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Title of the lecture:
Dynamics and Fluctuations of Nanomechanical Resonators in Fluids

Format:
TBA

Summary
I will first provide an introduction to fundamental ideas in gas kinetics and hydrodynamics [1]. A discussion of the dynamics of micro- and nanomechanical resonators immersed in gases and liquids will follow. I will then turn to the problem of Brownian fluctuations of a nanomechanical resonator in a liquid. Here, I will introduce the Fluctuation-Dissipation Theorem and Linear Response Theory of Statistical Mechanics, and show how the Brownian force acting on a nanomechanical resonator can be found from fluid dynamics [2]. At the end, I will look at the nanomechanical fluctuations, noise, and coherent oscillations in biological systems, such as bacteria and cardiac microtissues [3].

References:

1. V. Kara, V. Yakhot, and K. L. Ekinci, Generalized Knudsen Number for Unsteady Fluid Flow, Phys. Rev. Lett. 118, 074505.
2. Atakan B. Ari, M. Selim Hanay, Mark R. Paul, and Kamil L. Ekinci, Nanomechanical Measurement of the Brownian Force Noise in a Viscous Liquid, Nano Lett. 2021, 21, 1, 375–381.
3. Y. Yang, K. Gupta, K. L. Ekinci, All-electrical monitoring of bacterial antibiotic susceptibility in a microfluidic device, Proceedings of the National Academy of Sciences 117 (20), 10639-10644.