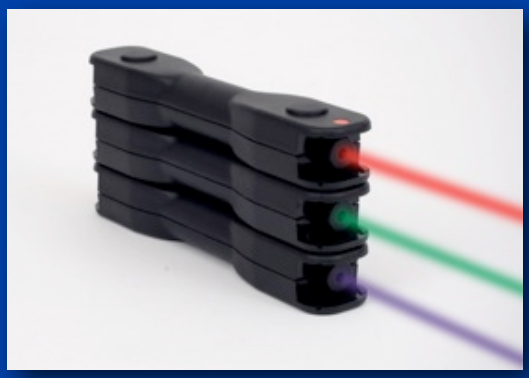
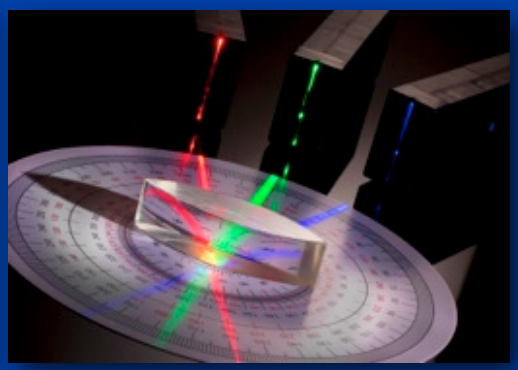
LASER CLASSROOM

Light, Lasers and Optics Outreach Guide





Guidance for scientists, professionals and advanced students who want to share their knowledge, passion and experience with K-12 students.

Welcome to our Outreach Guide

Introduction

As a scientist, professional or advanced student, you're excited to share what you know and love about Light, Lasers and Optics with students... but at the same time, you may be naturally hesitant about taking on a classroom of kids.

The objective of the Laser Classroom Outreach Guide (and Kit) is to inspire and prepare you to take your expertise into the classroom, to share with K-12 students.

Please browse the FREE Curriculum section of our website for lots of Activities, Demonstrations and Lessons to share with students.

This is a FREE, downloadable guide written to support you in your outreach activities. Please browse our FREE Curriculum for Activities, Demonstrations and Lessons to take into classrooms.

Why do k-12 outreach?

While highly trained professionals are critical to the advancement of science, the path to a STEM career starts with early engagement.

Outreach is a chance for you to hone your communication skills - specifically how you share your work with people outside your field.

Outreach creates goodwill between the scientific community - which is increasingly under public fire, and allows you to influence public opinion.

In a field like photonics, which we've noticed is not a household word, outreach is an opportunity to move the term and its work out of obscurity and into the mainstream.

Outreach in schools is particularly beneficial as young people's early experiences with science and engineering can influence critical decisions as they approach college and career decisions.

Finally, outreach brings resources in terms of expertise and equipment that most schools would not have access to otherwise.

If you use Lasers for your outreach , we advise the use of class 2, <1mW lasers for most classroom settings. This class of lasers does not have enough output power to injure a person accidentally, but is capable of causing eye injury if stared at for a long period of time OR if the beam is intentionally pointed directly into the eye. The bottom line is, these are real lasers and need to be handled cautiously and under adult supervision at all times.

General Safety Rules

1. Never look directly at the beam source, or aperture
2. Never point the beam at another person
3. Always be mindful of where a “bouncing beam” will land due to reflection

LASER Hazard Classifications

The most important criterion you will use in applying laser safety control measures is the hazard
classification designated by manufacturers on the equipment labels.

Class 1: cannot, under normal operating conditions, emit a hazardous level
of optical radiation. Included in this category is laboratory equipment using lasers with all beam paths and reflections enclosed.

Class 2: or low-power visible laser device of 1 milliwatt, does not have enough output power to injure a person accidentally, but may injure the eye when stared at for a long period. These lasers are used for alignment procedures and in the optical experiments in this kit.

