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 campus informed regarding laser safety news, bargains on laser safety equipment (including protective eyewear), 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".

FREE LASER SAFETY EYEWEAR!

EH&S was recently able to purchase about 35 pairs of laser safety eyewear through funding made available from the University of California Office of the President's *Be Smart About Safety Program*. A wide variety of eyewear was purchased including eyewear for use when operating the following lasers: Ti:Sapphire (both narrow and wide wavelength coverage); Ti:Sapphire with unenclosed frequency-doubled Nd:YAG pumping beam; Nd:YAG harmonics (ultraviolet, visible, and near-infrared protection); Argon; HeNe; Erbium YAG; frequency-doubled Nd:YAG; visible/near-infrared diode; and frequency-doubled Nd:YAG alignment only (low optical density).

This eyewear is available free of charge while it lasts to UC Irvine labs which can demonstrate a need for it. Contact Rick Mannix at 949-824-6098 or rcmannix@uci.edu if you would like to have some of this eyewear for use in your lab. Some of it will go fast!

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LASER SAFETY EYEWEAR CONFUSION

There are many labs on campus which operate a variety of types of lasers generating beams at different wavelengths. Of course, different lasers require different protective eyewear; eyewear is only protective at the wavelengths imprinted on it. The danger comes when persons accidentally put on the wrong eyewear for their laser applications.

An example of how this can occur is demonstrated by the 2 pairs of protective eyewear above which look very much alike. The pair of laser spectacles on the left is relatively inexpensive eyewear for use when Argon lasers and frequency-doubled Nd:YAG lasers are operated. It provides protection between 190 nm and 532 nm. *No protection at all is afforded for near-infrared beams.* The far more expensive eyewear on the right is protective for all Nd:YAG harmonics (266 nm, 355 nm, 532 nm, 1064 nm). If a person who will be operating a Nd:YAG laser generating near-infrared radiation at 1064 nm picks up and puts on the eyewear on the left by mistake, a serious eye injury could occur since the wearer has a false sense of security. **Therefore, always be careful when you select eyewear for a particular application**. **Check to make sure the wavelength and optical density are appropriate for your safety. Do not store eyewear for use with one particular type of laser near <u>other</u> types of lasers.** If you have any doubts about the suitability of your eyewear, contact EH&S.

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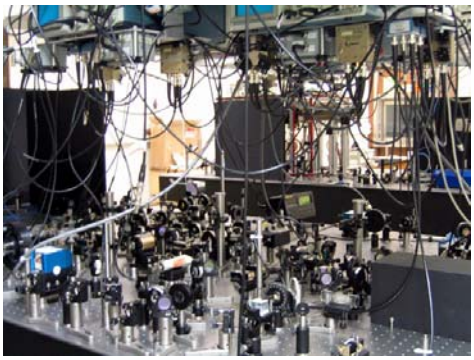

<u>SITTING AT AN OPTICAL TABLE</u>

Ideally, laser beams on optical tables are always located well below the eye level of a seated person. Even though this is the case, it is never a good idea to sit at the optical table if there is an unenclosed laser beam nearby. It is far better to keep your eyes “out of the line of fire”. Of course, generating laser beams in an upwardly direction in accessible areas is never wise. If a beam must be upwardly directed, completely block the beam at the top of its beam path (above the optic it is directed towards) and/or enclose the upward beam entirely. This can greatly reduce the likelihood of laser accidents.

COMPLACENCY: FEELING OF INVINCIBILITY

People who have performed a task repeatedly eventually reach the point where they feel extremely comfortable doing it. For example, a person who has driven a car for years with no accidents expects to continue to avoid accidents. The same thing is true for laser operators. A person with years of laser experience can easily become complacent and might believe that laser accidents only happen to others. Appreciation of the harm that lasers can cause is diminished.

A large majority of the laser accidents which have occurred at UC Irvine and elsewhere have involved laser operators with 5 or more years of experience, not novices. Novices generally retain their fresh respect for the hazards of laser radiation for awhile and really emphasize safety. However, individuals with many years of experience can tend to feel invincible and let their guard down. If laser operators have used lasers for a long time with no accidents, they have been at least somewhat competent safety-wise or extremely fortunate. If such people have followed robust safety procedures, they should continue to do that. If they have been lucky, they need to be aware that at some point their good luck might run out. *It already did for about 6 persons at UC Irvine who were injured by lasers.*

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COST CUTTING

In these days of escalating costs for both labor and materials, it is not surprising that PIs with lasers are watching their bottom lines very carefully. Cost-cutting issues frequently arise when funding problems exist – for example, when research grants expire and are not renewed. In such cases, PIs can attempt to proceed on a shoestring budget with the highest priority given to keeping the lab operating. Cost-cutting measures may include using lab personnel to perform potentially dangerous maintenance and service of high voltage laser power supplies (especially when a service contract is not in place), failing to purchase adequate protective equipment, using student labor for functions better performed by more experienced technicians, etc.

Some cost cutting may be necessary but it should never result in placing people into potentially hazardous situations. If money is not available to do laser operations safely, they should not be performed at all. In many cases, safety supplies such as beam path enclosures can be made from relatively inexpensive materials (e.g., black large-bore polyvinyl chloride or steel tubing painted black). Experienced personnel in adjacent laser labs could assist in training new graduate students in performing their studies safely, and eyewear could be shared with other nearby labs when absolutely necessary. **If an unacceptable degree of risk exists because of budgetary constraints, laser operations need to be terminated until the safety problems are addressed.**

MEMORABLE QUOTE

"In theory there is no difference between theory and practice.
In practice there is".

Yogi Berra (1925-); American Baseball Player/Manager

THE MOST DANGEROUS LASERS

Although any Class 3b or Class 4 laser can cause an eye injury, the most serious injuries continue to be caused by Class 4 near-infrared beam lasers - normally Q-switched (nanosecond pulse) Nd:YAG lasers and mode-locked (picosecond or femtosecond pulse) Ti:Sapphire lasers. A great deal of care is needed to avoid safety problems when using these types of lasers. For example, since the beams are invisible (or *barely* visible in the case of the Ti:Sapphire beam) there is no advantage to not using eyewear. Occasionally, persons operating visible-beam lasers tell me that they can't wear eyewear since they "need to see the beam". This is an unsafe practice if the visible beam has an average power greater than about 10 mW. But, it is a completely unacceptable practice when operating near-infrared beam lasers.

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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!