1 Introduction

The Drop Splasher [1] was used to capture the interaction of two drops. The apparatus allows the operators to synch the motions of lights, the camera, and releasing drops. The shot captured is of two drops. The first drop has already fallen into the water, ricocheted out of the water via a Worthington Jet. It looks like the second drop colided with the first drop soon after seperation from the worthington Jet [2]. Both drops were released at a slight angle, causing their collision to be non-symmetric. The second drop seems to have remained intact, while the first drop broke, forming a crown azimuthal instability [3].

Figure 1: Two drops collide forming an umbrella shape. The smashed drop recently seperated from the Worthington Jet and has formed the crown spash instability [3]. The drops form an umbrella-like pattern, which is crisply reflected by the milk surface. Capillary waves can be seen on the dome of the umbrella.

2 Methodology

The picture was taken in a dark room in the University of Colorado Boulder's Integrated Teaching and Learning Laboratory using the Drop Smasher apparatus [1]. Milk was held in a red cup and water with blue food coloring was used as the falling liquid. The milk had already become blue from previous drop splash shots. An approximate schematic of the device is shown in Figure 2. Figures 4 and 5 show representative settings used on the apparatus. During the shoot, we varied the timing between drops from 1450 to 1575 milliseconds. The camera was about 1.5 feet from the cup of milk.

3 Camera Settings

The settings camera settings used to take the picture are shown in Figure 3. A long exposure was used as it would be too hard to capture the drops otherwise. The quick flash of our stage lights allowed us to capture very small time scales. We adjusted the depth of field to try our best to have the entire mid-section

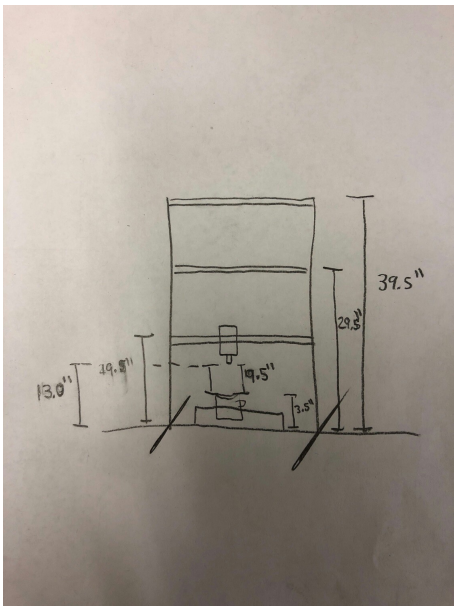

Figure 2: Approximate schematic of Drop Smasher apparatus (image by Wes Caruso)

of the cup in focus to maximize our chances of capturing the drop smashing dynamics. We found the lighting to be particularly challenging. It was tricky to create sufficient light on the water surface and the drops in mid-air without creating a glare effect. I found that using the diffusers and turning the lights away from the camera produced the best shots.

Dimensions:	4256 × 2832
Device make:	NIKON CORPORATION
Device model:	NIKON D700
Color space:	RGB
Color profile:	Adobe RGB (1998)
Focal length:	105
Alpha channel:	No
Red eye:	No
F number:	16
Exposure program:	1
Exposure time:	1/2

Figure 3: Settings used to capture the photo in Figure 1.

4 Discussion

The picture shows interesting dynamics between two droplets. The droplet that has been recoiled upwards was torn apart by the second droplet, which looks intact from the interaction. I don't know what happened after the collision, it is possible that the second drop was torn apart later. I hypothesize that the falling droplet had a much greater velocity and therefore more momentum than the drop that was traveling up, causing the latter drop the be smashed by the force of the former drop. The shape of the crown and lack of microdropletss indicate that the interaction happened at a low Reynolds' number (< 1500) and large Weber number (> 400)–collisions with different Reynolds' and Weber numbers have been observed to either not form such a crown or to create crowns with microdroplet splashes [3].

References

[1] DropSplash Apparatus, http://www.flowvis.org/2018/01/16/dropsplash-apparatus/, January 2018.

[2] C. J. M. van Rijn, W. G. N. van Heugten, and E. Boeker. A universal shape function for rising jets. *ArXiv e-prints*, November 2016.

[3] Li V. Zhang, Philippe Brunet, Jens Eggers, and Robert D. Deegan. Wavelength selection in the crown splash. *Physics of Fluids*, 22(12):122105, 2010.

