

AUDITORIUM SOUND AND LIGHT DEMONSTRATION

In an attempt to illustrate optical and acoustical phenomena on a large scale, we have an annual "sound and light" show in the school's auditorium. The program consists of demonstrations of color mixing and the interference and reflection of sound.

The auditorium is the perfect place to demonstrate an application of color mixing and observe how the perceived color of an object depends on the color of the incident light as well as the nature of the object. We have students come up on the stage and observe the color of their clothing under white light. Then the white light is turned off and each primary color (red, blue and green) is used in turn to illuminate the stage and its occupants. The apparent change in color of the students' clothing is amazing!

We begin our acoustics demonstrations by reviewing the principle of superposition of waves. Interference, a topic previously presented in class, is illustrated by projecting a ripple tank interference pattern on a movie screen.

A transition from water waves to sound waves is made by using two loudspeakers as point sources. While these two sources are being driven in phase students are asked to move around the auditorium and locate points in the auditorium where the sound level is low. This is best achieved when students move slowly about the room with the ear furthest from the speakers covered. By using a large number of students (~100) a well-defined nodal pattern emerges. While the students remain in their seats, the frequency and separation of the sources are changed. The resulting changes in the nodal pattern are easily observed. Music is then played to demonstrate how a large number of frequencies played simultaneously gives rise to a "washing out" of the nodal pattern.

The fact the nodal lines in the interference patterns formed are not distinct leads naturally to a discussion of virtual sound sources due to multiple reflections off the walls. The plane mirror analog is used in predicting the location of the virtual sources of sound. It is pointed out that our auditorium is very lively due to a zealous painter's brush, which filled most of the holes in the otherwise porous cement blocks.