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Giant Enhancement of Colloidal diffusion in a Corrugated Optical Vortex SANG-HYUK LEE, DAVID G. GRIER, Department of Physics and Center for Soft Matter Research New York University — We experimentally study thermally driven velocity fluctuations of a Brownian particle in a tilted washboard potential. Our system consists of a single fluid-borne colloidal sphere driven by a holographically projected superposition of optical vortices. A single optical vortex is a ring-like optical trap created by focusing a helical mode of laser light. Torque exerted by an optical vortex's orbital angular momentum flux drives a trapped colloidal particle around its circumference. Superposing two optical vortices with opposite helicities and different amplitudes creates a corrugated optical vortex with sinusoidal intensity variations around its circumference. The resulting tilted washboard potential admits both static trapped states and dynamic running states. Digital video microscopy measurements of the resulting particle trajectories reveal a hundredfold enhancement of the effective self-diffusion coefficient near the static-to-running transition.

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