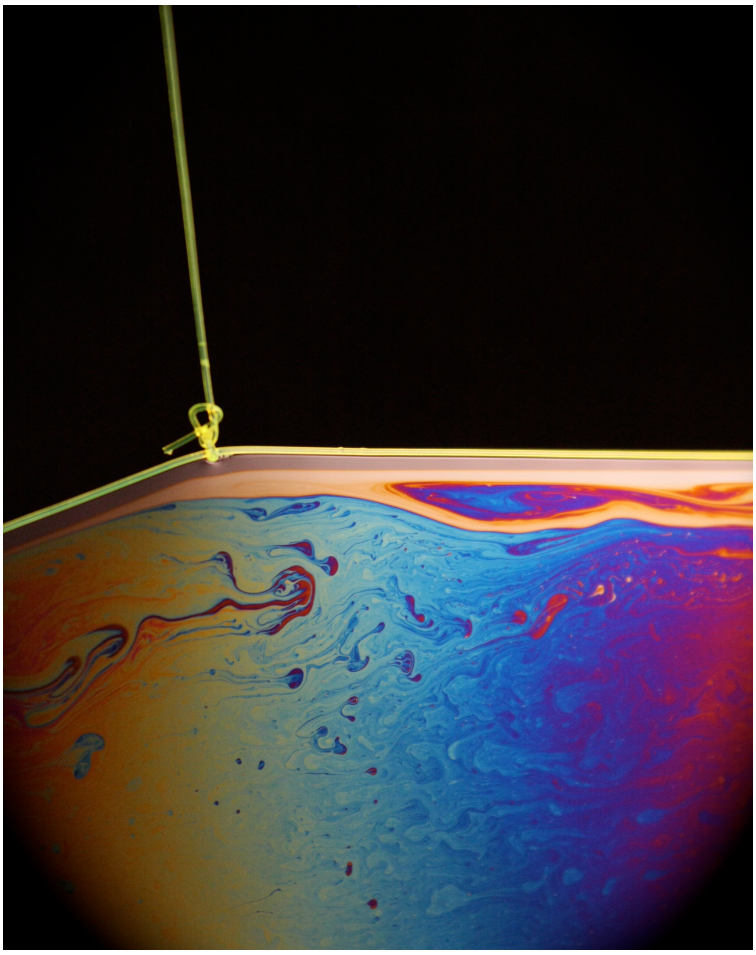

Soap Film Tunnel

Group Project 1

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For the first group project my group chose to observe flows within a soap film. We used a type of soap film tunnel maker which allowed us to quickly reproduce a soap film for observation and for photographing. Our main goal was to take a breathtaking picture of the soap film.

The soap film tunnel was a device that allowed the forming of a soap film with ease. Figure 1 shows a simple diagram of what the tunnel looked like along with what our set up was. A bottle on top of the frame allowed for a continuous flow of fluid to run. This flow went to two strings that was hanging between an additional frame that was adjustable to place the film at different angles. Additional strings attached to these strings allowed for the first two strings to be pulled apart producing a soap film between them in the shape of a diamond.

