

Typical DVD burners, which can operate in both CW and pulsed mode, have powers on the order of **250 mW**.



DVD burner



Paranal laser guide star

The setup built by Toptica Photonics for the ESO's Very Large Telescope combines four **22-W** CW lasers to create artificial "guide stars" for adaptive optics.

## Laser power spans many orders of magnitude

—from the microwatt beams of some continuous-wave (CW) lasers, to the European Extreme Light Infrastructure (ELI), whose femtosecond-scale pulses can deliver petawatt peak power (p. 26). Here are a few examples of laser power by the numbers.

One system recently built for ELI, with an average power of 53 W, delivers >50-mJ pulses of <10-fs width, for peak powers of **5-TW**—at high (kHz) repetition rates.

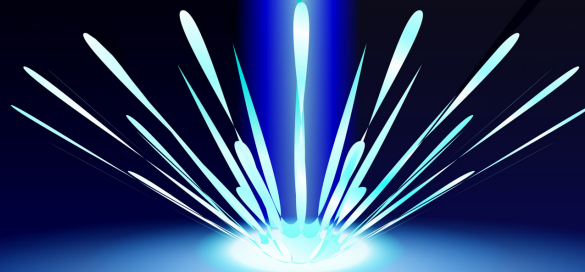


ELI-ALPS

The laser built for ELI-Beamlines, with an average power of 300 W, will deliver pulses with 30 J of energy and 30-fs pulse widths, for peak powers **>1 PW**, at repetition rates >1Hz.

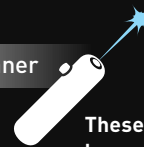


HAPLS



Milliwatt  
 $10^{-3}$

Laser pointer, barcode scanner



These familiar, CW laser devices generally have power levels of **1–5 mW**.

$10^{-2}$

$10^{-1}$

Watt  
 $10^0$

CO<sub>2</sub> surgical lasers can operate at CW powers of **30–100 W**.



$10^1$

$10^2$

Medical and surgical lasers



Kilowatt  
 $10^3$

$10^4$

Industrial fiber lasers



IPG Photonics has recently marketed a fiber laser with **100 kW** CW output power for cutting, welding and drilling applications.

Megawatt  
 $10^6$

Next-gen directed-energy weapons

$10^7$

The U.S. Navy reportedly plans to test a **150-kW** CW laser weapon aboard a test ship by 2018.



$10^8$

Gigawatt  
 $10^9$

Breakthrough Starshot

$10^{10}$

Highly speculative proposal envisions using a 10-km<sup>2</sup> phased laser array to create a CW beam of **100 GW** average power to accelerate tiny spacecraft.



Terawatt  
 $10^{12}$

$10^{13}$

National Ignition Facility

$10^{14}$



Petawatt  
 $10^{15}$

To drive laser-fusion experiments, NIF's 192 beamline amplifiers combine to create 1.85 MJ of ultraviolet laser energy and a peak flash of **500 TW**.

# Laser Power