Group Project #3

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May 3, 2010

The main goal of this photograph was to capture a still image of heat gradient coming off of an object using the Schlieren method of imaging. The most successful results were found when imaging objects which were submerged in a vase of water as compared to objects in air. This is because the temperature variations in the water led to a larger difference in the index of refraction of the medium. The reasons that this is important will be discussed later. For this final image an ice cube placed in hot water is shown with the temperature gradient streaming off at the lower corner of the ice cube downwards.

The Schlieren method of imaging assigns different colors for different gradients in index of refraction for the object of interest in a photograph. By this method one can see the magnitude of a temperature gradient between two points within a medium by observing how much color variation occurs between those two points in the image. The set up used for this Schlieren image is shown in Appendix A. In between the two parabolic mirrors the light rays from the point light source become parallel, thus when passing through the different indices of refraction the different light rays get bent to different magnitudes [1]. This is because the various temperatures cause the medium to have various indices of refraction. Thus when finally arriving and converging at the multicolored filter the light travels through different colored regions of the filter based on how much the given light ray was bent while passing through the object of interest. Then one can either look through the filter as shown in the figure, or use a camera to focus on the object of interest to capture the temperature gradient of the object. It is worth noting that auto focus was not working well with this set up so it was much easier to use manual focus for this image. In addition it was helpful to put a sheath made of construction paper over the light source to help guide it only towards the first parabolic mirror rather than allowing the light to shine out in all directions. A final note is that hot water will create a larger and more visible temperature gradient, but does so at the expense of heating up the object more quickly, and in our case melting the ice cube very rapidly.

I think that the intent of this image was realized and came out well. The temperature gradient being caused by the ice cube in water is clear and well defined. There was some distortion in the background of the image that arose from the glass of the vase. As the glass was not perfectly flat it bent the light as it passed through it leading to the noise throughout the background which looks like a noisy temperature gradient but is in fact due to the distortions in the glass. In future attempts I would like to try to use smoother glass, perhaps a fish tank. It also could be interesting to fix in place an object with a more complex shape in place under water to see how the heat gradient forms in respect to the complex surface.

Photographic Data:

Exposure: 1/25

ISO: 400

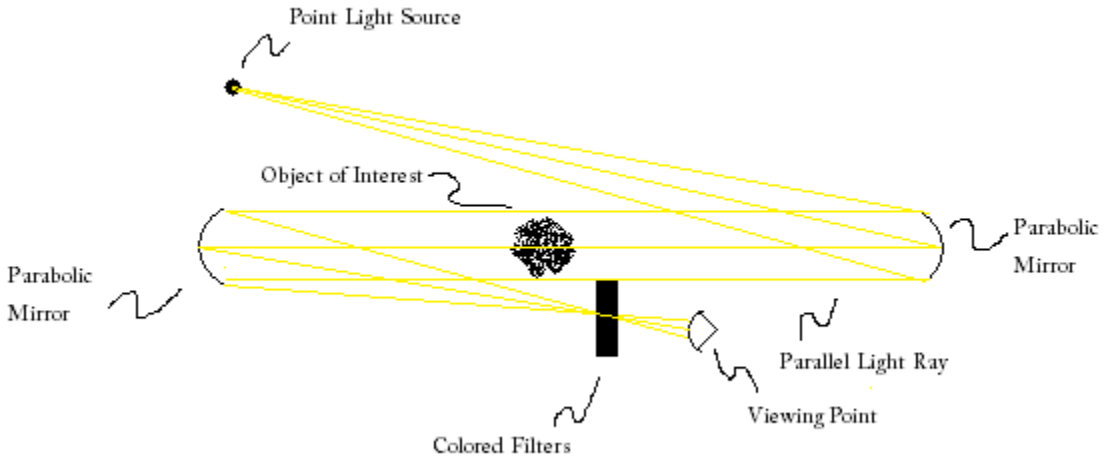
f/ : 5.6

Focal Length: 250mm

Focus: Manual

Flash: Did not fire

Appendix A:



References:

[1] http://www.ian.org/Schlieren/HowTo.html