# 3 Types of Lasers and Applications

According to the gain material, lasers can be divided into the following types. Several common used lasers are listed in each type.[1]

### Gas Lasers:

| Laser Gain Medium | Operation Wavelength(s) | Pump Source | Applications and Notes |
|---|---|---|---|
| Helium-neon laser | 632.8nm | Electrical discharge | Interferometry, holography, spectroscopy, barcode scanning, alignment, optical demonstrations |
| Argon laser | 454.6 nm, 488.0 nm, 514.5 nm | Electrical discharge | Retinal phototherapy (for diabetes), lithography, confocal microscopy, spectroscopy pumping other lasers |
| Carbon dioxide laser | 10.6 μm, (9.4 μm) | Electrical discharge | Material processing (cutting, welding, etc.), surgery |
| Excimer laser | 193 nm (ArF), 248 nm (KrF), 308 nm (XeCl), 353 nm (XeF) | Excimer recombination via electrical discharge | Ultraviolet lithography for semiconductor manufacturing, laser surgery |

### Solid State Lasers:

| Laser Gain Medium | Operation Wavelength(s) | Pump Source | Applications and Notes |
|---|---|---|---|
| Ruby laser | 694.3nm | Flash Lamp | Holography, tattoo removal. The first type of visible light laser invented; May 1960. |
| Nd:YAG laser | 1.064 μm, (1.32 μm) | Flash Lamp, Laser Diode | Material processing, laser target designation, surgery, research, pumping other lasers. One of the most common high power lasers. |
| Erbium doped glass lasers | 1.53-1.56 μm | Laser diode | um doped fibers are commonly used as optical amplifiers for telecommunications. |
| F-center | Mid infrared to far | Electrical | Research |

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|---|---|---|---|
| laser | infrared | current | |

## Metal-vapour Lasers:

| Laser Gain Medium | Operation Wavelength(s) | Pump Source | Applications and Notes |
|---|---|---|---|
| Helium-cadmium (HeCd) metal-vapour laser | 441.563 nm, 325 nm | Electrical discharge in metal vapour mixed with helium buffer gas. | Printing and typesetting applications, fluorescence excitation examination (ie. in U.S. paper currency printing) |
| Copper vapour laser | 510.6 nm, 578.2 nm | Electrical discharge | Dermatological uses, high speed photography, pump for dye lasers |

## Other types of lasers:

| Laser Gain Medium | Operation Wavelength(s) | Pump Source | Applications and Notes |
|---|---|---|---|
| Dye lasers | Depending on materials, usually a broad spectrum | Other laser, flash lamp | Research, spectroscopy, birthmark removal, isotope separation. |
| Free electron laser | A broad wavelength range (about 100 nm - several mm) | Relativistic electron beam | Atmospheric research, material science, medical applications |