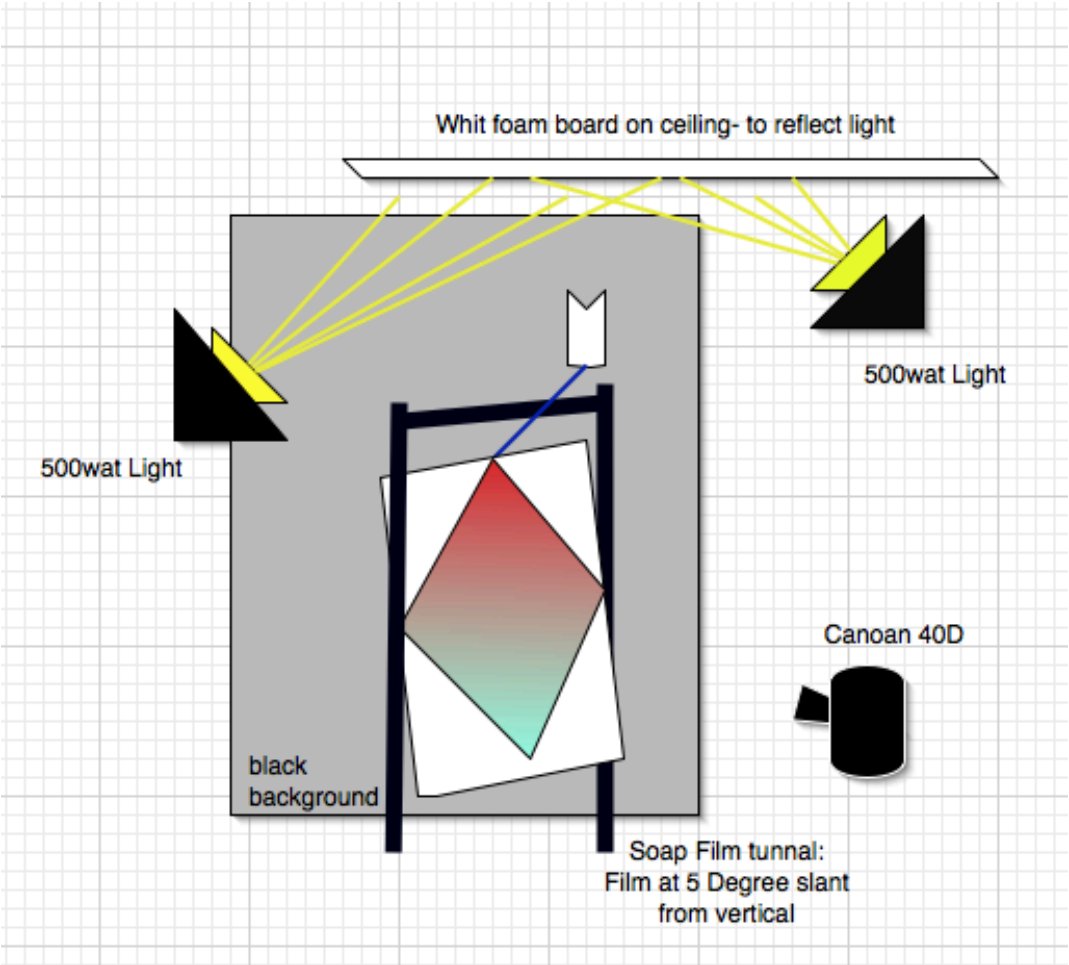

Figure 1

Because we were concerned with capturing a nice picture we needed to figure out how to get the soap film to reflect the most light back to the camera. To do this we set up two 500 watt lights pointing at the ceiling where we attached a large piece of white foam board (figure 1). By using the white foam board this also allowed for the image in the soap film not to have the texture of the ceiling in it.

The soap film was placed at a -5 degree angle to vertical to allow for the camera to be directly in the front and center of the soap film tunnel but still reflect the most light from the foam board on the ceiling.

A black background was used behind the soap film to ensure that no light would be coming from the back of the film. This allowed for unobscured picture of the film's flow to be captured because the light was only coming from one general direction.

The fluid used was a combination of 80% water, 15% dish soap and 5% glycerin. The mix was made the night before the shoot and was allowed to sit, in hopes of producing longer lasting, and more vibrant colors. It was released a flow of about 15 drops per second. The room also was very humid to hopefully produce longer lasting bubbles.

Canon 40D was used with a 18mm-55mm lens on it to capture this image. For this image the camera was about two feet away from the soap film with a lens length of 55mm. The exposure time was 1/60th of a second with an F/stop of 5.6, ISO 1600. The original image dimensions of the image was 3888 x 2592. I shot it as a jpeg in order to save total space and because the Canon 40D's converted engine preserves the image enough that a large jpeg is the same as a raw file of the same image. I did very little to to the image after it was imported. Because the colors came out so nicely I was able to leave the levels alone. I did however rotate the image clockwise to make the left pull string go out of the picture. The image was also slightly cropped and a small vignette was placed on the bottom. Both of this changes were made to enhance the visual composition. I choose to leave the string with in the final image to create a frame within a frame.

Because of Thin-film optics light that hits the soap film is refracted into different colors.[1] The different colors come from different thicknesses of the soap film. Thicker the film the more light is canceled out. For example the if the film is thick it will cancel out shorter wavelengths causing our eye to see it as blue. The thiner the film the more light that can travel through it. When the film is around 25nm it become so thin that no refection of visible light occurs and it become clear. This is also a sign of the film about to pop.[2]

This image shows the flow with in the soap film very nicely. Because the image has been rotated clockwise, the flow is falling to the left (from the right to the left). The blue and purple on the right of the image is caused by the film not being viewed head on; this causes there to be an increased thickness of film because of the angle. This also has to do with the angle from which the light is coming from the ceiling and hitting the film before the camera receives it, this is why we see red on the left. The flow of thinner film to the top (image right) and thicker to the bottom (image left) can be seen through the movement of the small mushroom-shaped forms in the center of the image. The area directly below the string is clear not as a result of thickness but because it is

where the velocity of the fluid is the greatest. An eddy can be seen in the upper right corner of the soap film which is due to the slight bend in the vertical (image horizontal) string. The eddy is a thicker section of the soap film caught between two quickly moving flows. The second flow is an upward flow which is directly under the downward flow and is visible because of the eddy caught between them.

This image meets my intent very nicely, with the true goal in capturing a clear, clean picture of soap film. However, the image does not do a great job in portraying a the flow within a soap film. This is due in part to the fact the image has been rotated clockwise but also because it is a still image of a very dynamic flow. I believe that a high speed video recording of the flow would do a better job at capturing the flow. Allowing for a slow-motion replay of the flows movement.

Articles Cited

[1] http://en.wikipedia.org/wiki/Thin-film_optics

[2] http://en.wikipedia.org/wiki/Soap_bubble