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Molecular dynamics simulations of Leidenfrost droplets on a vibrating nano ratchet ABHISHEK KUMAR, NICKOLAY LAVRIK, MIGUEL FUENTES-CABRERA, Oak Ridge National Laboratory — Asymmetrically nanostructured surfaces can function as Brownian ratchets, that is, create a bias in mass or energy flows in response to thermal noise or in a more general case, isotropic excitations. Recently, experimental studies have shown that it is possible to induce directional movement of water droplets deposited on a vertically vibrating hydrophobic substrate made of inclined nanopillars. To investigate this issue, we have performed large-scale molecular dynamics (MD) simulations of a water droplet on a pillared graphitic substrate. We have found that our results not only reproduce the experimental behavior but also reveal new phenomena. In particular, it was found that at certain critical amplitude and frequency, the motion of the droplet transits from circular to linear-oscillatory along the substrate. The transition ultimately depends on the relative size of droplet and pillars, suggesting new ways of controlling the movement of water droplets on superhydrophobic substrates.

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