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Team Second

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November 2019

ATLS 4151-001

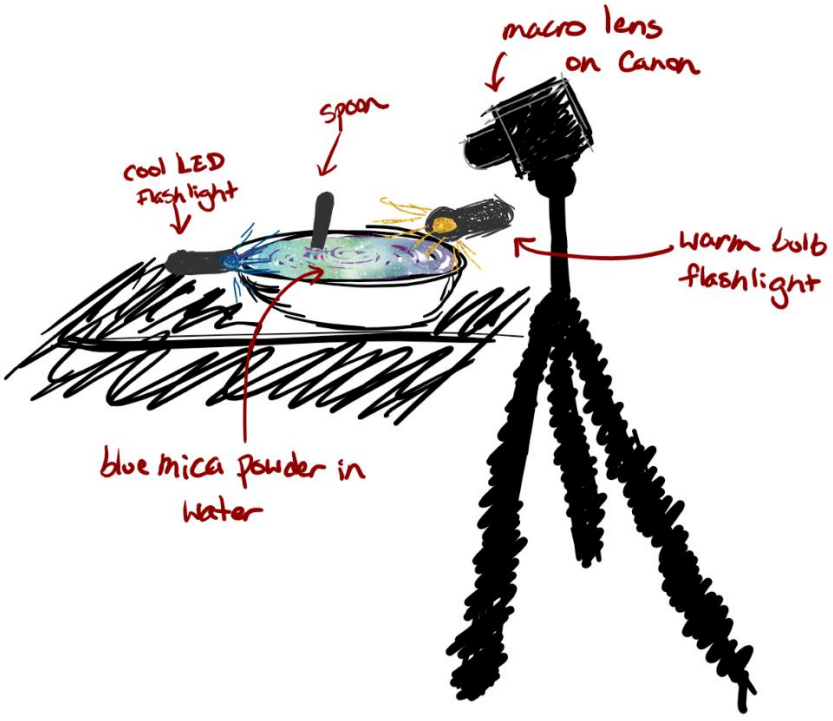
Glitter Galaxy

For the Team Third project, I decided to experiment with mica powder mixed in water to create rheoscopic fluid. I had some issues figuring out how to capture this. I originally wanted to put water on heat and capture the convection of the water. When I put the mica powder in the water, the powder stuck to the surface and the convection below was not visible. I tried stirring it, but I couldn't get the powder to stop sticking to the surface. I then tried putting cold water in a bowl and mixing mica powder in (thinking the hot water was the problem). I still ran in to the same issue. I concluded that the only way I could capture the flow of the water with the mica powder visible was if I capture the water flow from the side, capturing the mica powder's flow under the surface of the water. I found a big clear vase and put my rheoscopic fluid in it and start taking pictures of the flow from the side of the vase, through the glass. I wasn't capturing what I was attempting to capture at all, and I didn't feel like I was visualizing the physics of the water flow at all. This was disappointing, but the pictures I was getting were interesting and cool in a different way. I captured enough that I was satisfied with, so I started cleaning all the dishes I had used. As I was cleaning the dishes, some soap got in the rheoscopic fluid and broke the surface tension, stopping the powder from sticking to the surface and visualizing the flow of the water below. I was ecstatic!

