Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Flow Regimes and Parametric Competitions in Nanochannel Flows CHONG LIU, ZHIGANG LI, Department of Mechanical Engineering, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong — Nanoscale fluid flow systems involve both micro- and macroscopic parameters, which compete with each another and lead to different flow regimes. In this work, we investigate the competitions of four fundamental parameters, including the fluid-fluid, fluid-wall binding energies, temperature of the system, and driving force. By illustrating the fluid flux as a function of a dimensionless number, which represents the effective surface effect on the fluid, we show that the fluid motion in nanochannels falls into different regimes. For small fluid-fluid self-binding energy, there are three flow regimes; as the dimensionless number increases, the flux undergoes a transition from fluid-wall binding energy independent to temperature independent. If the fluid-wall binding energy is of the order of room temperature, there is a critical value for the dimensionless number, which divides the flow into weak and strong fluid-wall interaction regimes. Each of these regimes is associated with a distinct mechanism which reveals the competitions of the parameters.

Chong Liu
Dept of Mechanical Engineering, The Hong Kong University of Science
and Technology, Clear Water Bay, Kowloon, Hong Kong

Date submitted: 21 Oct 2009 Electronic form version 1.4