Laser Safety

LASER LITE: A Quick Overview of Laser Safety 06/09

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THE PRIMARY PURPOSE OF THE UCLA LASER SAFETY PROGRAM IS TO

AVOID GETTING A LASER BEAM IN YOUR EYE

NEVER STARE DIRECTLY AT A LASER BEAM, EVEN WITH PROTECTIVE EYEWEAR

LASER LIGHT
- Maintains strength over long distances
- Produces significant eye hazards at relatively low levels
- Concentrates to a very high intensity when focused by a lens
- Occurs in the Visible and Non-visible spectrum

BIOLOGICAL HAZARDS
- Can be laser beam and non-beam related
- Can occur at all wavelengths
- Occur mainly in the eyes and skin

MOST INJURIES
- Affect the eyes
- Occur during alignment
- Result from operator error

PROTECTION
- Eyewear must be worn for Class 3B and Class 4 laser use
- Eyewear must meet ANSI standards and be marked with Optical Density and Wavelength
- Appropriate skin protection is required for Class 4 lasers

LASER CLASSIFICATION TABLE

| CLASS  / 1M | Maximum power output is a few microwatts. Visible spectrum output Considered incapable of producing hazardous eye/skin exposure unless viewed with collecting optics (1M). Does not apply to open Class 1 enclosures containing higher-class lasers |
| CLASS 2 / 2M | Maximum power output is < 1 mW. Visible spectrum output Considered incapable of producing hazardous eye/skin exposure within the time period of human eye aversion response (0.25 s) unless viewed with collecting optics (2M) |
| CLASS 3R | Maximum power output is 1 mW - < 5 mW. Visible and non-visible spectrum Potentially hazardous under some direct and specular reflection viewing condition if the eye is appropriately focused and stable or if viewed with collecting optics. |
| CLASS 3B | Maximum power output is 5 mW - < 500 mW Visible and non-visible spectrum Presents a potential eye hazard for intrabeam (direct) or specular (mirror-like) conditions. Presents a significant skin hazard by long-term diffuse (scatter) exposure if higher powered and operating in 200 – 280 nm UVC ranges |
| CLASS 4 | Maximum power output is > 500 mW. Visible and non-visible spectrum Presents potential acute hazards to the eye and skin for all intrabeam and diffused conditions Potential hazard for fire (ignition), explosion and emissions from target or process materials. |

EYE DAMAGE - WAVELENGTHS

<table>
<thead>
<tr>
<th>WAVELENGTH</th>
<th>AREA OF DAMAGE</th>
<th>PATHOLOGICAL EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>180 – 315 nm (Ultraviolet UV-B, UVC)</td>
<td>CORNEA; Deep-ultraviolet light causes accumulating damage, even at very low power</td>
<td>Photokeratitis; Inflammation of the cornea, similar to sunburn</td>
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<tr>
<td>315 – 400 nm (Ultraviolet UV-A)</td>
<td>CORNEA AND LENS</td>
<td>Photochemical cataract; Clouding of the lens</td>
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<tr>
<td>400 – 780 nm (Visible)</td>
<td>RETINA; Visible light is focused on the retina</td>
<td>Photochemical damage; Damage to retina and retinal burns</td>
</tr>
<tr>
<td>780 – 1400 nm (Near Infrared)</td>
<td>RETINA; Near IR light is not absorbed by iris and is focused on the retina</td>
<td>Thermal damage to cataract and retinal burns</td>
</tr>
<tr>
<td>1400 – 3000 nm (Infrared)</td>
<td>CORNEA AND LENS; IR light is absorbed by transparent parts of eye before reaching the retina</td>
<td>Aqueous flare; Protein in aqueous humor, cataract, corneal burn</td>
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<tr>
<td>3000 – 10000 nm (Far Infrared)</td>
<td>CORNEA</td>
<td>Corneal burn</td>
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LASER OPERATION GUIDELINES

OPERATORS MUST:

- Review **Standard Operating Procedures**, operating and safety instructions and laboratory-specific laser instructions
- **Be trained in laser safety** and specific laser procedures
- Observe all written procedures, **safety rules** and properly use appropriate PPE
- Be **authorized by the Principal Investigator**
- Be **directly supervised** by a person knowledgeable in laser safety
- Wear appropriate PPE, follow safety procedures and SOP’s
- Never circumvent **Administrative or Engineering safety controls**
- Know the location and use of the **power kill switch and fire extinguisher**
- Use the buddy system when working with **high voltage equipment**
- **Not wear reflective metal jewelry** when working with laser beams
- **Never stare directly into a beam** even with eye protection; use indirect viewing
- Give sufficient attention to **non-beam hazards** to prevent possible injury and illness
- Be aware of **plasma and collateral radiation**
- Notify supervisor immediately of potentially hazardous conditions, personal injury, or property damage

IN EACH LAB, PERSONNEL MUST BE ABLE TO OBTAIN:

- **Training** on equipment, procedures and emergency procedures
- **Safety Equipment** that is sufficient in numbers for lab staff, appropriate for the equipment in use and in good operating condition
- **Standard Operational Procedures** for the safe use of all equipment
- Information from the PI or Lab Manager about potential equipment hazards

EMERGENCY INSTRUCTIONS

1. **Shut the laser off immediately** and remove the interlock key. If not possible, alert everyone to **exit the laboratory** and be the last to leave the laboratory

2. If there is a fire, get everyone out of the laboratory immediately. At the same time **shout “FIRE” loudly** and frequently. **Turn on a fire alarm**. Do not try to “fight” the fire from inside the laboratory; do it from the doorway to maintain an escape route

3. In the event of **MAJOR injury**, **Summon Medical Assistance**. Call 911 from a campus phone or 310-825-1491 from a cell phone

4. **Call Security and/or Fire Department (911) as necessary**

5. **Call EHS Hotline (59797) to report the incident**
   Note: ALL incidents must be reported to the Laser Safety Officer

6. **Contact the PI and/or Lab Manager** and describe the emergency