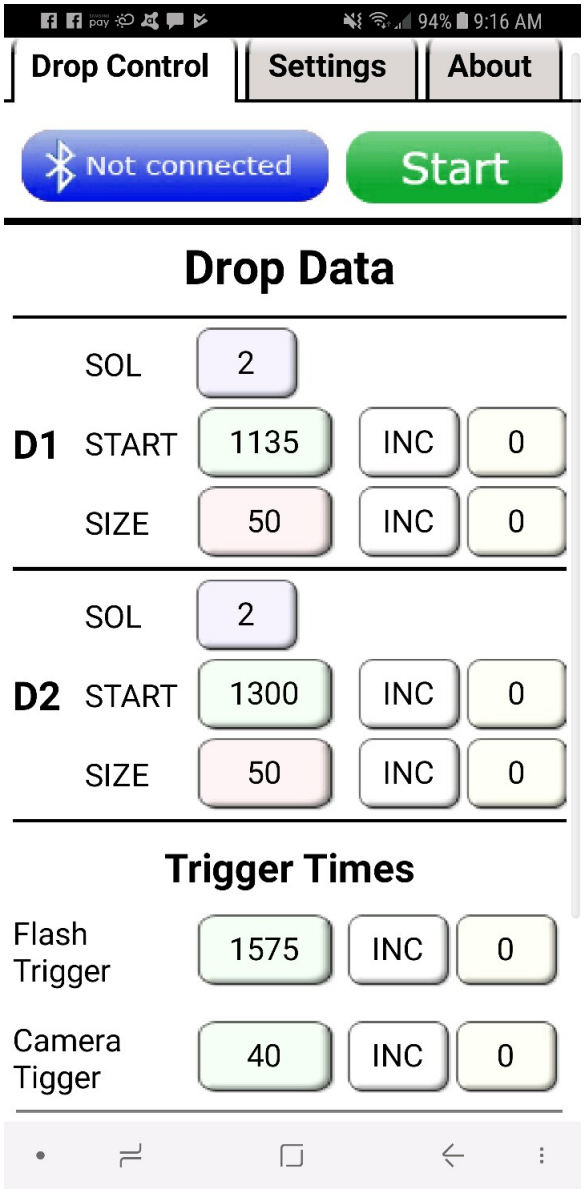

Figure 4: Representative Drop Smasher drop data input (this screenshot taken by Mason Gray)

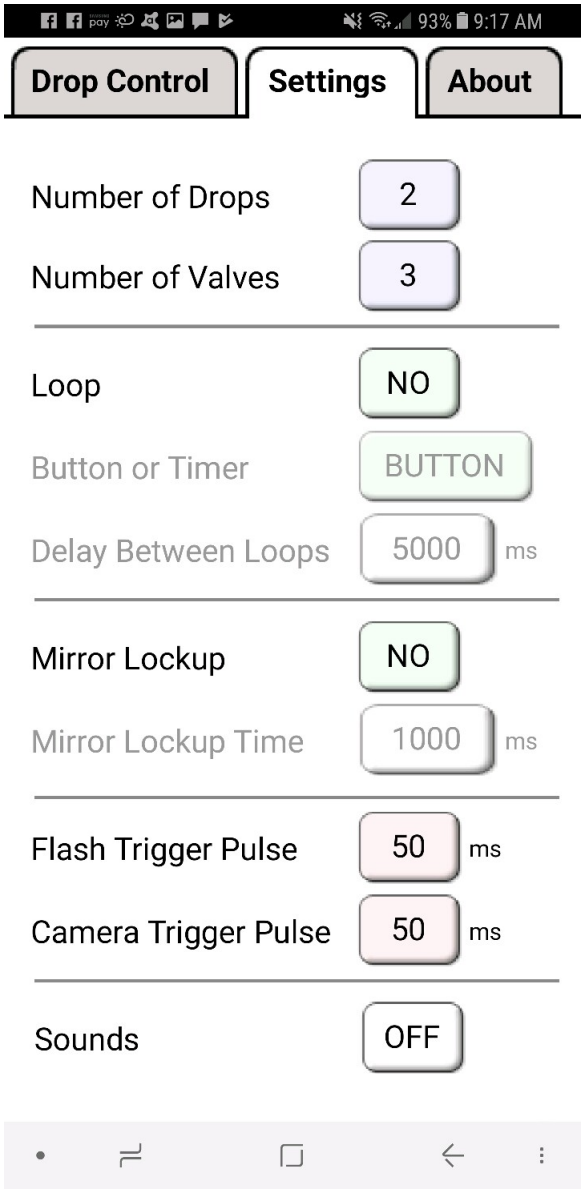

Figure 5: Representative Drop Smasher settings (this screenshot taken by Mason Gray)