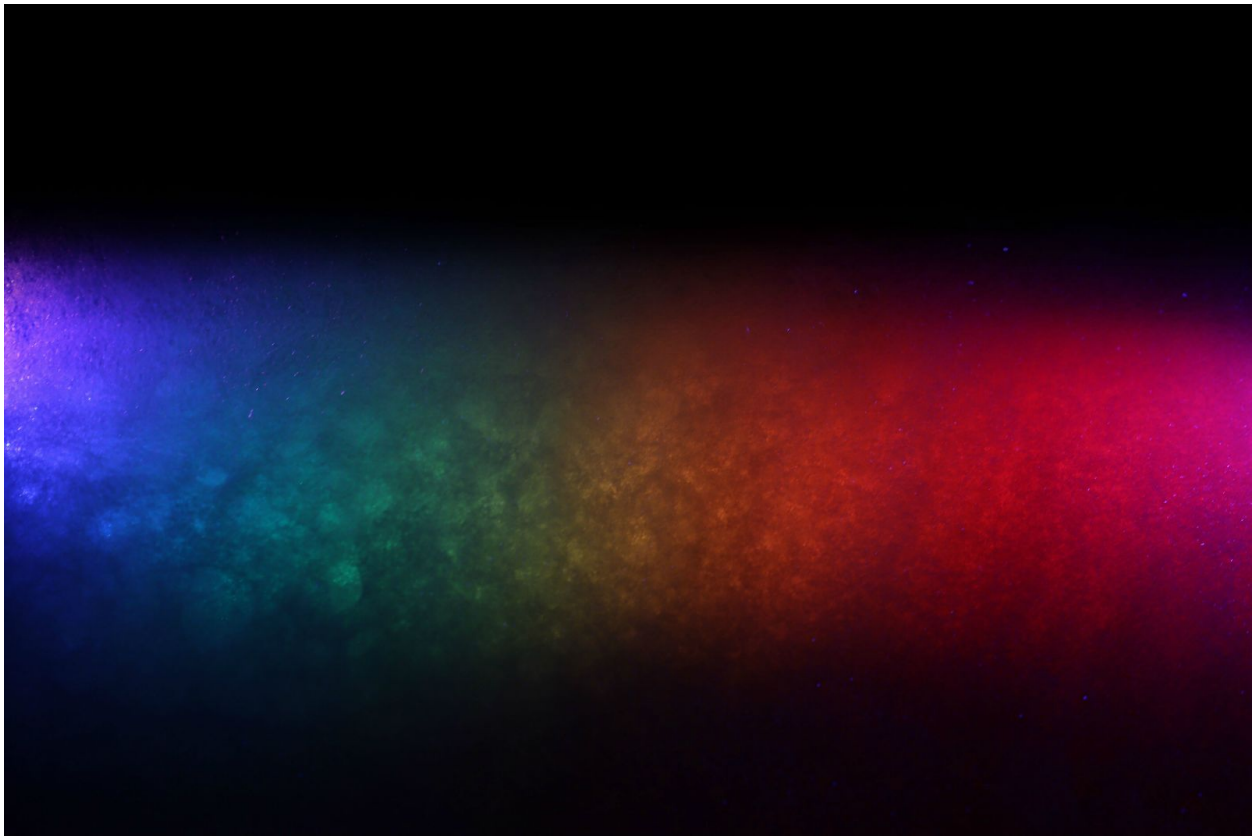
Team Second Report
MCEN 4151



Yousef Shashtari
With the help of Team epsilon
April 8th, 2018

This image was taken for the second team assignment, flow visualizatuion class. The team was initially trying to understand the deflection of laser in water. However, after couple of trials, the team decided to make an artistic picture using the help of water, soap, and LED lights. We placed an LED strap in a sink with some drops of dish soap. Then, we poured water into the sink and soap bubbles started to form. Finally, the LED lights were shining through the bubbles and we took this picture that seemed like a picture of the outer space. The whole team helped in making this image, including Luke Collier, Zachary Marshall, Phillip Nystrom, and Eric Robinson. Zachary Marshall was trying to splash the water, while Phillip was setting up the camera. Eric came up with the idea of using lights and water, and finally Luke was trying give some recommendations that would help in making a better image.

