Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Events before droplet splashing on a solid surface SHREYAS MANDRE, MADHAV MANI, MICHAEL BRENNER, Harvard University — A high velocity impact between a liquid droplet and a solid surface produces a splash. Classical observations traced the origin of this splash to a thin sheet of fluid ejected near the impact point, though the fluid mechanical mechanism leading to the sheet is not known. Mechanisms of sheet formation have heretofore relied on initial contact of the droplet and the surface. In this paper, we theoretically and numerically study the events within 1 μs of contact. The droplet initially tries to contact the substrate by either draining gas out of a thin layer or compressing it, with the local behavior described by a self similar solution of the governing equations. This similarity solution is not asymptotically consistent: forces that were initially negligible become relevant and dramatically change the behavior. Depending on the radius and impact velocity of the droplet, we show that the solution is overtaken by either the surface tension of the liquid–gas interface or viscous forces in the liquid. At low impact velocities surface tension stops the droplet from impacting the surface, whereas at higher velocities viscous forces become important before surface tension.

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Date submitted: 06 Aug 2009 Electronic form version 1.4