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Colloidal diffusion over a quasicrystalline-patterned substrate YUN SU, Department of Physics, Hong Kong University of Science Technology, PIK-YIN LAI, Department of Physics, National Central University, BRUCE ACKERSON, Department of Physics, Oklahoma State University, PENGER TONG, Department of Physics, Hong Kong University of Science Technology — We report a systematic study of colloidal diffusion over a quasicrystalline-patterned substrate. The sample substrate is made of a flat thin layer of photoresist and contains identical cylindrical holes of diameter d_h, which are arranged on a quasicrystal lattice. A monolayer of silica spheres of diameter comparable to d_h diffuse over the rugged quasicrystalline-patterned substrate and experience a gravitational potential $U(x, y)$. With optical microscopy and the particle tracking method, we measure $U(x, y)$ and particle's diffusion trajectories, which are found to undergo two distinct states: a trapped state when the particles are inside the holes and a free diffusion state when they are over the flat portion of the substrate. The dynamic properties of the diffusing particle, such as its mean dwell time, mean square displacement, and long-time diffusion coefficient D_L are obtained from the particle trajectories. The measured D_L is found to be in good agreement with the prediction of two theoretical models proposed for diffusion over a quasicrystal lattice. The experiment demonstrates the applications of this newly constructed colloidal potential landscape. This work was supported by the Research Grants Council of Hong Kong SAR.

Penger Tong
Hong Kong Univ of Sci
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