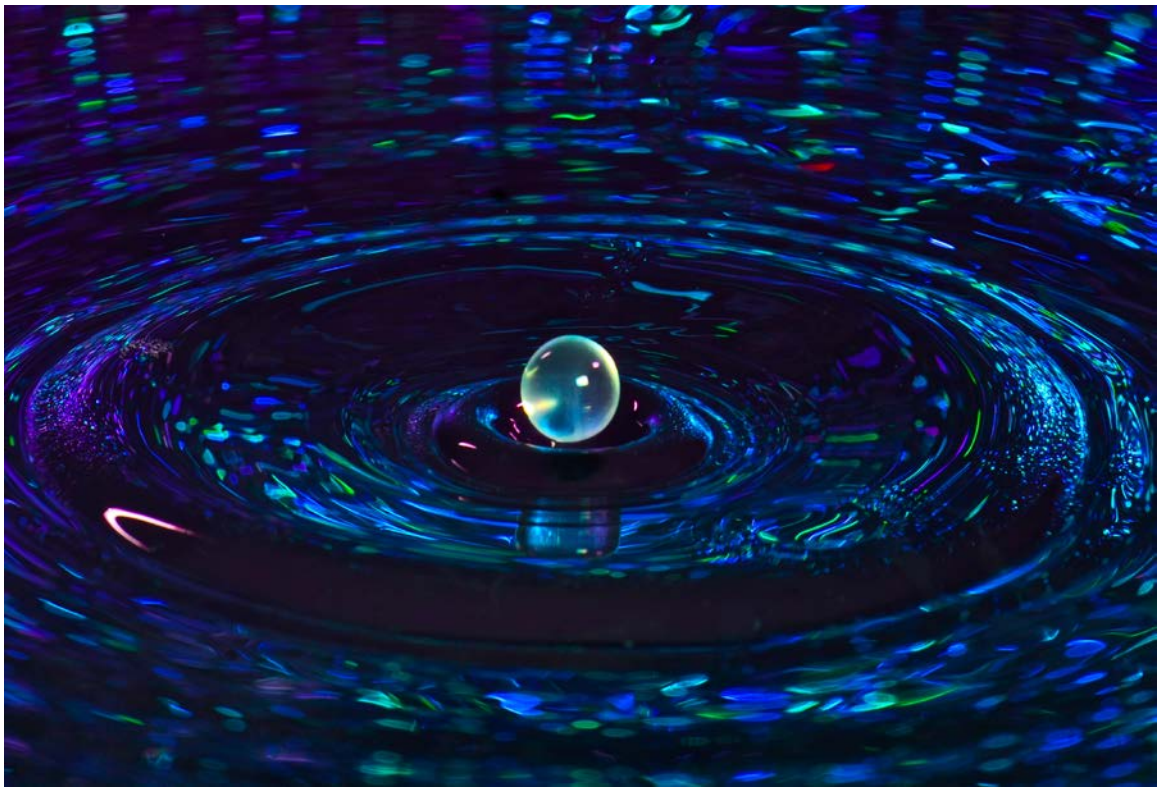
Team Image 3
Kelsey DeGeorge



Flow Visualization
MCEN 4151
University of Colorado at Boulder
Professor Jean Hertzberg

Purpose:

The purpose of the final team image was to collaborate with classmates to create a beautiful and unique image while capturing the dynamics behind fluid flow. For this image, I wanted to explore the Worthington Jet and particularly capture a single droplet suspended above the still fluid beneath it. I chose to drop water into water because it was simple and available and still displays the jet beautifully. For this image, I collaborated with Lindsey Yarnell, who assisted in the lighting and experimental set-up.

Image Description:

The set-up for this image was more complex than in previous images but easily reproducible. I placed a one-inch deep black pan on top of a counter and filled the pan to the brim with tap water. I then held a pipette full of water about 24 inches above the surface of a pan and rapidly dropped the water to create the jet. I had two external flashes set up and my camera was placed on a tripod roughly 8 inches away from the subject. I placed a multi-colored, glittery poster board behind the subject in order to get the colored reflection in the water and add an interesting element to the image. There were over 200 photos taken before I captured one I was satisfied with. I wanted to capture a droplet in its full spherical form. The one I captured in my image resembles a crystal ball and perfectly displays the ripples of the water droplets hitting the surface of the still water. The lighting used was two external flashes and the camera flash as the rest of the room was completely dark.

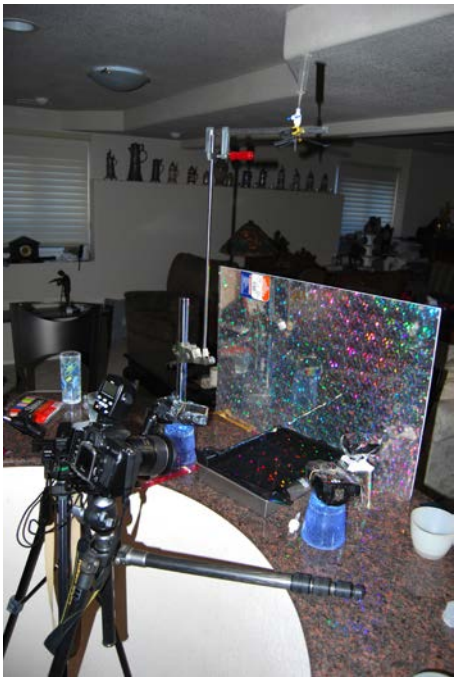


Figure 1: Photographic Set-Up

Photographic Technique:

The camera used to take this image was a Nikon D200 DSLR with a 105 mm macro lens. The dimensions of the original image are 3872 x 2592 pixels and the edited image dimensions are 2508 x 1702 pixels. The focal length is 105 with an f-number of 18. Because there was motion in the image, the shutter speed chosen was important in order to decrease motion blur. I found that the shutter speed used (1/60 s) was sufficient to capture a crisp, clean image. I needed good focus, and the high ISO allowed for a large enough exposure time. I estimate that the subject was approximately 8 inches away from my camera. The editing technique used was iPhoto. I did not do a great deal of editing. I increased the saturation to get brighter colors and cropped the image so that the single droplet was the primary focus. I also lowered the shadows setting to lighten it. Figure 2 below shows the original image.

Figure 2: Original Image

Physics:

The interaction between the still water and the high velocity of the water being dropped creates a phenomenon known as a Worthington jet. There is surface tension at the top layer of the still water, but the force of the water droplets interrupts this. As the surface tension breaks and the still water attempts to get back to its equilibrium state, there is an exchange of potential and kinetic energy, which

creates the surrounding ripples. As the momentum of the water droplet attempts to remain constant, a "jet" is created in the center of the ripples.

Conclusion:

In conclusion, I am very pleased with the result of my image. The way the colors are reflected in the water droplet and in the still water provides a visually appealing and unique aspect to the image. One of my favorite features of the photo is the reflection of the droplet in the still water because it is subtle, yet very unique. I also enjoy the symmetry of the photo with the shape of the liquid drop directly centered in line with the ripples. The motion blur within the still water makes the droplet stand out even more. If I could repeat this experiment, I would have used a solid colored poster board as the background, because I find it can be distracting. Overall, I find that the image is unique and accurately displays the dynamics of the Worthington jet, while also offering a beautiful and visually appealing photograph to look at.

Works Cited:

[1] http://www.newton.dep.anl.gov/askasci/phy00/phy00881.htm