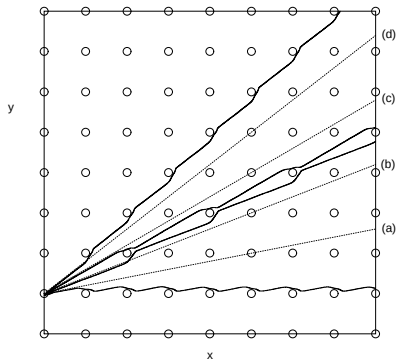
SORTING OF PARTICLES IN PERIODIC POTENTIALS

M. Khoury[1], A.M. Lacasta[2], J.M. Sancho[1] and K. Lindenberg[3].

(1) Departament d'Estructura i Constituents de la Matèria, Facultat de Física, Universitat de Barcelona, Diagonal 647, E-08028 Barcelona
(2) Departament de Física Aplicada, Universitat Politècnica de Catalunya, Avinguda Doctor Marañon 44, E-08028 Barcelona
(3) Department of Chemistry and Biochemistry 0340 and Institute for Nonlinear Science, University of California, San Diego, California 92093-0340

Particles moving on crystalline surfaces and driven by external forces or flow fields can acquire velocities along directions that deviate from that of the external force. This effect depends on characteristics of the particles and can therefore be used to sort different particles. We introduce a simple model for particles subject to thermal fluctuations and moving in different types of potential landscapes, such as those with periodic traps, periodic obstacles and mixed potentials with both traps and obstacles. Our approach clarifies the relevance of different parameters, the magnitude and direction of the external force (see figure), particle size, and temperature. In particular, resolution (calculated as the ratio between separation and dispersion for two type of particles) has been determined as a measure of sorting capability. Numerical results are compared to recent experiments on landscapes produced with holographic optical tweezers and microfabricated technology.



[1] A. M. Lacasta et al., Phys. Rev. Lett. **94**, 160601 (2005).
[2] J. M. Sancho et al., J. Phys.: Condens. Matter **17**, S4151 (2005).