Although it was not obvious in the image, but the team used a water faucet to create the flow. As mentioned in the previous paragraph, the team used dish soap and poured it on the LED strap that was laying in the sink. A water faucet was used to disturb the soap in the sink and create a pool of bubbles. The fuacet holes were around 0.01 m in diameter and the flow was laminar. Figure 1 shows the experiment setup and it shows the laminar flow of the water.

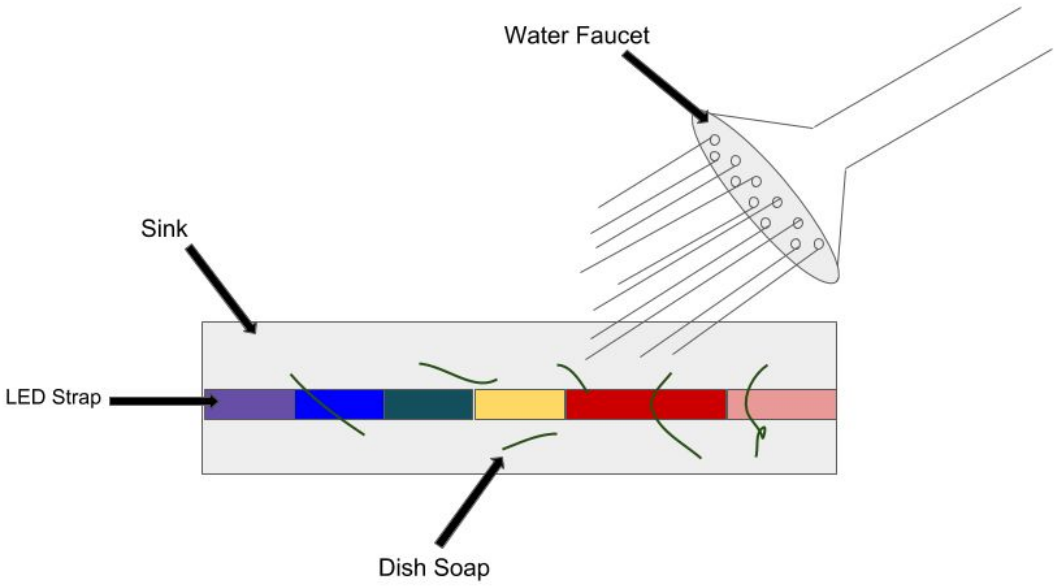


Figure 1: Experminet Setup

To talk more about the water flowing from the faucet, I am going to calculate its Reynold's number. The water velocity was around $0.1\ m/s$ with a kinematic viscosity of $1.004 * 10^{-6}\ m^2/s$. Finally, Reynold's number can be easily calculated using the following equation:

$$Re = \frac{U\,D}{v} = \frac{(0.1\ m/s) * (0.01\ m)}{(1.004 * 10^{-6} m^2/s)} = 996.01$$

We know that a flow in a pipe would be considered laminar when its Reynold's number is less than 2100, and turbulent when it is greater than 4000, so our flow was laminar.

Once the water exits the nozzel and hits the sink, soap bubbles started to form. Since the water flow was laminar, it was not enough to make more bubbles. Hence, we had to come up with a way to create bubbles. More bubbles formed later when the team disturbed the pool of water and soap by shaking their hands in the water. Also, we had to increase the amount of soap in the pool, so the total amount of soap used was around half a cup of dish soap.

The team used FastLED DemoReel100 and used an Arduino board to controll the LED strap. This LED was used to visualize both the water flowing from the faucet and the bubbles in the sink. However, my image only shows the bubbles and how the LED strap was giving it a rainbow look. Therefore, no external lighting source was needed, since external lighting ruined the effect of the LEDs on the bubbles. The soap used was Dawn dish soap and the experiment was performed in the ITLL 3D printing room.

Figure 2: Original Image before post processing

Figure 2 shows the original unedited version of the image. I used Phillip Nystrom's camera, which was Canon 6D DSLR camera. The lens was Canon 50mm lens, it was a fixed lens so we couldn't zoom in or out during the experiment. Since the room was dark and no external lighting was used, we had to take the picture at f/1.8 to make sure that there was enough light coming through the lens. The ISO was set at 100 and the original image size was 5472x3648 pixels. Finally, the field of view was around 0.25m and subjects were 0.5m away from the lens.

