

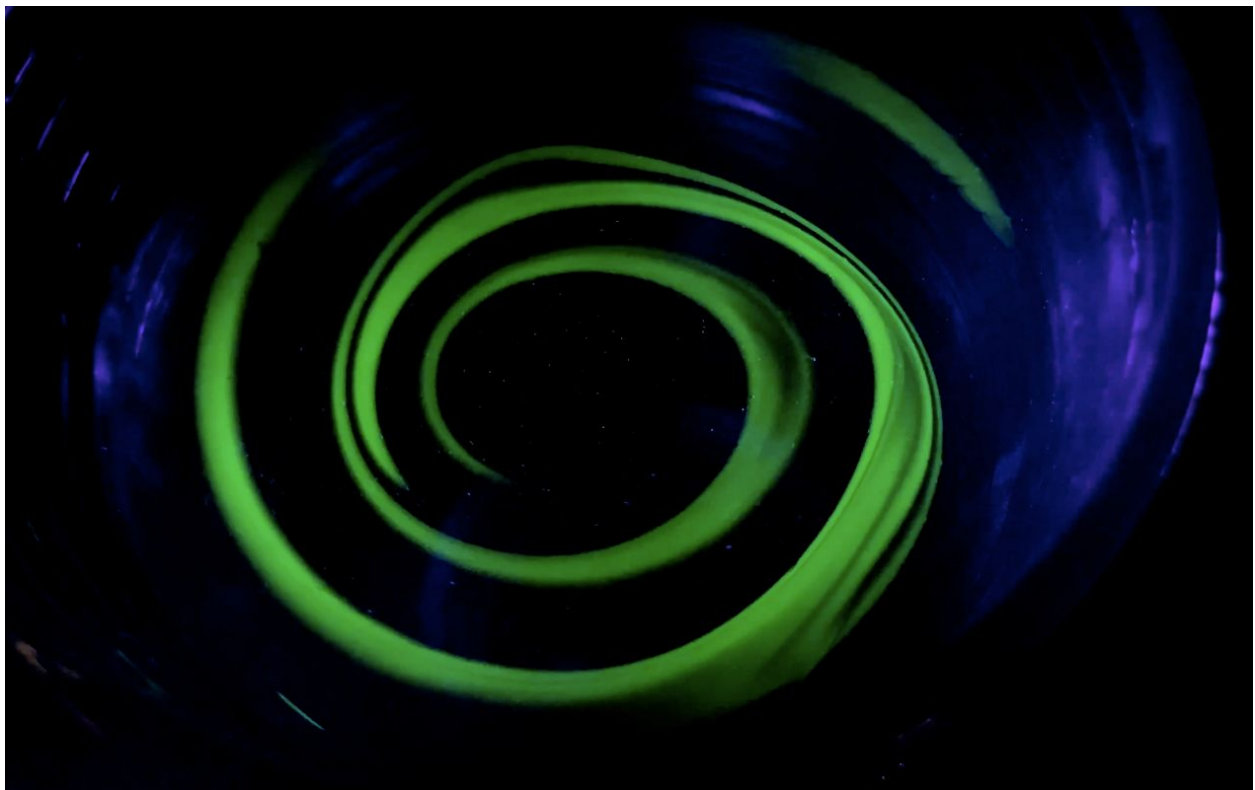
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**ATLS 4151 - Flow Visualization**

**Image-Video #3**

**11/25/2020**

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This image was taken from a video I made for the third image/video assignment in ATLS 4151, Flow Visualization. The purpose of this assignment was to capture an instance of physical interaction amongst some fluid to create a beautiful image as well as explain the physics occurring. My intent with this video was to capture the beautiful and cosmic fluorescent nature of highlighter fluid in ultraviolet light.

The main physics captured in the video reveals a basic vortex. A vortex typically involves the rotating motion of a fluid around a common centerline<sup>1</sup> and can be seen in my video as the highlighter fluid swirls around the glass towards the center. The fluid flow follows basic properties of vortices such as increase of speed towards the center along with decreased pressure<sup>2</sup>. This can be seen in the video as the fluid towards the center of the glass moves faster than the fluid towards the edge of the glass even as the entire flow slows over time. Another physical phenomenon captured in my video is fluorescence. Fluorescence occurs when a material absorbs light of a certain color then emits light of a different color with a longer wavelength.<sup>3</sup> The highlighter contains fluorescent chemicals so in a dimly lit scene, such as this one, the fluid appears to glow as we cannot see the UV light being absorbed by the fluid, only the visible light emitted by it.

The visualization technique I used to capture this flow phenomena was the use of fluorescent dye. The bright greenish-yellow glow of the highlighter fluid is caused by the fluorescent chemicals contained within them. The science of which is described above. I first filled a glass with approximately 16 oz of tap water. I did this at a slight angle as to cause the initial swirling motion of the water in the glass. I then quickly set the glass on the counter and dipped the tip of the *Up & Up* brand highlighter into the water for about one second as the ink was swept in by the vortex. The lighting was mainly provided by the fluorescent glow of the highlighter fluid with a small bit of the UV flashlight peaking in on the side of the shot. The glass was placed about 3 inches from my iPhone set on a tripod angled downwards towards the glass at about 40 degrees.

