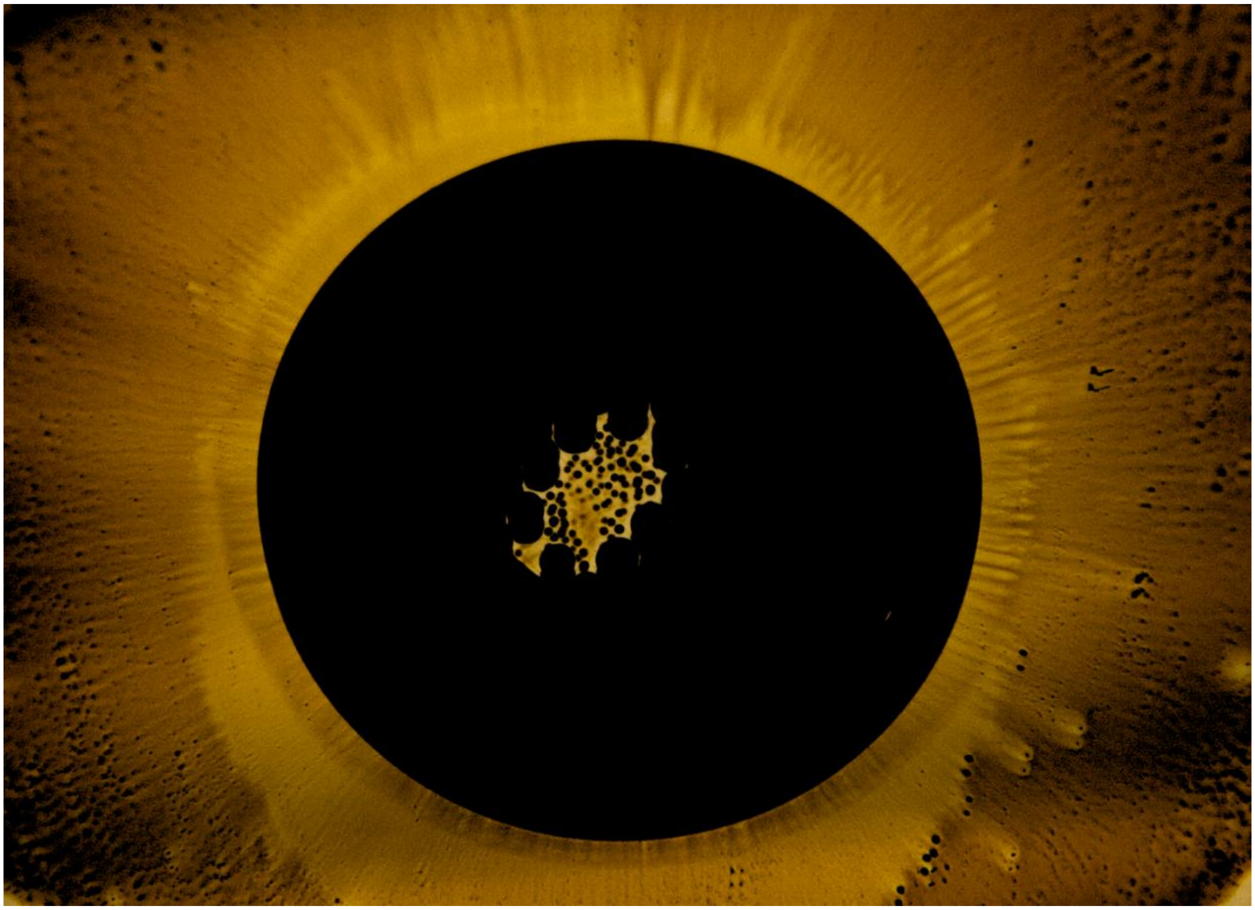

Figure 1: Image

Team Second
Venkata Durvasula
MCEN 5151

Context and Background:
In collaboration with my teammates Ben Clairday, Corey Murphy, and Zachary Taylor, we conducted an intriguing experiment involving ferrofluids and magnets to generate captivating patterns. The objective was to explore the dynamic behavior of ferrofluids under the influence of a magnetic field.

- Materials Used**:**
    - Ferrofluids: A colloidal liquid containing magnetic nanoparticles.
    - Glass Surface: The substrate on which the ferrofluid was placed.
    - Magnet: Positioned underneath the glass to induce magnetic effects.
    - Yellow Light Background: Used for optimal visualization and contrast during the experiment.
    - Imaging Equipment: We utilized cameras to capture images of the ferrofluid patterns.
- Experimental Procedure**:**
    - A thin layer of ferrofluid was carefully placed on the glass surface.
    - A powerful magnet was positioned underneath the glass, allowing us to manipulate the magnetic field affecting the ferrofluid.
    - The yellow light background was used to enhance the visibility of the ferrofluid patterns.

Discussion

Ferrofluids are a remarkable class of colloidal liquids that exhibit a unique combination of magnetic and fluidic properties. They are composed of tiny magnetic nanoparticles, often made from materials like Iron, Nickel, or Cobalt, suspended within a carrier fluid, typically a hydrocarbon-based or water-based solvent. The distinct features of ferrofluids make them a subject of great scientific interest and practical applications.

