Abstract Submitted
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Slip: How it Happens[1] ASHLIE MARTINI, SETH LICHTER, RANDALL SNURR, JANE WANG, Northwestern University — Liquids do not always obey the no-slip condition: the liquid and the adjacent boundary can be in relative motion. The amount of slip is often presented as a slip length, which is an average over all molecules adjacent to the boundary. Hence, the molecular-level detail of how the liquid molecules traverse over the solid surface is lost. For example, the same slip length can arise due to the fast motion of a few molecules as well as from the slow drift of many molecules. We present data from molecular dynamics simulations which shows how liquids slip. At low shear rates, only a small percentage of the molecules at the liquid-solid interface participate in slip: the creation of a vacancy at the liquid-solid interface precipitates a sequence of molecular hops which can be described in terms of the propagation of a local nonlinear mode along the interface. At high shear rates, there is a global motion in which all molecules at the interface contribute. There is a well-defined bifurcation from defect slip to global slip. This transition can be controlled through choice of channel geometry, lattice orientation and liquid properties.

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