lin, ..., **D. Daniel***, "Evaporation-driven electrosprays in charged drops on lubricated surfaces", *Preprint* (2024). DOI:[10.13140/RG.2.2.27778.90565](https://doi.org/10.13140/RG.2.2.27778.90565)