Class 3a: rated in power from 1 milliwatt to 5 milliwatts—cannot injure a normal person when viewed with the unaided eye but may cause injury when the energy is collected and put into the eye as with binoculars.

Class 3b: lasers from 5 milliwatts to 500 milliwatts can produce eye injury when viewed without eye protection. Eye protection is required.

Class 4: lasers above 500 milliwatts in power can injure you if viewed directly or by viewing both the specular and diffuse reflections of the beam. These lasers can also present a fire hazard. Eye and skin protection is required.

Tips for a successful classroom

Logistics

- Date, time, location and school visitor policy or check in procedure
- How much time will you have?
- How many students are in the class?
- How is the room arranged?
- If you have any specific needs - from audio visual equipment to a sink, now is the time to check and make a request if necessary
- Ask if there are any special situations or needs that you will need to consider (for example, are any of the children physically handicapped?)

Date: _____ Time:_____ Grade or Age:_____

Location: _____

Contact: _____

Educational Goal:_____

Presentation Topic:_____

Equipment/Materials to Bring Along

Other Notes or Considerations

Collaborating with the Teacher

- **Discuss and explore** what the students are currently learning about and how you might be able to support and expand on it given your area of expertise and the activities and lessons provided in this guide.

- **Explore** the skill level of the students - what are they familiar with already? what misconceptions might they have that you can address?

- **Discuss** the teacher's goals - what would the teacher like the students to get out of your visit? This can range from wanting the kids to be inspired to wanting them to have a new skill or a deeper understanding of some concept.

- **Share** your expectations regarding classroom management. In general, it remains the teacher's responsibility to support the visit and make sure that it goes smoothly. The teacher will remain in the classroom and manage students who are disruptive.

Before introducing a scientific concept to the class, assess their level of knowledge and how they may be thinking..

WHY?

- identify what makes the information difficult to understand;
- choose the most appropriate activity or demonstration;
- adjust the amount of content or speed of delivery to suit the classroom in real time.

HOW?

- ask questions to stimulate feedback - why did it change colors, direction etc.?
- have students comment on, or describe something you share.
- ask students to "guess" what will happen next.

Engaging Students

- **Connect t**he activity or demonstration to the “real world” - research has shown that connecting science to something that is of concern to the students is an effective strategy for engaging them in science. If you connect what you are doing in the classroom with something about your own work or an application or technology that kids care about, they are more likely to stay engaged, ask more questions and pursue answers, even when it’s not easy. Photonics applications can be found in nearly every area of life - medicine and biology, military and defense, communication and data, measurement, scanning, manufacturing... make a connection and make it stick!

- **Questions!** Challenging with questions is a great way to engage students in the scientific process. Put in the right way, a question can stimulate curiosity and even elicit a hypothesis. At the very least, questions give rise to a discussion.

CONNECTIONS TO:

- How your work or research uses or applies the concept or skill you are demonstrating or teaching about.
- A recent discovery or scientific advance that relies on the skill or concept you are demonstrating or teaching about.
- A technology or application that students can relate to or care about.
- Other disciplines - usually photonics is covered in physics, but it is applied in Biology, Chemistry, Earth Science and

QUESTIONS:

- Attract attention - What happens when? What do you notice?
- Inspire observation - How much? What size?
- Suggest Comparisons - what is the difference? Which is more?
- Inspires experimentation - Can you find a way to? How can you make this?
- Stimulate Conclusions - What happened? What might that mean?
- Encourages Critical Thinking - What do you think of? Do you agree? What is your opinion and why?

Engaging Students (cont.)

- **Don't lecture.** -- too much. Hands on activities that get students talking with each other and using real equipment is a powerful way to keep them engaged.
- **Consider your language** - use words students will understand and take time to explain and use new vocabulary. Choose simple, precise expressions rather than complex scientific terms and symbols. Give brief, concrete, and whenever possible - amusing, explanations that create teh desire to understand rather than long accounts that are overwhelming and intimidating and boring!