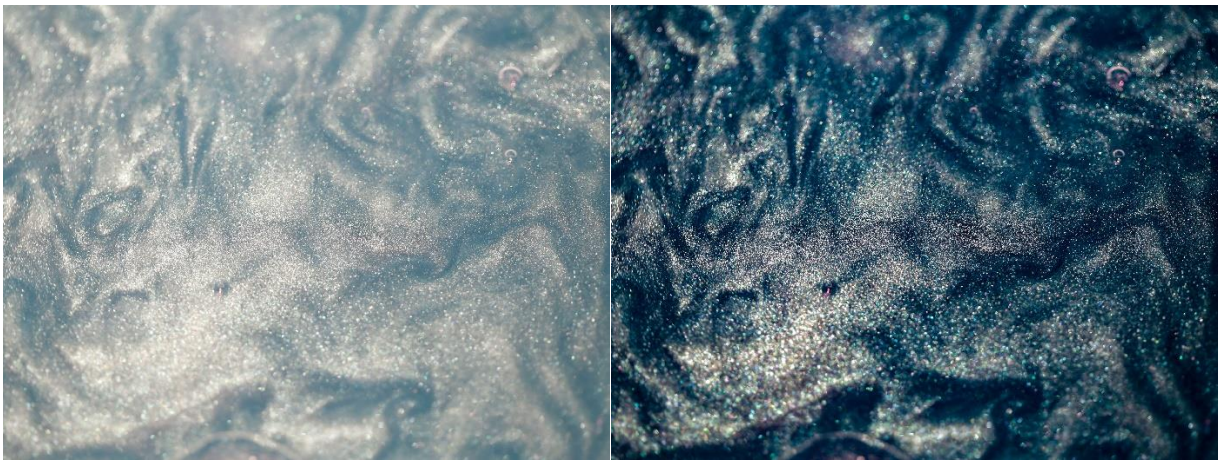
I re-set up everything, filling a bowl water hot water and mica powder and this time adding soap. I set up my camera on the tripod high above the bowl and angled it down, getting a bird's eye view of the water. Being on break, I took these pictures at my parent's house back in Boston, so I had my Dad help me complete this experiment. He held a warm bulb flashlight on one side of the bowl and a cool blue tinted LED flashlight on the other side of the bowl. I stirred the water with a spoon and took pictures as fast as I could after stirring the water to visualize the flow of the

disturbed water. I captured a few with the kitchen lights on and the flashlights shining on the scene, one of which I used as my final submission. I also took some with the overhead kitchen lights off and the flashlights as the only source of light on the scene. I included a lot of variations of these images at the bottom of this document because I got many images I was happy with and felt captured the flow in different and unique ways during this shoot.

The physics behind the visualization of hydrodynamics through rheoscopic fluid is complicated and not yet fully understand. What we know is this; we can visualize fluid flow with mica powder because of mica powder's properties. Mica powder is made up of tiny mica particles, which is a type of sheet silicate mineral that has almost perfect basal cleavage. These particles are shiny and are big enough to reflect light in different ways based on their orientation caused by the hydrodynamics of the fluid they reside. Mica powder is mass produced for a variety of different uses, so it is cheap and easy to buy. It can be found in a variety of different colors. I choose to use a light teal/blue color in hopes of making the most aesthetic image. I bought 2 grams of "*Mica Powder for Soap – Powdered Pigments Set – Soap Making dye - Hand Soap Making Supplies- Mica Powder for Soap Molds - Bath Bomb Dye Colorant (Mermaid Blue)"* from *"Soap Supplies and More*" off Amazon for only $2.00.



To take these pictures, I used my boss's Canon EOS 6D and macro lens (f/2.8) in hopes of capturing the mica particles and the flow the most crisply and clearly that I could. I used an exposure of 1/200. Because the water wasn't moving too fast, I didn't need an extremely high shutter speed. I used an ISO of 500 because the scene wasn't too dark, and I had a nice wide f-stop and relatively slow shutter speed to help let in enough light. My focal length was 100 mm and the image is 72 dpi. The original and final images are 4864 x 3648 pixels as I did not crop the image in post-processing. The original image turned out washed out because I had the overhead kitchen lights on, so the light was very diffused. I wanted to make the flow very defined, so I cranked up the contrast, shadows, highlights and saturation of my image and turned down the exposure.



I am very happy with how the final picture turned out and love how clear the mica particles are. I also was happy I was able to capture multiple pictures that I thought looked interesting and captured the flow well. This project was enjoyable, and I love getting to work with Macro lenses. Overall, I am happy and proud to walk away with my (multiple) final images!

References

Duda, Daniel & Klimko, Marek & Skach, Radek & Uher, Jan & Uruba, Vaclav. (2019). Hydrodynamic education with rheoscopic fluid. EPJ Web of Conferences. 213. 02014. 10.1051/epjconf/201921302014.

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