

Laser Pointer Safety

How are lasers classified?

Lasers are assigned a classification ranging from 1 to 4, with a higher class indicating a higher power laser that is more hazardous. Laser pointers typically emit visible light and their output power measured in milliWatts (mW). The table below lists all of the laser classifications, their visible wavelength power ranges, and the predominant hazard(s). Laser pointers most often fall into Class 3R (3A, 3a, IIIA, IIIa) or lower.

Class	Power (mW)	Hazards
1	$\leq (0.04 - 0.4)^*$	None
1M	$\leq (0.04 - 0.4)^*$	Eyes when viewed with magnifying optics
2	$0.4 < \text{Power} \leq 1$	Eyes if direct viewing of beam and long exposure (>0.25 second or purposeful staring into the beam)
2M	$0.4 < \text{Power} \leq 1$	Eyes when viewed with magnifying optics
3R	$1 < \text{Power} \leq 5$	Eyes possible if direct viewing of beam or mirror-like (specular) reflection (<0.25 second or <eye blink)
3B	$5 < \text{Power} \leq 500$	Eyes & possible skin from direct viewing/exposure of skin or viewing/exposure of skin to mirror-like (specular) reflection
4	Power > 500	Eyes & skin from direct viewing, mirror-like (specular), or diffuse (scattered) reflection; poses a fire hazard

*Wavelength dependent

Which lasers are regulated at GT?

The Georgia Tech Laser Safety Program applies to the possession and use of Class 3B and 4 lasers. These are powerful enough for research applications, and may require control measures like barriers, interlocks, and laser eyewear to operate safely. Training for users and registration of the laser with the Office of Radiological Safety (ORS) is required. More information can be found at <http://www.ors.gatech.edu/laser>.

What hazards are there with a laser pointer?

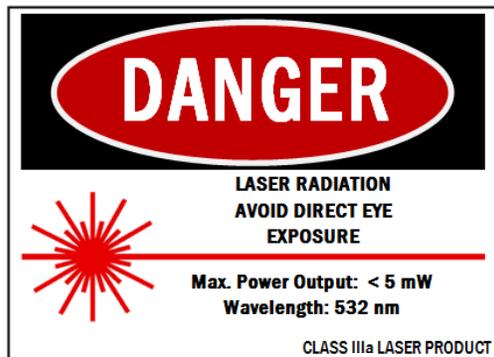
Potential retinal damage can occur when a Class 3R beam directly strikes the eye (intrabeam viewing) or a mirror-like (specular) reflection is viewed. The damage could occur before the blink of the eyelid (typically 0.25 sec) stops exposure. Retinal damage can lead to a "spot" in the individual's vision. More likely is that temporary flash blindness and jerking of the head can occur. If the exposed individual is driving a vehicle or piloting an aircraft, there could be immediate, major consequences.

What are some ways to avoid causing eye damage with a laser pointer?

- ✱ Avoid pointing the beam at an individual, vehicle, or aircraft (illegal per Federal Aviation Administration (FAA) regulations)
- ✱ Be aware of reflective surfaces, which could redirect the beam (e.g., glossy TV screens/computer monitors, mirrors, polished metal surfaces)
- ✱ Keep your laser pointer off while you are talking, especially if you frequently gesture with your hands while you talk
- ✱ Never allow a child to use a laser pointer as a toy

What does a proper label look like?

A sample FDA-compliant label and other information that will be seen on laser pointers properly classified and labeled as 3R (or 3a, 3A, IIIa, IIIA)ⁱ is shown below.



- a statement that it complies with Chapter 21 CFR (the Code of Federal Regulations)
- the manufacturer or distributor's name and the date of manufacture
- "AVOID EXPOSURE--Laser radiation is emitted from this aperture"

How else can laser pointers be hazardous?

Many laser pointers have become low cost items manufactured with insufficient quality control. Random testing by the Food and Drug Administration (FDA)ⁱⁱ and National Institute of Standards and Technology (NIST)ⁱⁱⁱ has shown that a significant percentage of laser pointers labeled as Class 3R actually operate as higher power Class 3B lasers that pose a significant eye hazard. Some pointers labeled as Class 2 have also been found to operate as Class 3B. Additionally, many green laser pointers do not sufficiently filter elevated levels of the infrared wavelengths of 808 nm and 1064nm. This has led the FDA to issue a consumer safety alert^{iv}. Also avoid using any laser pointers that may have been altered or damaged as protective features designed into the product may be compromised.

How can I check if my laser pointer is FDA compliant?

ORS has assembled a setup, described by NIST^v, to measure the power of laser pointer emissions. It will be available periodically for members of the Georgia Tech community to have their personal laser pointer(s) tested. The Laser Safety Officer will also be on hand to answer questions.

Where can I read more information about laser pointer safety?

Additional laser pointer information can be found at the websites of the FDAⁱ, Rockwell Laser Industries, Inc.^{vi}, and the Laser Institute of America^{vii}.

ⁱ "Illuminating Facts About Laser Pointers." <http://www.fda.gov/Radiation-EmittingProducts/RadiationSafety/AlertsandNotices/ucm153548.htm>

ⁱⁱ Strzelecki, Woody. "An Eye Hazard Posed by DPSS Green Laser Pointers – A Regulatory Assessment." International Laser Safety Conference, 19Mar2013.

ⁱⁱⁱ Hadler, Joshua and Dowell, Marla. "Accurate, inexpensive testing of laser pointer power for safe operation." Measurement Science and Technology 24 (2013): 045202 (7pp).

^{iv} "Consumer Safety Alert: Internet Sales of Laser Products." <http://www.fda.gov/Radiation-EmittingProducts/RadiationSafety/AlertsandNotices/ucm116534.htm>

^v Hadler, Joshua and Dowell, Marla. "Accurate, inexpensive testing of laser pointer power for safe operation." Measurement Science and Technology 24 (2013): 045202 (7pp).

^{vi} "Safety Recommendations of Laser Pointers." <http://rli.com/resources/articles/pointer.aspx>

^{vii} "Laser Pointer Safety." http://www.lia.org/subscriptions/safety_bulletin/laser_pointer/