

Abstract

Here, by simulating the motion of drifting and of kicked Au clusters on graphite – a workhorse system of experimental relevance, we demonstrate and characterize a novel “ballistic” friction regime at high speed, separate from drift at low speed. The temperature dependence of the cluster slip distance and time, measuring friction, is opposite in these two regimes, consistent with theory. Crucial to both regimes is the interplay of rotations and translations, shown to be correlated in slow drift but anticorrelated in fast sliding. Despite these differences, we find the velocity dependence of ballistic friction to be, like drift, viscous.