



## MECHANICAL ENGINEERING SEMINAR

**Monday, March 18 2024 at 14:30**, D. Dan and Betty Kahn Building , Room 217

**Online:** <http://technion.zoom.us/BestSeminarEver>

### Long-time levitation of evaporating droplets

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**Hosted by: Prof. Oleg Gendelman**

Liquid droplets play a key role in industrial applications that involve heat and mass transfer due to a large surface-to-volume ratio. They are used, e.g., in ink-jet printing, microfluidic transport, microscale chemical reactors; the applications call for a robust non-invasive mechanism that allows manipulation over droplets. The talk presents a system of that kind. We study the millimetric size droplets levitating over a liquid bath heated below the boiling point of the droplet. For properly chosen liquids for the droplet and the bath, one observes a relatively long (from several tens of seconds to tens of minutes) staying of the droplet slightly above the bath surface at nearly constant temperature. This system, on one hand, benefits from almost frictionless motion of the droplet using the advantages like the Leidenfrost effect (levitation over a hot plate due to a vapor cushion underneath the droplet) but enjoys much softer lifetime limitations defined by the heat flux from the bath. We present the results of experimental studies focusing on the lifetime and the stability of droplet levitation, and the mathematical model of the system. We distinguish different scenarios of the behavior of the droplet placed onto the bath and find the criteria for the levitation occurring. The model considers quasi steady-state levitation to explain the supporting force mechanism and estimate the lifetime. It includes a wide range of relevant factors; the key points are coupled convection in the bath and the ambient air, capillary equilibrium of the droplet in the gravity field, Stokes flow in the gap between the droplet and the bath. The theoretical findings are validated by our experiments and external numerical simulations and provide practical suggestions for the system optimization.



Evgeny Mogilevskiy graduated MSc and PhD in Fluid Mechanics from Lomonosov Moscow State University in Russia. After a postdoctoral fellowship at the University of Leuven (Belgium), he worked at Lomonosov Moscow State University as a faculty member. The focus of his group research was on free surface viscous liquid flows. In 2022, Evgeny Mogilevskiy repatriated to Israel and after a fellowship at Weizmann Institute of Science with Prof. Gregory Falkovich, started working as a researcher at Tel Aviv University, School of Mechanical Engineering, in the group of Prof. Lev Shemer on theoretical and experimental investigation of the gravity waves.