I had to decrease the brightness of the image a little bit to give it richer colors. Contrast was increased to give it a sharper look and to make sure everyone can see the bubbles. I thought that the bubbles on the top left side of the image were distractive, and I thought that the image would look better without them. Hence, I used the Gradient tool in Photoshop to remove some of the bubbles on that side of the image. Finally, the image looked sharper, had richer colors, and the bubbles looked more organized. I did not crop the image, so the final image, as shown in figure 3, had the same size as the original image.

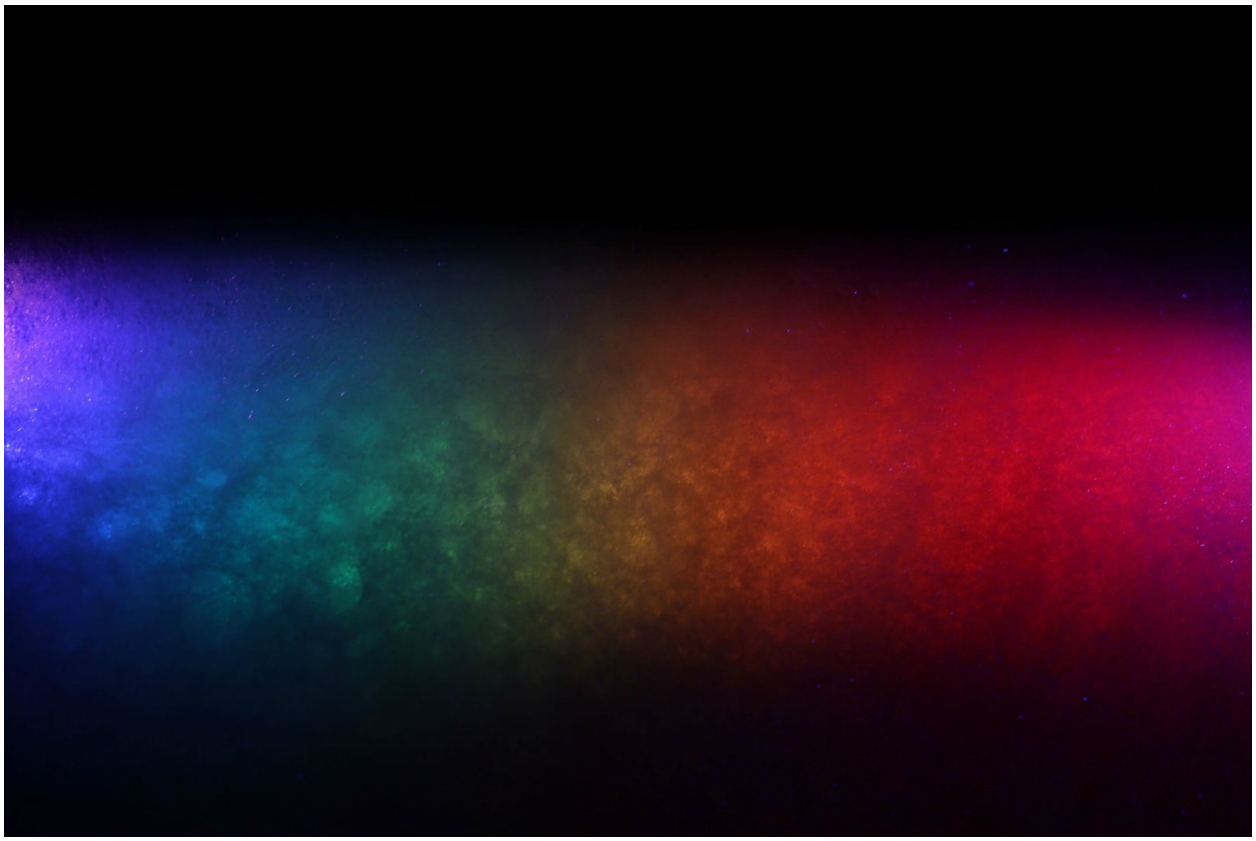


Figure 3: Final edited image

Finally, I believe that the image shows the effect of LED lights on water and bubbles. It also shows that beautiful images can be taken using simple flows and basic equipments. I liked how the lights were distributed over the bubbles. No one can actually tell that this is basically a picture of bubbles and LED lights, and that's what I actually liked the most about my image. The image can be improved by using other LED straps that have more colors. I would like to do this experiment again but with different LED strap and I would like to make more create shapes from the strap.