

Team Project 2

For our 2nd group project we ended up using a fish tank filled with water and took pictures of the shadows certain fluid flow creates. The primary purpose of our images was to use shadowgraphs to study surface flow in a fish tank. Originally we had intended to use the Schlieren photographing setup, but we did not have a good enough light source to create a photograph. The image shows water wave propagation through a fish tank.

For our apparatus we used a 15 gallon fish tank half filled with water. We then held the fish tank at an angle so that the bottom of the fish tank was approximately perpendicular to the light coming in; This way we had a clear view at the shadows the water created instead of getting shadows from different parts of the tank which would disrupt the picture. The shadowgraph was created by one of our group members tapping rhythmically tapping on one side of the fish tank. This eventually produces a series of propagating waves from all sides of the tank, creating areas of positive and negative interference. This can be viewed in the shadowgraph by the bright (positive) and dark (negative) colors. It can also be seen the diminishing returns of a propagating wave due to friction forces: The waves coming directly off of the side being tapped are stronger and brighter while the secondary waves coming off of the side not being tapped are dimmer and not as large. The speed of the tapping was approximately 240 taps per minute.

The only technique used to visualize our fluid flow is a shadowgraph created by sun light being bent by propagating waves. The water had a few drops of blue food coloring that were from a previous experiment; This most likely had no effect on our final picture. Normal sunlight was used with no flash present.

Picture Specifications:

- Size of field of view: Approx. 2 feet across by 1 foot
- Distance from lens to object: Approx. 3 feet
- Focal length: 31 mm
- Camera type: Canon Digital Rebel XT, 3456 x 2304 pixels
- Aperture: f/16, Shutter Speed: 1/640, ISO: 800
- Photoshop processing: cropping and small contrast changes

Outside of a physics perspective, the image reveals that fluid flow can be very systematic when certain criteria are met. The shadowgraph also competently shows elementary physics principles of positive and negative wave interference with fairly steady plane waves. The image wasn't perfect, some droplets of water on the tank caused imperfections in the picture. If I were to do this again I would try and get a crisper picture, the shadows seem to be inherently blurry. To develop this idea further I would probably get a dual camera tripod setup so I could take pictures of the surface and the shadow at the same time to compare them.