

**Final Report for Marsh White Award**

# **Fun Physics You Can See: Lasers, Holograms, and Spectroscopy**

**The University of Iowa Society of Physics Students, Iowa City, Iowa**

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## **Abstract:**

This activity is a presentation that will teach students and adults about the science behind many interesting visual phenomena. We will show through various demonstrations the physics of subjects that have always captured the interest of the general public. We will introduce some theories of lasers, optics (lenses and holograms), and spectroscopy (colored light and "glow-in-the-dark") while de-emphasizing the reliance on mathematics.

## **Overview for the Presentation**

Giving our presentation, Fun Physics You Can See: Lasers, Holograms and Spectroscopy, was a very interesting learning experience for our SPS members that helped to make it possible. We sincerely hope that it was just as interesting for the 70 sixth graders to whom we presented. We delivered our presentation twice on Friday, May 23, each time to a classroom of about 35 students. We used exciting, kid-friendly demonstrations to teach our audience about the properties of light and illustrate its many

uses in current technological applications. For demonstrations, we focused on these topics: diffraction, phosphorescence, and information transfer and storage using light.

These topics have many physical concepts behind them. We focused on the most important fundamental ideas that are constant throughout each topic.

In our presentation, we attempted to give the students important background information-such as the idea of wavelength and its relationship to color of light and energy-before presenting specific demonstrations. After a discussion of light's wave properties, we looked at diffraction patterns through diffraction gratings (which we gave to each student to take home). We then discussed briefly the idea of spectroscopy by explaining the concept of an electron changing energy states. This discussion was accompanied by a demonstration using tubes of different gases excited by electricity (we originally intended to show this using flame salts, but school regulations wouldn't allow it). This discussion segues into phosphorescence, which we demonstrated using glow-in-the-dark materials (some samples of which we also distributed to the kids).

Our third topic, information storage using light, contained two specific technical areas of physics: fiber optic communication and holography. We presented holography mostly for its value just for fun, but tried to teach the students about its uses for storing information, such as the security information on a credit card hologram. We also discussed briefly how holograms are made using lasers to capture images of real objects.

We demonstrated the use of fiber optics with a modified "walkman" tape player that communicated with an audio amplifier via a light signal instead of standard headphone

cable. We were able to run the light signal through a fiber optic cable to demonstrate how it can be used to transfer the audio information using light.

### **Conclusion/Outcome**

With these demonstrations we attempted to teach these students a few key ideas regarding the behavior of light-how it carries energy related to wavelength, diffraction patterns, and how it is produced by electron energy transfer-and also give them examples of how this is not just a novelty, but actually a very useful and astounding area of scientific study today. We hope to have the opportunity to present this talk again. We are working toward an outlet to give our presentation to the public this summer, and we have already been given an invitation to present a new talk to another group of elementary students next year.

NOTE: Please see the attached Microsoft PowerPoint file that we used as a visual aid for our presentation.