Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Non-equilibrium steady-state distributions of colloids in a tilted periodic potential[1] XIAOGUANG MA, University of Pennsylvania, PIK-YIN LAI, National Central University, BRUCE ACKERSON, Oklahoma State University, PENGER TONG, Hong Kong University of Science and Technology — A two-layer colloidal system is constructed to study the effects of the external force F on the non-equilibrium steady-state (NESS) dynamics of the diffusing particles over a tilted periodic potential, in which detailed balance is broken due to the presence of a steady particle flux. The periodic potential is provided by the bottom layer colloidal spheres forming a fixed crystalline pattern on a glass substrate. The corrugated surface of the bottom colloidal crystal provides a gravitational potential field for the top layer diffusing particles. By tilting the sample with respect to gravity, a tangential component F is applied to the diffusing particles. The measured NESS probability density function $P_{ss}(x, y)$ of the particles is found to deviate from the equilibrium distribution depending on the driving or distance from equilibrium. The experimental results are compared with the exact solution of the 1D Smoluchowski equation and the numerical results of the 2D Smoluchowski equation. Moreover, from the obtained exact 1D solution, we develop an analytical method to accurately extract the 1D potential $U_0(x)$ from the measured $P_{ss}(x)$.

[1]Work supported in part by the Research Grants Council of Hong Kong SAR

Xiaoguang Ma
University of Pennsylvania

Date submitted: 05 Nov 2015 Electronic form version 1.4