

Athena Ross

Flow Visualization

Film 4151

Team Assignment 2



## I. Purpose

This image was created for the Flow Visualization course, Film 4151, and was the second team image. The group decided to do work with Ferro fluid. For my image I wanted to demonstrate the way Ferro fluid reacts with a magnet when placed in a suspension fluid. The most difficult part of this image was trying to figure out the distance to hold the magnet which would allow the urchin-like figure to form, without causing the fluid and the magnet to come together. Amanda Kennedy held the magnet while I photographed the image.

## II. Flow Apparatus



Figure 1

The Ferro fluid used was being suspended in a fluid. I do not know the make-up of the suspension fluid because it is considered a trade secret, and I wasn't allowed to know. The jar which it was contained in was approximately 10.2cmx5.1cmX5.1cm. The magnet being used was a small, round magnet which was maybe 2cm in diameter. Amanda held the magnet between .5 and 1 centimeters away from the bottle. (See figure 1. For more detail)

Ferro Fluid is a viscous fluid, which reacts when it is brought close to a magnet. It isn't inherently magnetic, but does react with other magnetic fields. The fluid contains small magnetic particles suspended in liquid. When a magnet is applied, the fluid begins to stand up. The spots where there are spikes are the locations of magnetic field lines. Regions with higher flux in the magnetic field result in larger spikes.

### III. Visualization Technique

The suspension fluid in the container was already dyed before I used it. The dye was a blue fluid which reacts with black light, resulting in the glow of the fluid in the image. The lighting used was a black light and a work light. The black light was placed at an angle, directly next to container which was holding the ferro fluid and suspension fluid. A work light was placed approximately 5 feet away in the corner of the room. It was pointed away from the container and towards the white wall so as to bounce small amounts of light off the wall. This allowed for some extra light to compensate for the darkness of the black light, without working as a clearly visible light source.

### IV. Photographic Technique

This image was taken using a Canon EOS REBEL T3i. The focal length was 194. The F-stop was set to 5.6 with an exposure time of .8 seconds. The ISO was set to 800. The original image had dimensions of 5184x3456. After editing the dimensions were changed to 4532x3434. Editing was done in GIMP. The image was cropped to remove the finger and magnet from the right. The contrast was brought up minimally in order to bring out the colors and emphasize the spikes in the ferro fluid. The sharpness was increased in the image in order to emphasize the dark lines on the spikes and make sure they came out crisp and clear. In the original image there was a sharp line from light reflection. Using the blur tool I smudged the line until it blended in with the ferro fluid and lost all sharpness.

I shot relatively close to the fluid, leaving about 10 to 15 cm between the lens and the fluid. This was to avoid getting too many distractions in the image, such as the magnet and hand holding it, that would have to be cropped out later. I also didn't want to zoom since zooming emphasizes shakiness and made it difficult to get a clear picture. The camera was on a tripod to get the most still image possible, but because the tripod was flimsy I had to turn up the ISO and turn down the shutter speed. Also, the hand of my assistant Amanda was incapable of remaining still at all times, meaning there were minor movements in the fluid which were picked up during a longer shutter speed. 5.6 is the optimal F-stop for getting good depth-of-field and was recommended for black-light shooting. I selected a mid-range ISO to avoid the extra grain that is added in higher ISO's.

## V. Conclusion

This image reveals the magnetic properties of ferro fluid and how it gathers around a magnetic location. It also demonstrates how spikes form along magnetic field lines. I love the way this image looks, it has a very artistic feel while still showing off the science. However, I dislike how dark the image is, it makes it a little more difficult to see what exactly is occurring with the fluid. I wish I'd had a second black light so I could better illuminate the image and capture more of the detail in the spikes. I would like to experiment more with the fluid and see how multiple magnets would affect it, and try creating different shapes.