**Which laser is best suited for projecting an image on the ceiling?**

For the school project we need to simulate stars, we need to use lasers to project images on ceilings. There are a vast range of lasers, so we need to research which one fits best for the project.

**Project requirements**

* The laser is small (10 x 10 x 10 cm).
* The laser is cheap ( under the 10 euros).
* The laser is not dangerous ( no radiations, no safety glass or cloths needed, can’t burn though human flesh)

**Laser classes**

To choose lasers that are considered safe enough for the project. Research into a variety of laser classes needs to be done. [1].

Lasers can be classified in 5 classes:

* Class 1 lasers have an output power that is below the level at which eye injury can occur.
* Class 2 lasers emits visible light of less than 1mW. It is considered safe for the project. It would not harm someone’s eye unless a person deliberately stared into the beam [2].
* Class 3A/3R lasers have an output power of 1 to 5 mW. It is considered safe unless the person stares in the laser [3].
* Class 3B lasers have an output power of 5 to 500 mW. Hazardous when exposed to someone’s eyes. They can heat skin and materials. Laser protective eyewear is recommend [4].
* Class 4 lasers have an output power of 500 mW and above. The laser can cause eye injury if the beam, whether directed or reflected, enters the eye. Even staring at a diffuse reflection of a laser dot on a wall or surface may cause eye injury. A class 4 laser can also burn skins and materials. Eye protection is recommend [5].

**Lasers**

* A KY-008 laser is a laser module that can be directly powered from an Arduino. The wavelength of the laser is 650 nm. The color of the laser beam is red. The voltage of the laser is 5V and the operating current is 30 mA. The output power is 5mW and it belongs to class 3A. It is safe for use unless you look directly into the laser. The size is 18.5mm x 15mm and the price is around 1 euro [6],[7].
* Adafruit Laser Diode(ADA 1054) is a class 3A laser with an output of 5 mW and with a 650 nm red wavelength. The voltage input is 2,8 -5,2 V and the current is 25 mA. The diameter is 10 mm and the length is 31mm. The price of the Adafruit Laser Diode is around 6 euros [8].

## ARIM ADL-65055TL is a class 3A laser with an output power of 5mW. The color of the beam is red and the wavelength is 650 nm. The operating current is 25 mA and the operating voltage is 2.5 V. The diameter of the laser is 5,6 mm. The price of 1 laser is around 3 euros [9].

|  |  |  |  |
| --- | --- | --- | --- |
|  | KY-008 | ADA 1054 | ARIM ADL-65055TL |
| Wavelength | 650 nm | 650 nm | 650 nm |
| laser class | 3A | 3A | 3A |
| Beam color | red | red | red |
| output power | 5 mW | 5 mW | 5 mW |
| operating voltage | 5 V | 2,8 - 5.2 V | 2.5 V |
| operating current | 30 mA | 25 mA | 25 mA |
| size | 18.5 x 15 | diameter is 10mm,  length is 31mm | diameter is 5,6 mm |
| price | € 1,00 | € 6,00 | € 3,00 |

**Conclusion**

All these lasers are classified as class 3A and are considered safe according to our requirements unless you look directly into the laser. Both the size and the price of the lasers fulfil the requirements. The KY-008 laser tops the other 2 lasers, because it is much cheaper compared to the ADA 1054 and the ARIM ADL-65055TL laser.

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