LASER BEAM

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UC IRVINE LASER SAFETY NEWSLETTER

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The purpose of this newsletter is to keep laser operators on this campus informed regarding laser safety news, bargains on laser safety equipment (including protective eyewear), novel/inexpensive methods for controlling laser hazards, lessons learned from laser accidents, and other tips to improve safety. These newsletters are distributed approximately every 6 months or whenever a laser safety issue with significant urgency arises. For past issues of this newsletter, please visit the UC Irvine Environmental Health & Safety website (www.ehs.uci.edu) and look under "Radiation & Laser Safety".

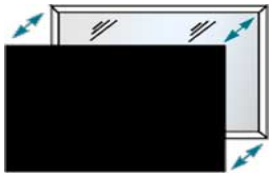
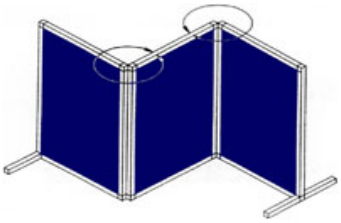
SETTING UP A NEW LASER LABORATORY

When a new laser is received and a room is being converted into a laser laboratory, follow the steps below to ensure safety:

1. Register the new laser with EH&S. This can be done by completing and submitting a *Laser Registration Form* which is available on the EH&S website at the link below. Be sure to include all of the information requested so that a hazard analysis can be performed and sufficiently protective laser safety eyewear can be recommended by EH&S:

   http://www.ehs.uci.edu/programs/radiation/Laser%20Registration%20Form%20Web.pdf

   In addition, EH&S will prepare custom laser warning signs for you free of charge to post on the doors to your laser laboratory based upon the information contained in your completed *Laser Registration Form*.


2. All laser operators need to attend EH&S laser safety training which is currently a 75-minute classroom-type Laser Safety Seminar. However, by April 2006 an on-line laser safety training program will also be available through the UC Irvine Training & Employee Development website (www.ted.uci.edu).

3. It is advisable to set up your laser in a dedicated room reserved for laser use only and well away from office areas, computer workstations, doorways and high traffic areas. Cover all of the windows in the room with an opaque material.

4. If the laser beam will not be completely enclosed *(always try to do that to the best extent possible!)*, isolate the laser use area from other areas of the laboratory with protective barriers.

5. When setting up the optics for your laser system, keep the following in mind:

   a) Contain the beam on one optical table – ***the beam should never cross walkways!***

   b) Tightly secure optical components to the optical table and back up optics at the edges of the table with beam stops or beam dumps to terminate the beam in case the laser is accidentally energized with the optics missing.

   c) Situate the beam well below normal eye levels. ***Never direct the beam in an upwardly direction!***

   d) All shiny objects not being used including mirrors, tools, etc., should be removed from the optical table to reduce the risk of stray radiation.

6. Make sure the door-type warning signs provided by EH&S are posted. Temporary *"Laser Operating – Do Not Enter"* doorknob-type signs are also available free of charge from EH&S for use during beam alignments and other instances when needed. *Note: Illuminated "laser on" warning signs are not required at UC Irvine.*

7. **Use protective eyewear unless the beam is totally enclosed or isolated.**

8. Contact me *(Rick Mannix, UC Irvine Laser Safety Officer; 949-824-6098)* so that I can visit your laboratory and inspect your laser setup prior to the use of the laser in studies. I can also assist you in controlling non-beam hazards such as toxic gases, toxic laser dyes, and electrical hazards.

MEMORABLE QUOTE

"If we knew what it was we were doing, it would not be called research, would it?"

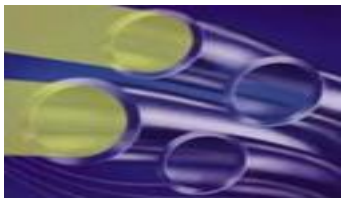
Albert Einstein (1879—1955), German/American physicist

SETTING A GOOD EXAMPLE

It is very important to always set a good example when training new laser operators since they tend to follow the lead of experienced personnel whether the example they are provided with is good or bad.

I have been conducting laser safety inspections at UC Irvine since 1994. During that time I have encountered many research groups that have always been safety minded and made safety the top priority. I have also observed a few research groups for which safety is secondary to experimental progress – or, the personnel there simply don't think their laser experiments are hazardous. Most laboratories in which protective eyewear was habitually worn back in 1994 still emphasize the need for eyewear even though the technicians and students I met in those laboratories back then are long gone. On the other hand, laboratories in which the need for protective eyewear in particular and laser safety in general were not strongly emphasized back then now have a new generation of laser operators who believe that there is no need to use eyewear or alter their procedures in response to my suggestions to improve safety.

The last thing anybody would want would be for his/her poor example to contribute to a laser accident later suffered by another person. Emphasizing safety and being a good role model are good ways to prevent that from happening.



LASER BEAM TUBES

An effective means of safely conducing laser radiation from one location to another is to contain the radiation within a beam tube. Some laboratories use commercially-available small-bore black aluminum beam tubes to enclose their laser beams. However, large-bore polyvinyl chloride (PVC) tubing is inexpensive, readily available at any hardware store, and very useful for this purpose.

Some research groups use PVC tubing that runs along the length of their optical tables to safely conduct laser radiation from the laser itself to an analytical device on the other end of the table. Another application is to contain the beam inside of a beam tube if it is absolutely necessary for the beam to cross a walkway/aisle *(a bad idea unless the radiation is totally enclosed)*.

One advantage of the aluminum beam tubes sold by vendors is that there is no risk of high power beams striking the inside of an aluminum tube and generating air contaminants (smoke, etc.). This is potentially a problem with non-metal beam tubes. However, use of large-bore PVC tubing reduces this problem since the beam is generally centered at least a couple of inches away from the walls of the tubing.

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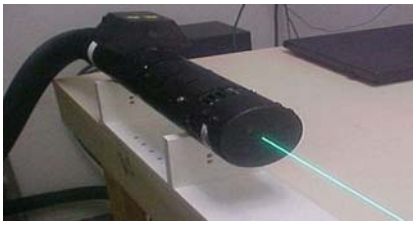
MEMORABLE QUOTE

" I don't mind your thinking slowly: I mind your publishing faster than you think."

Wolfgang Pauli (1900 - 1958), Austrian physicist



BLUE LIGHT HAZARD?

For decades it has been believed that eye exposure to violet and blue light is considerably more damaging to the retina than exposure to equal quantities of green or red light. This was thought to be the case because of *photochemical injury* caused by short wavelength violet and blue light (400 nm – 500 nm). On the other hand, longer wavelength light (500 – 700 nm; green to red) primarily causes *thermal injury*. More recent studies have suggested that retinal damage for short exposures to blue laser radiation (like from an Argon laser) is much less than previously thought. Thus, it appears that it is not substantially more hazardous than red light such as from a HeNe or diode laser.

This new data does not have an immediate consequence for safety guidelines related to acute exposures to laser radiation since the maximum safe irradiance for all visible light (400 nm – 700 nm) is 2.5 mW/cm^2 for 0.25 second exposures *(protection by the aversion/blink response in that amount of time)*. However, this data will lead to a review of safety guidelines for chronic (long-term) exposures to laser radiation and to broadband light sources (non-coherent light sources such as bulbs in biosafety cabinets, bulbs used in artificial lighting, blue light-emitting diodes, and even solar radiation).

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If you have any questions concerning laser safety, please contact Rick Mannix from EH&S (949-824-6098; rcmannix@uci.edu).

✌ **BE SAFE!**