

## Bubbles!

### Introduction

For what I believe may be my last image/video assignment in our flow visualization semester, I have decided to take a picture of something that everyone loves; bubbles! The reason I decided to capture this oh-so magical substance is because I was recently reminded how cool and unique each bubble really is. I was washing the dishes and decided to take a closer look at the individual suds. After playing with it for a little, I decided to make my final image/picture assignment about this magnificent substance. In this document, I will explain the additional research that I conducted that made the human race name these fun little spheres, bubbles!

### Calculation/Research

While conducting research for this assignment, one of the most interesting facts that I stumbled upon about bubbles lies in the forces being inflicted on the bubble. For example, did you know that it is physically impossible to blow a bubble in space? This is due to the lack of exterior pressure pushing on the surface of the bubble. A bubble is essentially made up of three different layers; two soap layers that lie on the interior and exterior of the bubble and a water layer that is sandwiched between the two soap layers as shown in figure 1.

### Atmospheric pressure

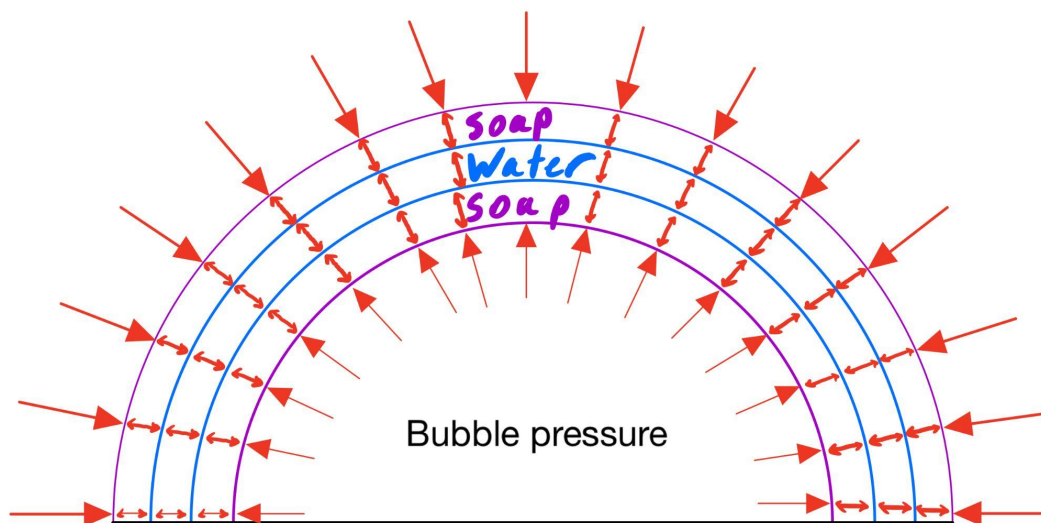


Figure 1

Additionally shown in figure 1 is the forces that the bubbles are enduring. The individual layers will be in compression trying to combat the pressure the atmosphere and bubble are inflicting. If we add up all the forces happening in this scenario, the summation of these forces should add up to zero due to Newton's Second Law.

$$\sum F = 0$$

Due to this law, we can actually boil our forces down to the fact that atmospheric pressure is equal to the interior pressure within the bubble. So if we were to blow a bubble in space where there is no atmospheric pressure, the inner pressure of the bubble would make the bubble pop immediately.

To bring this back to my photo, we now have a better understanding of why there are bubbles in my photo. Due to the atmospheric pressure in Denver, Colorado, there are an abundant amount of bubbles that are able to form. Since the atmospheric pressure is approximately 12 psia the pressure inside the bubbles are also equal to 12 psia.

In conclusion, due to atmospheric pressure (and surface tension) the bubbles are able to produce their spherical shape. If we were to eliminate all atmospheric pressure in the world, all the magnificent bubbles would no longer exist (along with the human race). This is all to say that, though these bubbles are a small feature in the world we live in, bubbles encapsulate an abundant amount of physics.

### **Materials/Setup**

\_\_\_\_\_The setup for this photo was relatively simple. In a large white sink, I pulled the drain plug and poured in a generous amount of Dove Deeply Nourishing body wash. As water poured into the sink, I used my hand to agitate the soap. I found that a left-to-right motion with my hand was the best way to create as many suds as possible. Once I decided there was a variety of sizes of bubbles and plenty of them, I decided it was time to take the photo. I steadied my iPhone 13 pro Max approximately 2.5 inches away from bubbles, making sure that I did not cast any shadows onto the photo. With the fantastic iPhone 13 pro Max camera, I was able to get a very clear and upclose photo that captures every bubble and detail.

For the settings of the camera, the iPhone has limited variability so I used the default settings of the phone (settings of which are not very clear). This photo was taken with the iPhone 13's 12 MP telephoto camera with a  $f/2.3$  aperture with a 1080p resolution.

As for the post processing, I used the iPhone's editing tools to bring out more color and depth in the photo. The settings that I decided to change in the photo can be seen below:

Setting:	Value:
Shadows	6

Saturation	14
Vibrance	2
Brightness	-11
Highlights	-7
Black Point	100
Contrast	7

### **Conclusion**

In conclusion, I am relatively happy with how my photo turned out. I was trying to focus on capturing the details and every bubble to show its simplicity and complexity all at the same time. I think this photo possesses many great qualities; one of which I would say is the amount of detail and contrast. Every nook and cranny of the bubbles and where they intersect with each other. This photo is one of those pictures that you could show to your family and friends and it would bring a lot of attention.

One thing that I think I could have improved on is maybe adding a little bit more color to the photo. In my head I thought that the refraction of the bubbles would create a rainbow looking effect, but sadly that was not the case. One quick way that I think I could have added more color would be to add some type of dye. I think potentially adding dye would bring in more color of whites and eye popping colors.

Overall, I am generally happy with the way that my photo turned out. I think I was perfectly able to capture the simplicity and complexity of bubbles. As humans it's easy to over such simple things but sometimes you just have to slow down and appreciate the things around you.

### **References**

- “Can You Blow Bubbles in Space?” *Can You Blow Bubbles in Outer Space? - Windows to the Universe*, [https://www.windows2universe.org/kids\\_space/bubble.html](https://www.windows2universe.org/kids_space/bubble.html).