

# “TEAM SECOND”

Image Context Report

## ABSTRACT

This report will provide context for my first team image in the fall 2016 flow visualization class.

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Flow Visualization: The Physics and Art of Fluid Flow

# 1 CONTEXT AND PURPOSE

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I am very excited to speak about our second team photo. I took a slightly different approach than my teammates and focused on ferrofluid and iron sculpture that is subjected to a magnetic field. The phenomena that is created when ferrofluid is subjected to the magnetic field of an electromagnet is very interesting. Originally, ferrofluid was designed and created by NASA as a fuel. They wanted to be able to attract liquid fuel towards a fuel pump in a zero gravity scenario. Ferrofluid is essentially nano-scale ferromagnetic particles suspended in a fluid. When ferrofluid is subjected to a strong magnetic field, such as in the apparatus used in the photograph, large amounts of spikes are formed with the fluid. These spikes are created between the interactions between several dynamic forces like, Van der Waals, magnetism, surface tension and gravitational force.

## 2 FLOW APPARATUS

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The ferrofluid flow apparatus is pictured below in figure 1. The apparatus is located in the lobby of the Integrated Teaching and Learning Laboratory in the engineering center on the campus of the University of Colorado Campus at Boulder. The apparatus consists of a large copper coil underneath a



Figure 3- Iron Sculpture

reservoir of ferrofluid. The copper coil is powered and current runs through it when the exhibit is activated. When coil is activated, a magnetic field is created. The direction of the magnetic field can be seen in figure 2 seen below. This magnetic field is what acts on the ferromagnetic fluid above it. In the reservoir, there is an iron sculpture that guides the ferrofluid when it is being formed under the magnetic field. The particular sculpture that is in the final image is a sort of helical spike. They sculpture can be seen in figure 3.



Figure 1- ITLL Ferrofluid Exhibit

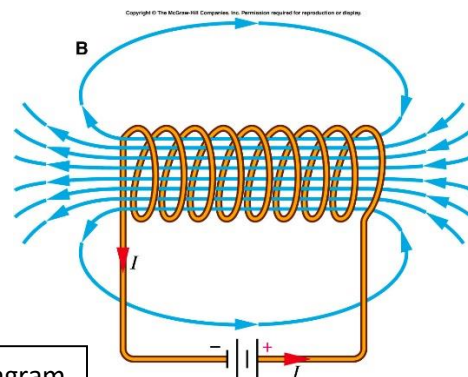


Figure 2- Coil Magnetic Field Diagram

### 3 DESCRIBE THE VISUALIZATION TECHNIQUE

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The visualization technique shown is rather true to the original image. You can see the original un altered image taken in figure 4. Additionally, you can see the final team 2<sup>nd</sup> image shown after post processing in figure 5. You can tell that a monochromatic filter was applied over the final image. This was applied the stock Microsoft photo editor. Additionally, there was cropping done to the image to center it. A relatively low aperture was used to try and create depth of field moving down the length of the sculpture. I used a focusing rack and pinion style tripod head to achieve tack sharp focus on the tip of the spike.

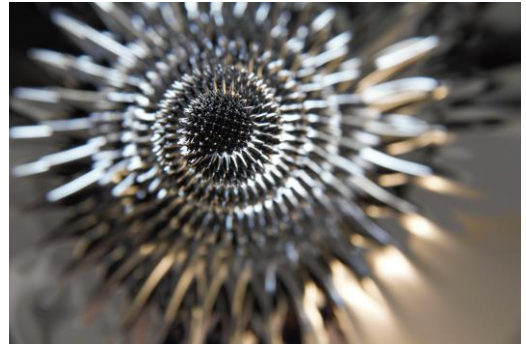


Figure 4- Original Image un altered

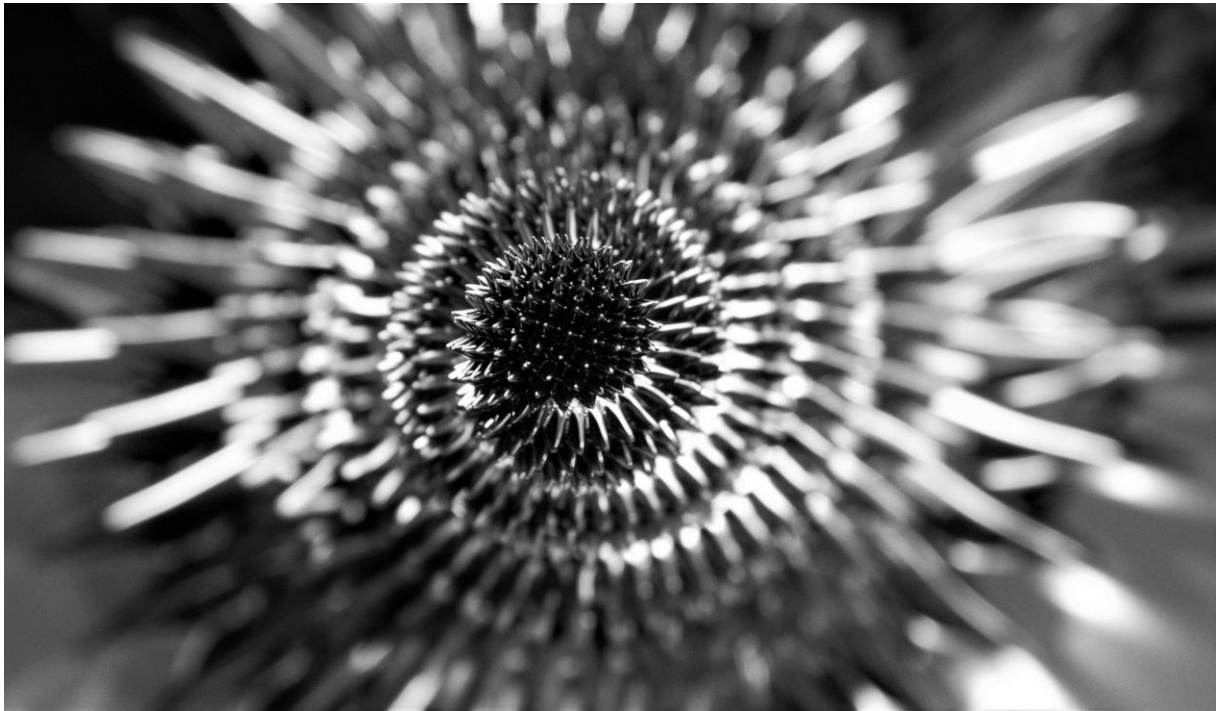


Figure 4- Final, altered image

## 4 PHOTOGRAPHIC TECHNIQUE

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I'll begin my discussion on my photographic technique with my camera. I am using a Canon 7D DSLR camera body. Capable of achieving 18.1 MP of resolution in its highest quality mode. The camera has a APS-C sensor, not a full frame. At the time I was using a Canon 18-200 mm F/3.3-5.6 lens. The lens had a UV eliminating Tiffen filter. The camera modes for this particular image were as follows, F/ 11, ISO-1600, Exposure time of 1/4 sec. With a focal length of 200 mm focal length at the time. The ferrofluid shown in the photograph is about 1-1.5 feet away. A photo of the tripod and camera set up is show below in figure 6.



Figure 6-Camera Setup