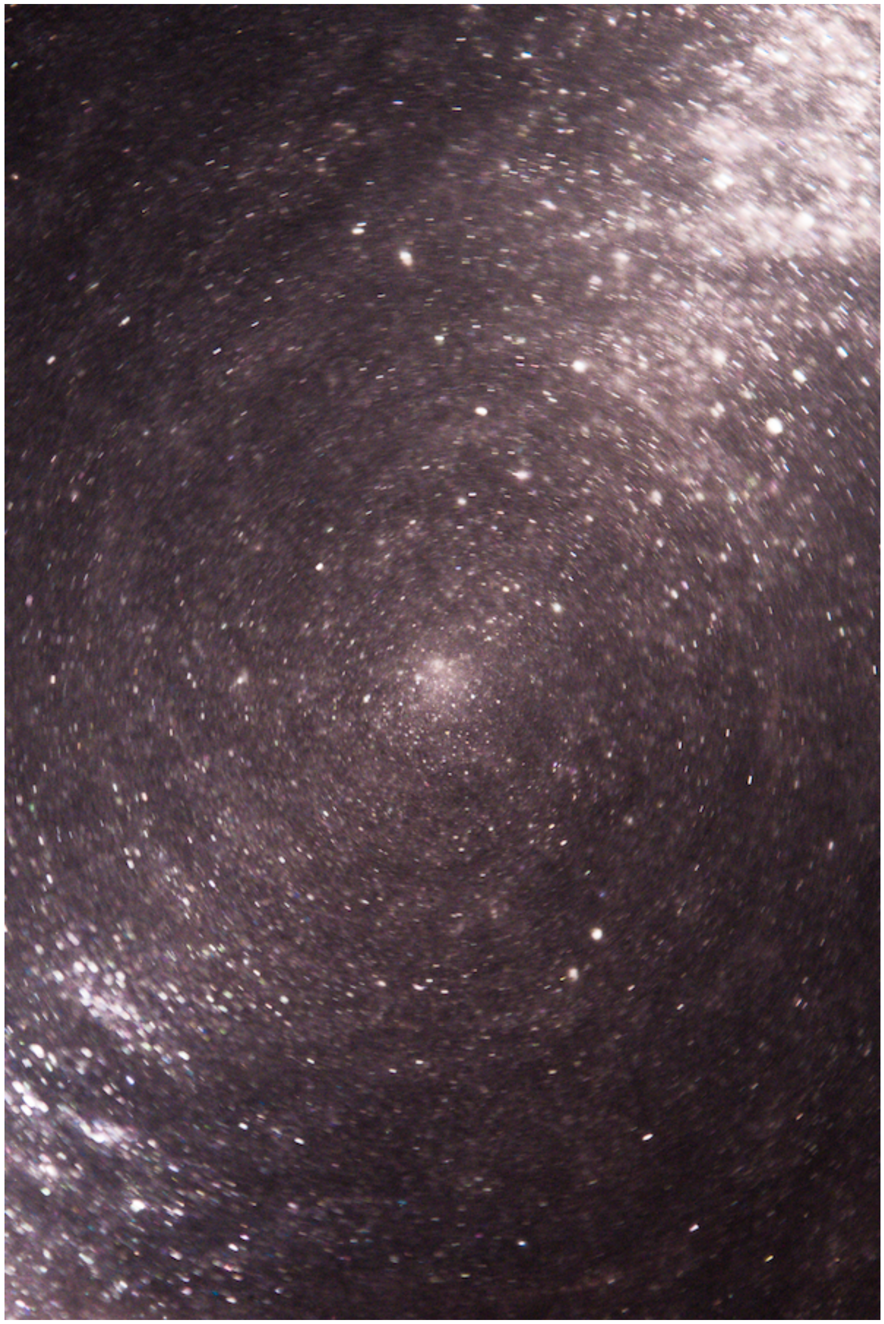

A Glitter Galaxy

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With contributions from: Diogo Silva

CVEN 5153: Flow Visualization
Get Wet Assignment
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1. Introduction

This image was taken for the "Get Wet" assignment as part of the Flow Visualization course at CU Boulder. The objective of this assignment was to take a compelling picture or video that captures a flow phenomenon. For this assignment, I was inspired by the look and feel of galaxies. I wanted to create an image that resembled a galaxy, while also clearly demonstrating an interesting flow. To achieve this, I designed an experiment to make a vortex, using edible glitter to trace the flow's motion. This experiment was done in collaboration with my partner, Diogo Silva, who ran the experiment, allowing me to focus on the photography. Additionally, I used Anthropic's Claude 4.6 Sonnet to review this report for grammar and consistency (Anthropic, 2026).

