MCEN 5151-003 Flow Visualization — Team First

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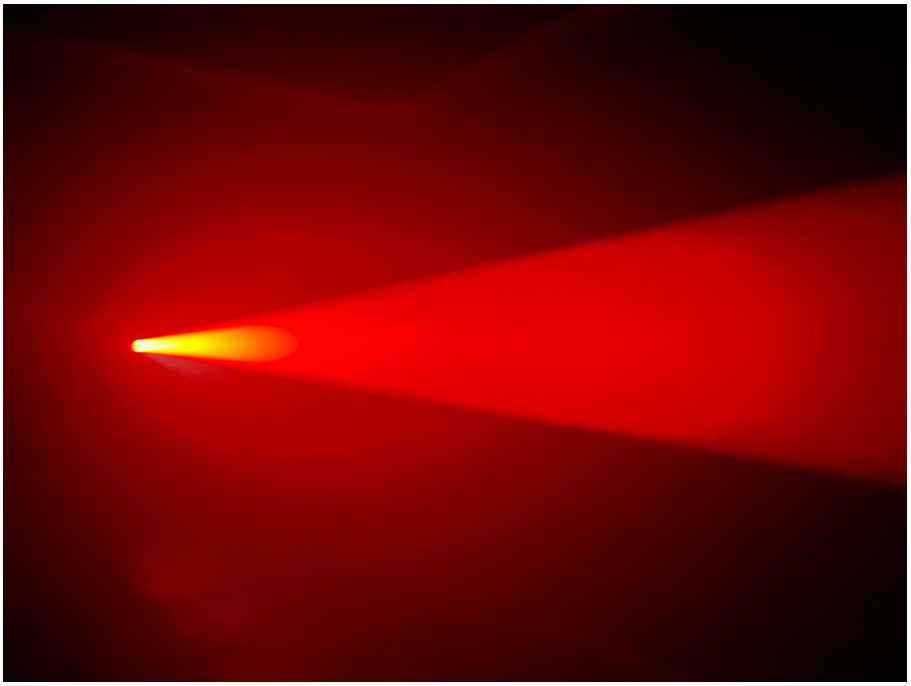

In this project, I aimed to capture the interaction between light and air, using the light from a movie projector as the medium to showcase the movement of the air through the reflection of the light in the suspended particles. Although the final photograph did not clearly display the movement of the particles, it resulted in a captivating and artistic portrayal of the interplay between light and suspended particles. The image reveals the beauty of the light been reflected on the particles, which creates a cool visual effect.

The setup for this experiment consisted of positioning a standard movie projector in a dark room with high brilliance projections of different colorful backgrounds. The projector was directed at a blank wall, and its beam passed through the surrounding air, which contained naturally suspended dust particles, and artificially injected water particles. The goal was to capture these illuminated particles while inducing flow patterns while my friends would shake their hands in circles, blew the air or run across the room. While the dust movement was not clearly captured, the lighting and subtle shifting patterns created some magical effects, somewhat capturing the otherwise invisible flow of air.

The phenomenon under investigation was the movement of dust particles within the air, a result of small currents and disturbances. When illuminated by the projector light, these particles became visible as specks of light within the beam, effectively visualizing the flow of air. This phenomenon is governed by light scattering, where particles act as tiny reflective surfaces, scattering light in all directions. The subtle shifts in the air flow became evident through this scattering effect, offering a glimpse into the otherwise invisible dynamics of the room's atmosphere.

To enhance the visualization, I ensured that the room was free from strong air currents (closed doors and windows), allowing for delicate and subtle movements of the dust to stand out. I also highlighted the amount and size of particles by diffusing water with a spray on the rooms air. The shots were taken during the night, with the curtains down and no lights besides the projector creating a high-contrast atmosphere. This contrast allowed to emphasize the interaction in between light and particles.

For this experiment, I used my Fujifilm XT-2 digital camera to capture the images. The original image dimensions were 6000 pixels in width by 4000 pixels in height, pro-

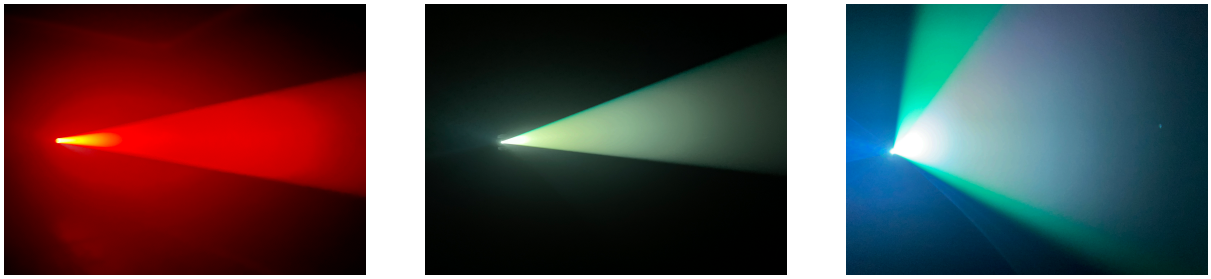

Figure 1: Collection of different edited photographs

viding a high-resolution depiction of the illuminated particles. The field of view covered the projector beam, approximately 1 meter in diameter at its widest, with the camera positioned about 4 meters away from the projector and up to 2 meters away from the light beam. At times, I took the picture from closer or even inside the beam to achieve a more abstract and artistic photograph. The lens used was a 50mm prime lens, providing a balanced perspective for the close-up image.

In terms of camera settings, I used an aperture of f/2.8 to allow more light into the lens, ensuring that the particles in the beam were captured with sharpness and clarity. The shutter speed was set to 1/60 seconds to maintain smooth illumination without overexposing the particles. The ISO was set at 800 to maintain a clear image while minimizing noise. These settings allowed for an optimal capture of the light and dust interaction, creatively capturing the beauty of the scene.

The final images were all distinctly post-processed to enhance the visual appeal, depending on the nature of the shot and the intended artistic effect. In general, I typically increased the contrast to further define the particles within the light beam, making them stand out against the dark background. I also adjusted the exposure slightly to ensure the beam and particles were well illuminated while maintaining the surrounding darkness. To create a strong black background, I raised the black point, enhancing the darkness around the light beam. Additionally, the colors were lightly adjusted to bring warmth to the light beam, creating an atmospheric effect that mirrored the surreal quality of the light's interaction with the particles.

To improve the experiment, I would have liked to better capture the particle patterns and their movement within the light beam. One potential way to achieve this would be by using a shorter exposure time to avoid movement blur. Alternatively, using a higher frame rate with a camera capable of capturing faster movements could result in clearer snapshots of the particles in motion. These adjustments would allow for a more detailed exploration of the fluid dynamics involved in the interaction between the air, particles, and light.