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Slip stick and the rapid dynamics of static friction

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Understanding the dynamics of frictional sliding is important for various fields,ranging from engineering to geophysics. We focus on the local dynamics of slip events that arrest before traversing an entire frictional interface. Our experiments measure slip and contact area evolution, at timescales spanning μsec to hundreds of seconds. We recognize three distinct phases of local slip dynamics. The first phase consists of a rapid drop in the contact area, accompanied by the onset of local slip at velocities of $\sim$10-25cm/sec that occurs immediately upon passage of a rapid detachment front. The second phase consists of steady-sliding at constant lower velocities (0.3-1cm/sec). The final phase comprises logarithmic aging of the contact area, which starts immediately upon slip arrest, within 400μsec of the front arrival.