2. Experiment Overview

Figure 1 depicts the experimental setup needed to recreate this image. A round, glass Pyrex container of 16 cm diameter and 8 cm height acted as the base. The round shape provided curved sides that minimally disrupt the vortex. Water was poured into the container to a height of roughly 4.5 cm. Approximately one teaspoon of NiHome edible glitter in the color purple and Piiper edible dust in the color chrome were added to the water. A 16.5 cm stainless steel teaspoon was used to stir the solution and create a vortex. To create a dark background, a square of black fabric was placed under the container.

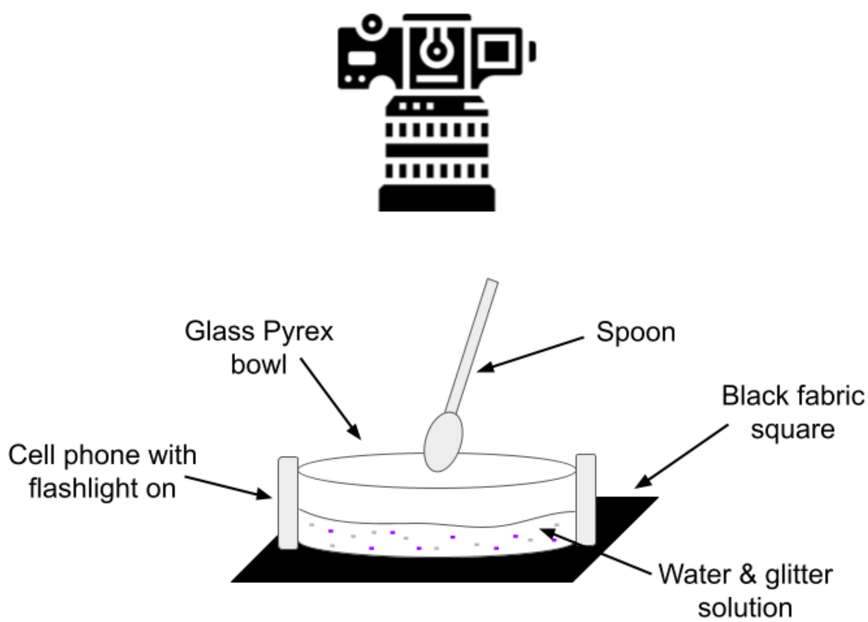

***Figure 1**. Experimental set up*

3. Photographic and Visualization Techniques

To achieve the galactic appearance, two cellphones with their flashlights on were placed at opposite ends of the container. This positioning provided directional illumination from opposing angles, creating a diagonal light through the image, mimicking that of a galaxy. Although the overhead lights were turned off, some ambient daylight was present as the photo was taken in the early afternoon. The camera flash was not used to avoid potential glare or reflection from the water. A relatively fast shutter speed of 1/250 was selected to minimize motion blur and capture the moving glitter. An aperture of f/5.6 provided a moderate depth of field, while an ISO of 3200 compensated for the low lighting and provided the grainy texture desired. An overview of the full camera settings used is shown in Table 1.

Table 1. *Overview of image characteristics*

Camera Setting	**Value**
Camera model	Canon EOS Rebel T3I DSLR Camera
Lens model	Canon EF-S 18-55mm f/3.5-5.6 IS II Macro Autofocus APS-C Lens
Lens focal length	55 mm
Distance from object to lens	17.78 cm
Size of the field of view	7.2 cm x 4.8 cm
Image size	Original image: 3456 x 5184 pixels Final image: 3456 x 5184 pixels
Aperture	f/5.6
Shutter speed	1/250 s
ISO	3200

To enhance the image, post processing was completed in darktable, an open-source photo editor. The original image (Figure 2) captured the flow and the colors, but with fairly muted tones. To make the colors and flow look more dramatic, I increased the contrast between the dark background and the lighter flow. I also increased the sharpness and adjusted the exposure to improve the overall quality of the image.