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<sup>1</sup> Nitsche, M. (2006). Vortex Dynamics. *Encyclopedia of Mathematical Physics*, 390-399.  
doi:10.1016/b0-12-512666-2/00254-6

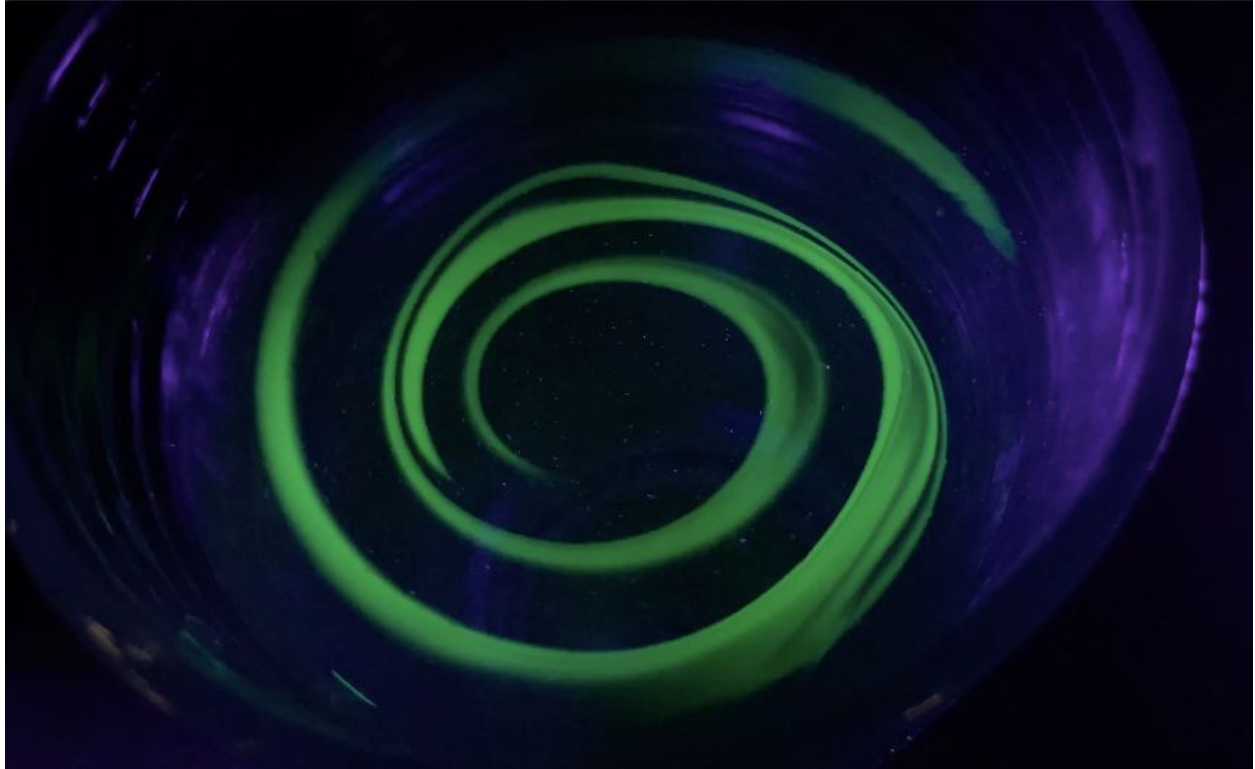
<sup>2</sup> Nitsche, M. (2006). Vortex Dynamics. *Encyclopedia of Mathematical Physics*, 390-399.  
doi:10.1016/b0-12-512666-2/00254-6

<sup>3</sup> Baird, C. S. (2015). What makes a "fluorescent" highlighter marker so bright? Retrieved November 23, 2020, from <https://wtamu.edu/~cbaird/sq/2015/05/15/what-makes-a-fluorescent-highlighter-marker-so-bright/>



(Shot setup)

Aside from the somewhat complex setup, this shot was fairly easy to capture as a video on my iPhone SE. I captured this on the highest quality video settings I could attain which in my case was 4K video at 60 frames per second. The original shot size was 3840 x 2160 pixels and the final MP4 measured 2720 x 1530 pixels. In post production I did a small bit of editing within Adobe Premiere Pro including adding a title slide and music that I made using Logic Pro X. I also increased the brightness and contrast slightly to make the glowing effect pop out a bit more as well as zoomed in on the center portion for a change of perspective.



(Screen shot before editing)

I am very pleased with the final outcome of this video. I definitely prefer working more with still photography but it was nice to get out of my comfort zone and work with video. I believe this medium really shows the fluid physics well as you can watch the vortex fully develop over time which would have been unattainable with a still shot. I really love how the fluorescent nature of the highlighter fluid really pops in the scene and reveals the flow clearly . This video reveals to me yet another instance of the beauty of flow visualization that exists all around us and that can be captured in the simplest of settings to reveal the most interesting patterns in nature.