

Get Wet Report

AJ Terio

ATLS 4151 - Flow Visualization

09/12/2023

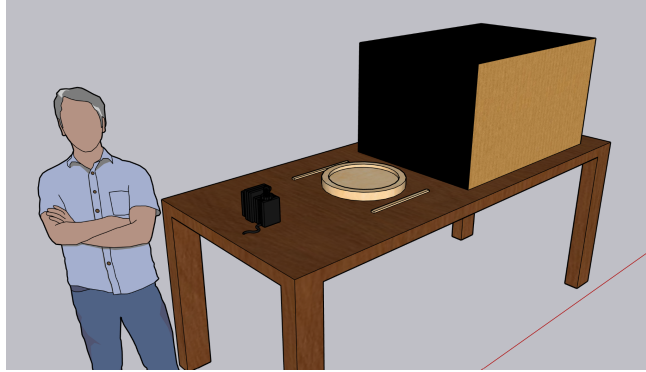
I. Purpose

The purpose of this assignment is to experiment with and visualize some type of fluid phenomenon and to understand and explain why it looks the way it does. This assignment was pretty open ended, and each student is doing something unique and different. For the first assignment of the class, I wanted to find an experiment that did not demand much, but wasn't as simple and overdone as often as milk and food coloring or oil in water.

In the end, I was inspired by a student's work from last year, Kendall Shepard, and her report on the changing spectrum of falling colors created by the light refracted off a soap film (<https://www.flowvis.org/2022/09/07/get-wet-kendall-shepherd/>). This type of phenomenon can be seen in bubbles as well, but a soap film provides a flat surface making it easier to capture and visualize the flow than on a sphere.

II. Flow Apparatus

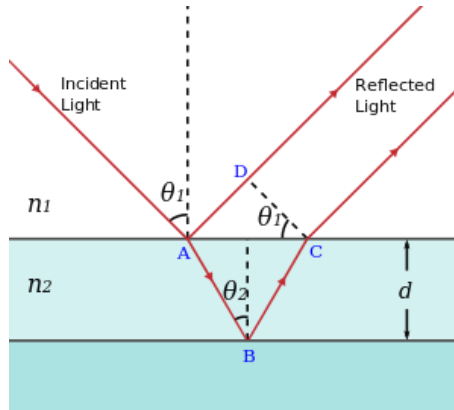
The setup was relatively simple; a large table, a black blanket draped over a box for the background, a frisbee filled with soapy water, two sticks attached to a loop of string with some quarters taped to the bottom for a weight, and a white wall behind me to reflect the light. Below is a representation of how things were set up while I took this image.



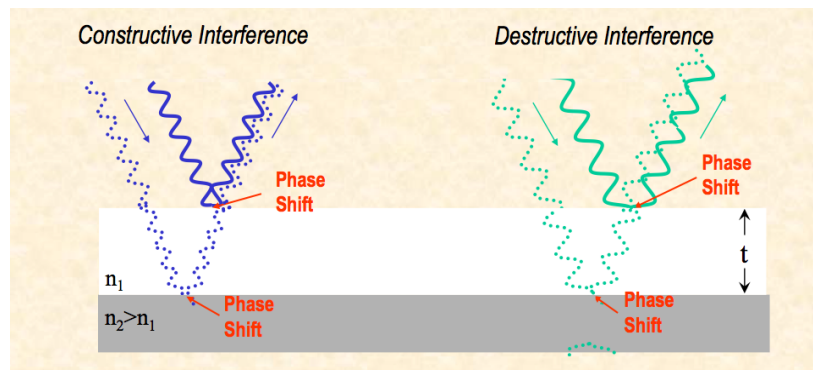
More on the process; I would begin by dipping the string loop into the frisbee filled with soap, soaking all sides as much as possible. I would then lift the film out, and angle it best I could to reflect the light back to the camera. It takes about 5 seconds for any color to become visible, but as time goes on, the complexity of the drips of color grows. At about 15-20 seconds is the best time to capture these looping colors, but soon after the yellows, golds, and black colors start to form, the film at the top will break due to gravity pulling on the liquid for too long.

