



# Bling Blaow

Nebiyu Tadesse | MCEN 4151 - 001 | October 14, 2019  
Helped By: Jamie Frankel, Jared Moya, Dimario Cancanon and Alejandra Abad

For the team second project, my team and I decided to capture bubbles and their interesting physics. Our initial intent was to put dyes in the mixture to form colored bubbles. However, the dye color was not strong and vibrant enough to be seen boldly. Although our initial intents were not achieved, we were able to make something unexpectedly gracious and beautiful. I highly want to thank Jamie Frankel for blowing our bubbles up, Jared Moya for setting up the camera and capturing the videos, and Alejandra Abad and Dimario Cancanon for taking pictures and setting up the lighting.

To make this video, no special flow apparatus was utilized. To make the bubbles, we used a mixture of a tub of water and one bottle of dawn soap and used a string as a wand tensioned by our fingers to dip into the mixture and blown into. For capturing, we used a high-speed camera that was checked out from the ITLL, positioned two feet away from the bubble, in order to capture a video that could be played back in slow motion for us to see every step in the formation of the bubble. We also used two 250W T bulbs for illumination. The setup can be seen in the figure below.



Bubbles have an interesting physics. Soap molecules have both a hydrophilic and hydrophobic end which when mixed with water creates a thin layer of water between the molecules. When a wand is dipped into water, it captures this thin film of soap and water mixture with water trapped in the middle of soap walls. When air is blown into the film it pushes the surface but due to surface tension it keeps elongating until the area blown on breaks off from the film enclosing a volume of air and forms what we know of as a bubble. A bubble, no matter where it comes from, will always take the shape of a sphere due to a sphere having the lowest energy state needed to enclose the air.

The camera that was used to capture the video is a 2001 Phantom Micro C110. The camera was setup with dimensions of 1280 pixels x 1024 pixels, exposure of 1100, FOV of approximately 10 in by 6 in and a sample rate of 900 frames per second. After the video was captured, I used Windows Video Editor to crop out only the interesting part I wanted to showcase, add title cards to it, and add an upbeat royalty free samba music from bensound.com to give the video a happy and chill vibe to it.

The video reveals a bubble with the dye colors slightly being seen due to refraction and diffraction happening at the bubble's surface, although not significantly, and some aspects of a bubbles physics, like how it stays round and can change it's shape as long as the surface tension is not destroyed. Our initial intent was not truly accomplished due to the dye colors not being strong enough. However, we were able to change and adapt our mission to visualize the formation of bubbles and their physics. The idea can further be developed by getting stronger dyes and provide better lighting conditions.