Nanofluidics of Oscillating Bodies: Application to Nanoresonators

The dynamics of oscillating bodies are considered in the entire range of dimensionless frequency variation $0 \leq Wi \equiv \omega \tau \leq \infty$ where $\tau$ is the relaxation time of a close-to-equilibrium fluid. I will show the analytic solution to the Boltzmann-BGK equation and present a universal expression for the dissipation rate of kinetic energy valid in both Newtonian ($Wi \to 0$) and non-Newtonian ($Wi \to \infty$) regimes. The theoretical predictions have been tested against LBM numerical simulations and experiments of nanoresonators operating in a wide range ($10^6 \text{ Hz} \leq \omega 10^9 \text{ Hz}$, frequency and pressure ($1 \text{ torr} \leq p \leq 1000 \text{ torr}$) variation. The experimental results are insensitive to variation of a linear dimension of the resonator in the interval $10^{-6} m \leq L \leq 10^{-2} m$.

TUESDAY, SEPTEMBER 16, 2008
3:00pm
Barus & Holley, Room 190