Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Drop impact on solid surface: Short time self-similarity JULIEN PHILIPPI, PIERRE-YVES LAGRÉE, ARNAUD ANTKOWIAK, UPMC Univ Paris 06, CNRS, UMR 7190 Institut Jean Le Rond d'Alembert, Paris, France —
Drop impact on a solid surface is a problem with many industrial or environmental applications. Many studies focused on the last stages of this phenomenon as spreading or splashing. In this study we are interested in the early stages of drop impact on solid surface. Inspired by Wagner theory developed by water entry community we shown the self-similar structure of the velocity field and the pressure field. The latter is shown to exhibit a maximum not near the impact point, but rather at the contact line. The motion of the contact line is furthermore shown to exhibit a transition from "tank treading" motion to pure sweeping when the lamella appears. We performed numerical simulations with the open-cource code Gerris which are in good agreement with theoretical predictions. Interestingly the inviscid self-similar impact pressure and velocities depend on the self-similar variable $r/\sqrt{t}$. This allows to construct a seamless uniform analytical solution encompassing both impact and viscous effects. We predict quantitatively observables of interest, such as the evolution of total and maximum viscous shear stresses and net total force. We finally demonstrate that the structure of the flow resembles a stagnation point flow unexpectedly involving $r/\sqrt{t}$.

Julien Philippi
UPMC Univ Paris 06, CNRS, UMR 7190 Institut Jean
Le Rond d'Alembert, Paris, France

Date submitted: 18 Jul 2014 Electronic form version 1.4