

# LASER Safety



# Classification of LASER Classes

- **Class 1** - Safe under reasonably foreseeable operation
- **Class 1M** - Generally safe – some precautions may be required
- **Class 2** - Visible light at low power, blink limits risk
- **Class 2M** - UV or IR light at low power, generally safe - some precautions may be required
- **Class 3R(A)** - Safe for viewing with unaided eye, (i.e. not by telescope etc)
- **Class 3B** - Viewing beam hazardous, diffuse reflections safe
- **Class 4** - Hazardous under all conditions, eyes and skin

## Laser : Fundamentals and Applications

Class	Power	Remarks	Typical examples
<b>I</b>	Very low or beam completely enclosed	<ul style="list-style-type: none"><li>• Inherently safe,</li><li>• No possibility of exposure</li></ul>	CD, DVD drives, laser printers...
<b>II</b>	1 mW  Visible only	<ul style="list-style-type: none"><li>• Staring into the beam is hazardous</li><li>• Eye protected by aversion response</li></ul>	Supermarket laser scanners, some pointers
<b>IIIa</b>	1-5 mW	<ul style="list-style-type: none"><li>• Aversion may not be adequate</li></ul>	Laser pointers
<b>IIIb</b>	5-500 mW	<ul style="list-style-type: none"><li>• Direct exposure is a hazard</li></ul>	Ar laser CF microscope
<b>IV</b>	>500 mW	<ul style="list-style-type: none"><li>• Exposure to direct beam and scattered light is eye and skin hazard</li><li>• Fire hazard</li></ul>	Laser ablation setup

# Labels on LASERs



**Class II**  
**Class IIIa with expanded beam**



**Class IIIa with small beam**  
**Class IIIb**  
**Class IV**

# Safety Measures

- Eyewear for classes IIIb, IV for everybody in the room.
- Beam paths above  $>200$  mW should be guided through tubes.
- Highest risk is during alignment, optical setup modification.
- Use minimum power/energy required for project



- Reduce laser output with shutters/attenuators, if possible
- Terminate laser beam with beam trap
- Use diffuse reflective screens, remote viewing systems, etc, during alignments, if possible
- Remove unnecessary objects from vicinity of laser
- Keep beam path away from eye level
- Be Informed



- **Don't put your body parts  
(particularly your eyes) in the beam!!**



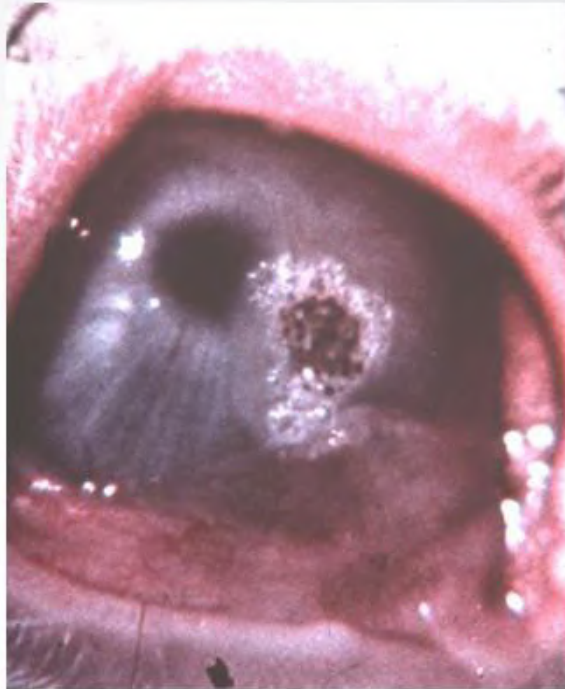
# Causes of Accidents

- Eye protection not used when needed.
- Unprotected eye exposure during alignment
- Badly aligned optics
- Equipment breakdown
- Covers not replaced after service/alignment
- Altering beam path (e.g., adding optical components without regard to beam path)
- Inserting reflective objects into beam path
- Bypassing interlock (particularly during servicing and alignment)
- Inappropriately turning on power supply
- Inappropriately firing of laser
- Lack of operator training

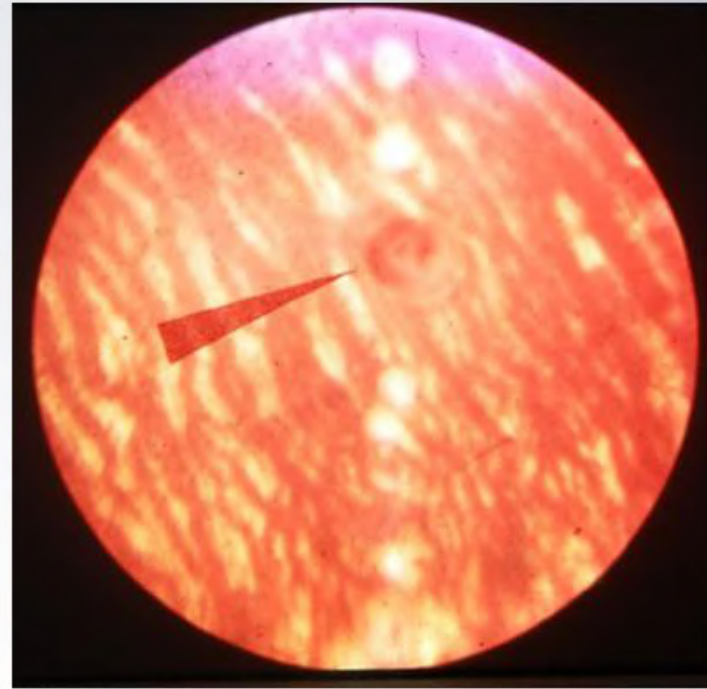


**Burning Injuries from CO<sub>2</sub> LASER**





Corneal injury from CO2 laser



Retinal injury from a dye laser