Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Biased Brownian motion in narrow channels with asymmetry and anisotropy KIWING TO, Institute of Physics, Academia Sinica, ZHENG PENG, School of Physics and Electronics, Central South University — We study Brownian motion of a single millimeter size bead confined in a quasi-two-dimensional horizontal channel with built-in anisotropy and asymmetry. Channel asymmetry is implemented by ratchet walls while anisotropy is introduced using a channel base that is grooved along the channel axis so that a bead can acquire a horizontal impulse perpendicular to the longitudinal direction when it collides with the base. When energy is injected to the channel by vertical vibration, the combination of asymmetric walls and anisotropic base induces an effective force which drives the bead into biased diffusive motion along the channel axis with diffusivity and drift velocity increase with vibration strength. The magnitude of this driving force, which can be measured in experiments of tilted channel, is found to be consistent to those obtained from dynamic mobility and position probability distribution measurements. These results are explained by a simple collision model that suggests the random kinetic energies transfer between different translational degrees of freedom may be turned into useful work in the presence of asymmetry and anisotropy.

Kiwing To
Institute of Physics, Academia Sinica

Date submitted: 28 Jul 2016 Electronic form version 1.4