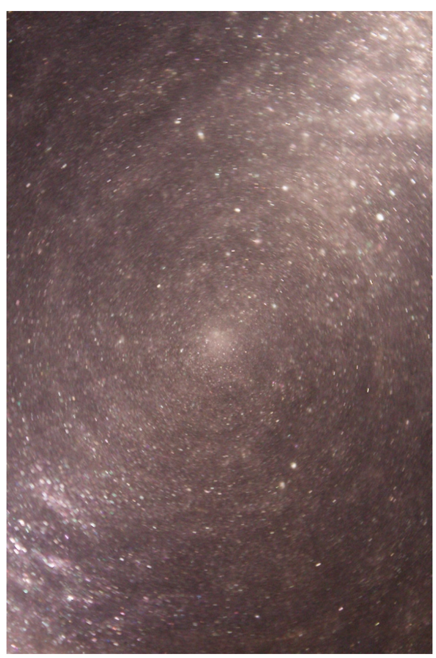

Figure 2. *Original raw image*

4. Fluid Dynamics

The aim of this experiment was to create a vortex, or a flow in which fluid rotates around a central axis (Tian et al., 2018). In this experiment, stirring the solution with a spoon applied a tangential force to the fluid, transferring angular momentum and initiating rotation (White, 2023). After removing the spoon, the vortex decayed gradually as this momentum dissipated. The curvature of the glass minimized the disruption of the circular flow pattern, slowing the decay. Past research has shown that stirring speed and position, as well as boundary interactions, can influence vortex formation, strength, and decay (Kaiser et al., 2020; Yamamoto et al., 2019).

Due to the transparency of water, edible glitter was added to the solution to act as a tracer and make the flow more visible. The edible glitter created a rheoscopic fluid, a fluid that is seeded with "small, anisotropic, reflective particles" (Borrero-Echeverry et al., 2018). When illuminated, these particles reflect light at differing intensities, revealing the fluid motion.

The Reynolds number can provide additional insight into the behavior of the fluid. The Reynolds number is a dimensionless ratio that compares inertial and viscous forces in a moving fluid:

$$Re = \frac{UL}{\nu} \tag{1}$$

where U represents the estimated flow velocity, L is the characteristic length, and ν is the viscosity of the fluid. To estimate the velocity of the flow, the speed of the spoon's rotation was calculated by dividing the circumference of the spoon's circular path ($\pi * 0.0762\ m$) by the time required for one complete rotation (2 seconds).

$$U = \frac{\pi(0.0762\ m)}{2\ s} = \mathbf{0.12\ m/s}$$

The characteristic length is the diameter of the glass Pyrex dish (0.16 m). Finally, 1.0 x 10^{-6} m^2/s is the viscosity of water. The addition of edible glitter could affect the viscosity of the fluid, however, as it was highly diluted, the effect was assumed to be negligible.

$$Re = \frac{0.12\ m/s\ * 0.16\ m}{1.0x10^{-6} m^2/s} = \mathbf{1.9x10^4}$$

A Reynolds number of 1.9x10^4 indicates that the flow was turbulent at the time that the spoon was stirring the solution. At this value, disturbances such as vortices are expected to be present. However, as the image captures a decaying vortex after the spoon was removed, the Reynolds number may be slightly overstated.

5. Conclusion

The final image successfully captures the flow phenomenon, while also replicating the look and feel of a galaxy. Overall, I appreciate the soft aesthetic, along with the diagonal light, and the texture from the glitter. The colors work well together and contrast well against the black background. The image shows a clear vortex, however, it is a decaying vortex, which is not as dramatic as a stronger, more sustained vortex. If I were to repeat this experiment, I would investigate alternative methods for creating a vortex such as a milk frother or a magnetic stirrer.

These methods could create a stronger vortex that would be more defined in the image. In terms of the photographic and visualization techniques, I would be interested in taking video footage, using a macro lens to capture more details, and experimenting with taking pictures while pulling the spoon out of the container.

6. References

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