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Colloidal diffusion over a random landscape YUN SU, XIAOGUANG MA, Hong Kong University of Science and Technology, PIK-YIN LAI, National Central University, Taiwan, PENGER TONG, Hong Kong University of Science and Technology — A two-dimensional quenched random energy landscape is generated by using a randomly packed layer of colloidal spheres of two different sizes fixed on a glass substrate. A number of monodisperse particles diffuse on the top of the first layer particles. The diffusing particles in water feel the gravitational energy landscape U(x,y) generated by the modulated surface of the first layer particles. The trajectories of the particles are obtained by optical microscopy and particle tracking. The energy landscape U(x,y) is obtained from the measured population histogram P(x,y) of the diffusing particles via the Boltzmann distribution, P(x,y) =exp[-U(x,y)/ k_BT], where k_B T is the thermal energy of the particles. The distribution of the energy barrier heights is obtained from the measured U(x,y). From the particle's trajectories, we obtain the dynamical properties of the diffusing particles over the random energy landscape, such as the mean square displacement and distribution of the escape time across the energy barriers. A quantitative relationship between the long-time diffusion coefficient and the random energy landscape is found experimentally, which is in good agreement with the theoretical prediction.
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