

# The Effect of Rapid Pressure Change on the Morphology of Splashes in a Low Pressure System

William Stumph

## Introduction

When a drop of liquid impacts a solid surface under normal conditions a portion of the liquid rebounds from the surface as it spreads from the force of its impact. This phenomenon is known as a splash. Many parameters are known to impact the properties of a splash: the liquid's velocity, viscosity, surface tension, and inertia to name a few (Worthington 1894). However, recently the fluid medium through which the drop moves before impact has recently been shown to drastically affect the properties of a splash by Xu et al (2005). Xu demonstrated that at low pressures the magnitude of the splash could be reduced and prevented altogether. This has led to the theory that "corona" splashing, in which a roughly symmetrical disc shape crown is formed, is caused by fluid, and that "prompt" splashing is caused by surface roughness (Xu et al 2008).

The mechanism of the "corona" splashes is disputed to be either Rayleigh-Taylor instability, in which the densities and accelerations of the fluids play a large role, or Kelvin-Helmholtz instability, which is driven by the relative velocities of fluids. The dominant theory is currently Kelvin-Helmholtz and is argued convincingly by Yoon et al (2006). In both scenarios the pressure, density, compressibility, and other properties of the fluid medium combine to influence the splash as modeled by Park et al (2007) via computational simulations. In these simulations Park shows that the fluid along the edge of the liquid is a primary influence on the formation of the primary splash crown, while the pressure of the fluid trapped between the surface and the liquid seems to influence the formation of a secondary splash characterized by the formation of fingerlike extrusions.

In order to confirm this relationship, this experiment aims to rapidly adjust the medium pressure within a small range along the threshold for splash formation for the duration of the impact and splash. The intention is to indirectly influence the pressures of the trapped fluid and displaced fluid separately. The initial medium pressure will impact the trapped pressure and the final medium pressure will impact the displaced fluid pressure. By varying the initial and final pressures and quantifying the impact on the formation of splash crowns and "fingers" this experiment will attempt to answer the question, "how do initial and final medium pressures affect the formation of crowns and fingers of splashes?" Review of previous experimentation has led to the hypothesis that the initial pressure will influence only the pressure of the fluid trapped and thus the formation of fingers, while the final pressure will influence only the pressure of the displaced fluid along the edge of the drop and thus the formation of a crown feature.

## References

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