- Magnetic Nanoparticles:
    - Ferrofluids owe their magnetic properties to the presence of nanoparticles, which are typically on the nanometer scale in size. These nanoparticles are often coated with a surfactant to prevent clumping and stabilize their dispersion in the liquid medium.
- Response to Magnetic Fields:
    - When subjected to an external magnetic field, the nanoparticles within the ferrofluid align themselves along the field lines. This alignment gives rise to the overall magnetization of the fluid.
- Fluidic Behavior:
    - Despite their magnetic properties, ferrofluids retain the characteristics of a liquid. They flow and can take the shape of their container, behaving like typical fluids when not subjected to a magnetic field.
- Surface Tension and Capillary Action:
    - Ferrofluids exhibit unique behaviors at the liquid-air interface. Surface tension causes them to bead up on surfaces, forming characteristic

    shapes and patterns. When influenced by capillary action, the fluid can rise along surfaces, leading to the formation of spikes and other structures.
- Stability and Relaxation:
    - Ferrofluids are known for their stability, provided the surfactant coating the nanoparticles prevents agglomeration. However, over time, ferrofluids may relax and return to a more stable, lower-energy state when the external magnetic field is removed.
- Applications:
    - Ferrofluids have found a wide range of applications in various fields. They are used in seals and dampers for precision engineering, as well as in loudspeakers to improve sound quality. They are also utilized in medical diagnostics and as contrast agents for magnetic resonance imaging (MRI). Additionally, they have applications in scientific research, art, and educational demonstrations due to their visually striking properties when exposed to magnets.

Ferrofluids' combination of magnetic and fluidic characteristics has made them a subject of scientific research and innovation, with the potential for even more applications in the future. Their dynamic response to magnetic fields and visually appealing behaviors make them a fascinating subject for experimentation and exploration, as demonstrated in your experiment with the magnet and glass.

Image Capture and Editing Details:

I utilized a Canon EOS 40D camera to capture the original image. The original image dimensions were 3888 x 2592 pixels. It served as the starting point for the subsequent editing and enhancement process. For post-processing and image enhancement, I employed Darktable, a powerful open-source software designed for photo editing and manipulation.

Editing Steps:

- Cropping: The original image was cropped during the editing process, resulting in a final image size of 2347 x 1965 pixels. This adjustment allowed for a closer and more focused view of the subject.
- RGB Curve**:** The editing process involved the use of the RGB feature. This feature may have been utilized to fine-tune and optimize the image's color representation, emphasizing the visual impact of the subject.

Camera Settings:

- Shutter Speed: The image was captured with a fast shutter speed of 1/1250 seconds. This fast shutter speed effectively froze motion and allowed for a sharp, well-defined image.

- ISO: The ISO setting was 640, indicating a moderate sensitivity to light. This choice would have contributed to maintaining image quality while ensuring proper exposure.

- Aperture: An aperture setting of f/5.6 was used. This aperture size controlled the depth of field, determining the range of focus within the image.

- Focus: The focal length was set to 109 mm, indicating a specific choice of lens or zoom level to capture the subject at this particular focal length.

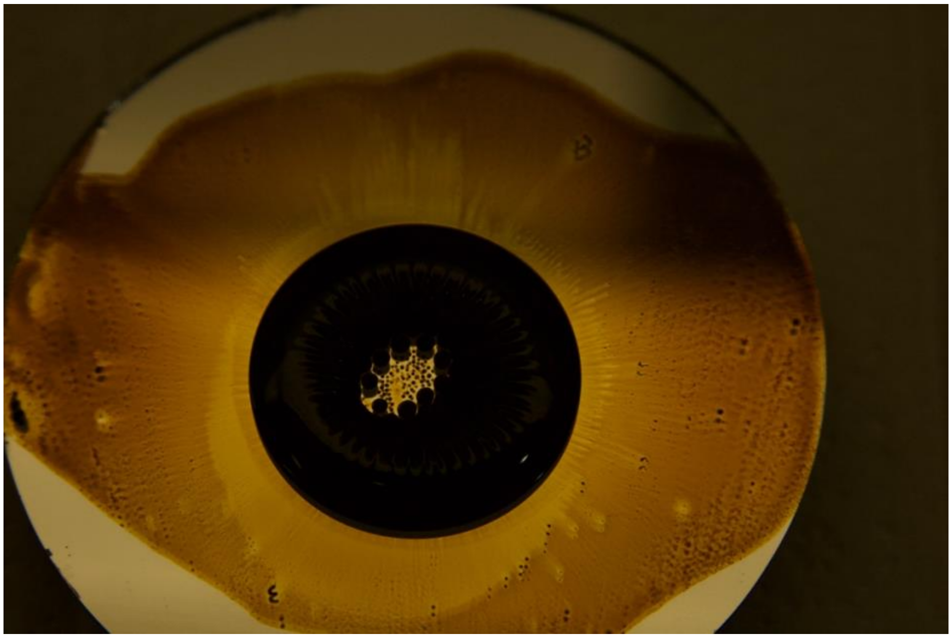

Figure 2: Original image

Conclusion:

I have a strong affinity for the resulting image, as it beautifully captures the captivating effects of the experiment. The post-processing work unquestionably enhances the original image, lending it a golden hue and drawing more attention to the central circle. The interplay of colors and the visual impact are truly mesmerizing.

In retrospect, it does occur to me that a touch of additional symmetry could further accentuate the image's visual appeal. A symmetrical gap placed precisely in the center of the circle would have introduced a harmonious balance, adding an extra layer of aesthetic allure. Symmetry often has a way of enhancing the visual impact, and the notion of a perfectly centered gap within the circle aligns with the quest for an even more visually pleasing composition.

Nonetheless, the image remains a striking representation of the experiment, and the choices made in post-processing have undeniably transformed it into a captivating work of art.

References :

1. S. Odenbach, “Ferrofluids-magnetically controlled suspensions”, Colloids and Surfaces A ; Physiochemical and Engineering Aspects, Volume 217, Pages 171-178. (2003).