1982

Making waves in color - a basic color Schlieren system

Andrew Davidhazy

Making Waves in Color - a Basic Color Schlieren System

Andrew Davidhazy
Imaging and Photographic Technology
School of Photographic Arts and Sciences
Rochester Institute of Technology

Why do the classes in Photographic Technology at RIT of Professor Davidhazy evoke such enthusiasm among his students?

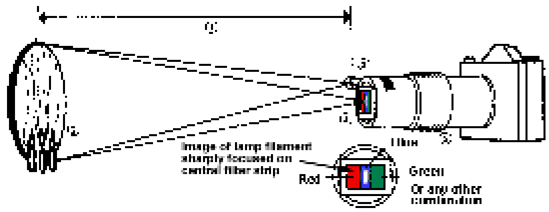
To answer a question with a question - where else can students find fascinating original projects in sophisticated photoinstrumentation achieved with often brilliantly simple means which they can put together themselves at prices that even o student can afford?

The career of Professor Andrew Davidhazy, the perennially youngish experimenter and teacher, has been intimately involved with the Rochester Institute of Technology over the years. Born in Budapest, he not only studied at RIT but took three degrees. He is presently an Associate Professor in the Photographic Technology Department of the School of Photographic Arts and Sciences at RIT. His field of interest is technical photography, high-speed photography, infrared, particularly schlieren photography, and various applications of streak and strip photography.

The purpose of these photographs by Davidhazy was to illustrate for his students the principle that in a color schlieren system, the colors can be introduced arbitrarily by choice of a filter matrix arrangement placed in front of the camera lens. The photographs were used in classroom demonstrations.

The objective of schlieren photography is to make visible [and thereby investigate] "wave" movements within transparent mediums, specifically gases and liquids. This is accomplished by following light rays as they are bent passing from one transparent medium to another one of different density: from air to water from one gas to another, or among currents of the some gas at different temperatures. The study of these density gradients has provided an indispensable tool in studies such as those of flow patterns in aeronautical engineering, shock waves in ballistics, the burning of fuels in combustion engineering, and heat transfer studies. Color schlieren offers easy recognition, rapid identification and qualitative analysis of gradient differences by on optical method that does not interfere with the flow patterns.

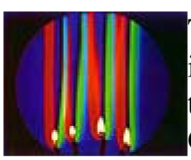
Whereas classical schlieren photography required a fairly elaborate arrangement, usually with two straight edges (such as safety razors) or circular diaphragms, and two schlieren mirrors with critical adjustments, the color schlieren photography setup of Davidhazy has simplified the task. (See diagram below.)



1. 2X focal length of mirror
2. 6" diameter, 60" focal length spherical astronomical mirror
3. 12 volt auto tailight bulb on bracket taped to lenshood
4. Replaceable filter matrix taped to hood. Image of light source focused precisely on center strip of filter matrix
5. 200mm, f/4 lens with 2X converter (or 400mm lens) focused on subject

A 12 V auto taillight bulb on a bracket is taped to the camera lens hood. Its image is reflected by a 6" diameter spherical astronomical mirror of 60" focal length positioned at twice its focal length, or 10 feet (Edmund Scientific is an inexpensive source for the mirror). A 200mm lens with a 2X converter is used to fill the frame of a 35mm camera with the image of the 6" mirror at 10'.

A simple three-color replaceable filter matrix is constructed out of a cardboard frame with strips of color gels (try red, blue and green) as shown in the diagram and it is taped to the hood. Fine tuning the sharpness of the source image on the filter matrix is done by moving the lens shade as required. A lens with an integral sliding lens hood such as is on the Canon 200mm, f/4 will simplify this. The subject whose flow pattern you wish to study is introduced in front of the mirror.


The color schlieren photographs seen here are as follows. A 40W high-intensity lamp produced strong density (color) gradients, further varied by the choice of differing color gels in the matrix. Left to right: R, B,G; R and G with clear center patch; R and G. **NOTE:** these photographs are not currently available but a single example of a color schlieren photograph wqhere the desity gradients are produced by candle flames heating surrounding air is included above.

Light rays not deviated by density gradients pass through the center strip with its single given color. The rays which are bent (by gradients caused by heat differences, for example) pass either right or left on the strip appearing of different color than the undisturbed areas of the subject. Ektachrome 64 daylight film was used and the exposure was 1/125 sec at f/8.

If you'd like to communicate with me about this topic simply send me e-mail by clicking **HERE!**.