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Standard procedures for laser laboratories

You must know:

- the layout of the laboratory and the layout of the surrounding areas;
- the location of fire escapes;
- the location of fire extinguishers within and just outside the laboratory;
- the location of the nearest telephone which gives access to the emergency services.

In addition, personnel authorized to operate lasers must:

- be aware of the class, power and wavelength of the lasers that they are using;
- be acquainted with emergency shut-down procedures;
- have received a period of training on unfamiliar equipment;
- have read the laser safety guidance of the School of Natural Sciences (these notes) and the University's local laser safety rules within the last year. The University's rules can be found at http://www.safety.ncl.ac.uk/uploads/laser%20print%2011102004.doc ;
- have read the laser manufacturer's manuals, taking special note of safety procedures and advised working practices.
- wear eye protection devices specifically designed for laser light at the wavelengths and powers used in the laboratory when technological, experimental and administrative protocols are unable to eliminate potentially damaging exposures.

Information on the classification of lasers can be found at the website of the UK government's Health Protection Agency at http://www.hpa.org.uk/radiation/faq/laser/laser9.htm .

Guidelines on the limits of exposure to coherent and incoherent non-ionizing radiation are published by the International Commission on Non-Ionizing Radiation Protection at http://www.icnirp.de/pubOptical.htm .

General safety regulations for use of class 3R, 3B and class 4 lasers

1. Class 3R, 3B and 4 laser systems shall be operated, maintained and serviced only by authorized personnel. A list of personnel so authorized shall be posted on the door of each laser laboratory.

2. Users of class 3B and 4 lasers are required to undergo an eye test prior to commencement of work with lasers in these categories.

3. Eye protection devices specifically designed for protection against radiation from Class 3R, 3B and Class 4 lasers shall be required and their use enforced when technological, experimental or administrative protocols are unable to eliminate potential exposure in excess of the applicable maximum permitted exposure.

4. The operation of laser systems, like any technological or industrial process, involves various possible related hazards. The following considerations apply: (a) compressed gases; (b) cryogenic liquids; (c) ventilation; (d) toxic materials; (e) vacuum systems; (f) high voltages.

5. In laboratories where more than one laser experiment is present, these should be located in separate areas. Resposibility for safe operation of the lasers in each experiment shall rest with the laser operators undertaking the separate experiments. One person—e.g. a senior graduate student or postdoctoral fellow—shall take overall responsibility for a particular laboratory on a given day and shall ensure that all equipment is safely shut down at the end of the day.

6. Spectators shall not be permitted within a laboratory which contains a Class 3B or 4 laser unless:
(a) appropriate supervisory approval has been obtained;
(b) the degree of hazard and avoidance procedure has been explained;
(c) appropriate protective measures are taken.

7. Copies of all laser manuals must be kept in the laboratory at all times.

8. Eating, drinking and smoking are not permitted in any laser laboratory at any time.

General operating protocols for class 3R, 3B and 4 lasers

1. Lasers should be fixed securely to an optical table which should be at waist height. Beam-routing optics should also be fixed securely to an optical table. All laser beam paths should be maintained at waist height if possible; if the laser beam propagates above waist height special care must be taken to attenuate all back reflections. Laser beams should be confined to the area above the optical table if at all possible and aligned parallel to its surface; if the beam path is outside the area of the optical table it should be enclosed by guide tubes.

2. Class 3R, 3B and 4 lasers should be operated by authorized personnel only.

3. Because the eye is the critical organ susceptible to damage by intense laser light, a high level of ambient illumination should be provided in the designated laser working area. In this way, the pupil of the eye remains as small as possible, thereby minimizing the risk of laser radiation irradiating the retina.

4. Initial optical alignments should be performed at low powers. Low power can be obtained by a variety of different means depending on the laser, such as reducing the current from a power supply, placing a small aperture in the laser cavity, misalignment of a doubling crystal or reduction in repetition rate by use of a cavity dumper etc. At low powers a laser beam can be aligned through all optical components and back reflections blocked. Only when this has been done should the power be increased.

5. Alignment of optical components (mirror, lenses, beam deflectors etc) should be performed in such a manner that the primary beam or a specular or diffuse reflection of a beam does not expose the eye or skin of personnel to a level above the applicable maximum permitted exposure.

6. Back reflections from all optical components should be blocked with apertures, black anodized aluminium or black screens.

7. As far as possible work standing up in laser laboratories. If it is necessary to sit down to operate a computer, ensure that this area is shielded from stray laser beams.

8. Avoid wearing anything reflective on your hands and wrists, such as metallic watch straps and jewellery, when using lasers. Also avoid wearing lose clothing and tie back long hair when using lasers.

Interlock protocols

1. Unauthorized personnel must not enter laser laboratories when the lasers are on.

2. When any laser is powered on the exterior laser hazard warning light must be turned on (even if the laser beam itself is blocked).

3. Wherever possible the lasers must be interlocked; this means that if the door to the laboratory is opened the laser is automatically powered off.

4. Entry to a laser laboratory is prohibited when an exterior laser hazard warning light is on: the specific procedures to be followed to gain entry to a laser laboratory when laser work is taking place are included in the start-up protocols for the lasers in each laboratory.

5. If the laser is not interlocked the laser hazard warning light must still be switched on and the door to the laboratory kept locked during operation.

6. It is the responsibility of the laser users to ensure that the laboratory is safe at all times. If an experimental procedure is being undertaken that could possibly result in the exposure of other persons (spectators) to laser radiation then the laboratory door should be locked, any windows covered and a 'no entry' notice placed on the door. The duration of such procedures should be kept to an absolute minimum.

7. If the door to the laboratory is unlocked, the laser hazard warning light is on, and there are no 'no entry' notices on the door, then it is the responsibility of the laser users to ensure that the laboratory is safe for other persons to enter the laser area.

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