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Flow Visualization

MCEN 4151-001

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Team Third Project Report

For the final Flow Visualization project, I decided that I wanted to work more with the flow of fire. For my first team image my group members and I made a fire whirl with a cut vase. I thought the flow was interesting and wanted to try something new with fire. I had seen some images of sparklers in water and thought that the contrast of fire-like components and water-like components was interesting. For this final image I decided to try to make a wave of fire to contrast properties of waves of fluid with the properties of fire.

To set up the picture, I purchased a few bottles of hand sanitizer. I chose hand sanitizer as the fuel for the fire because it burnt at a lower temperature with an interesting blue color, and because the viscosity would allow for a wave to form. I waited till dark and put a thin layer of the hand sanitizer onto a cooking sheet. When I had the camera focused and set to the correct settings, I lit the hand sanitizer and formed a wave with a plastic card. After trying to catch the image of the fire wave on camera. I quickly blew out the flame to conserve the hand sanitizer. I continued to light the hand sanitizer and create waves to catch better images until I captured an image that I liked.

The camera was set a few inches of the ground on a small tripod. The camera was set two feet away from the cooking sheet at a parallel angel to the ground. To focus the camera, I placed a pencil at the center of where I intended to create my fire wave. I took a few images of the flame of the lighter to set the ISO and shutter speed to the correct settings.

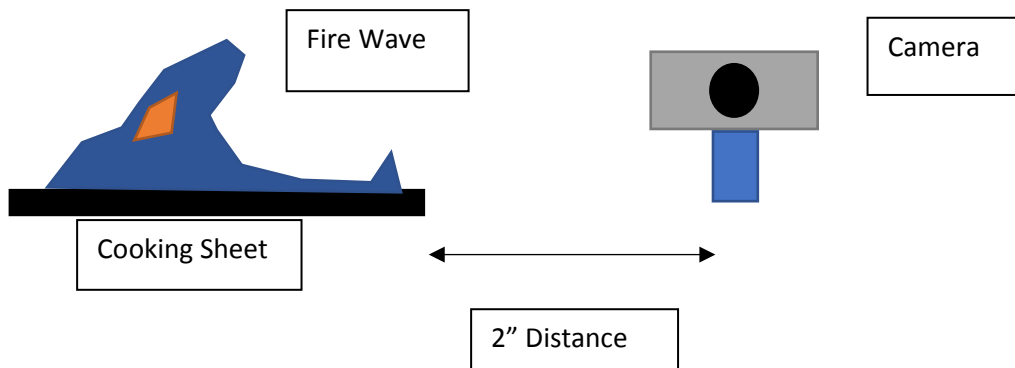


Figure 1: Experimental Setup

The photo was taken on a DSLR camera at a shutter speed was at 1/500 of a second. This speed was chosen to clearly capture the flow without blur and to limit the outside light. The aperture was held at f/3.2 to allow the flame to be bright enough. The picture was taken at a portrait angle with fixed 50 mm lens from a two-foot distance. The coloring of the image was not edited, but some sections were blacked out because they took away from the image of the fire wave.

The intent of the image was to show the physics of a fluid wave as it breaks, as well as the physics of a disturbed flame. The breaking of a wave is created when a waves amplitude reaches a critical level. At this point the energy of the wave needs to be dissipated. This energy is dissipated through the breaking and spreading of the wave. In my image, the hand sanitizer fluid was given energy by the movement of the card though the layers of fluid. This caused energy to be concentrated into a wave and eventually dispersed though its break.

I think the final image has an interesting artistic presentation. I like the colors in the image as well as the flow of the fire in the image. I would like to have gotten a better wave shape in the final image, but I think the image I captured showed the wave an interesting manner. I think I could do a better job presenting the physics in the image because it can be hard to tell what exactly is going on with the flows. Overall, I think I captured a good image and I am proud to submit my fire wave for my final project in Flow Visualization.