Now I did not receive much help in performing this experiment. I had to take the picture with my right arm, and hold up the film with my left. I highly recommend to anyone trying to recreate this to have some friends helping you to either capture the picture or to hold the film. If not extra people, a more advanced setup with automated film lifting or camera shots would also be ideal. I really do wish I had friends with less shaky hands, but alas.

One thing that excited me about this experiment is that all of the colors and chaotic design of the image is not the result of using different colors of dye or using a marked boundary technique (technically this is sort of a marked boundary technique, but the boundaries are constantly changing depending on other variables), but instead is the result of an interesting phenomenon called *thin film interference*. Thin film interference is a natural phenomenon in which light waves reflected by the upper and lower boundaries of a thin film interfere with one another, by either enhancing or reducing reflected light.



The visible light that is reflected back to our eyes and perceived as different colors depends on the wavelength of the two vectors of light exiting the film. These wavelengths can either be constructive or destructive to one another, and this depends on the thickness of the film.



What creates the changing gradient of color from the top to the bottom of the film is gravity. Gravity and the weight of the soap pulling down on itself creates a non uniform thickness along the film, creating a gradient of different colors along its vertical axis.

III. Visualization Techniques

For this experiment I used dish soap and shampoo whisked together in a frisbee of water, about a 2:1 ratio water to soap. The frisbee was used in place of a deep flat dish that I did not have. I tried all different types of lighting, but in the end I ended up getting the best results when I used only 1 light source (a small

desk lamp turned up to max brightness) that pointed towards the white wall behind me and the camera.

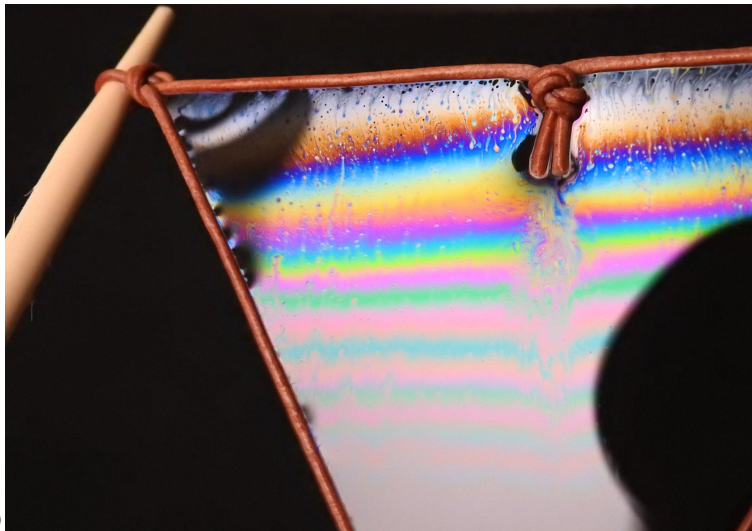
IV. **Photographic Techniques**

The camera I used is my grandfather's old Nikon model COOLPIX P900. I used manual settings and adjusted them constantly to try to optimize for the best result. The best settings I found were these:

- F-stop - f/3.5
- Exposure time - 1/15 sec
- ISO - 1600
- Focal length - 9mm

The angle at which I both took the picture and held the soap film affected the resulting image a lot. I definitely couldn't take the picture straight on because the film would reflect the lense of the camera back into the photo, so I had to angle it the best I could trying to keep the black background behind the film.

I edited my photo in Lightroom classic, not much more than cropping, increasing vibrancy and texture.



UNEDITED



EDITED

V. **Image Revelations / Self Assessment**

I really love how this phenomenon actually looks. It's very pleasing to the eye and is never the same and has a very chaotic nature to it. This is definitely something I had noticed before in my life, but never took the time to wonder why and appreciate the significance of something as beautiful and complex as this coming from something as simple as soapy bubbles.

To be honest, I wish I could have had more time to perfect this image. Had I also put in more effort to improve my setup, it would have been easier for me to capture without getting all sorts of shadows and reflections in the way. This is also a very easy experiment to conduct and I could very easily transport this to the ATLS building and have a teacher or one of the professional photographers there help me out.

In the future, I think that I will decide what exactly I would like to do faster and perform the experiment with a different setup at least 2 or 3 times, improving upon little details and things each time I reset. I believe this will help improve the quality of my result, as well as my understanding of the sciences behind each phenomenon I encounter.