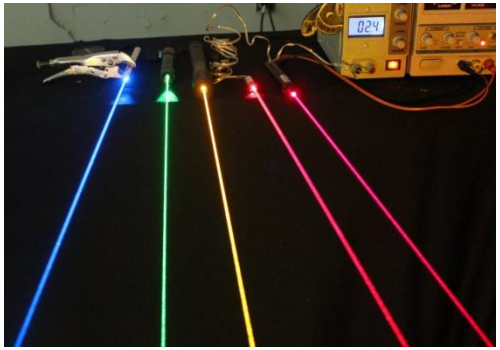
Instrumental Technique

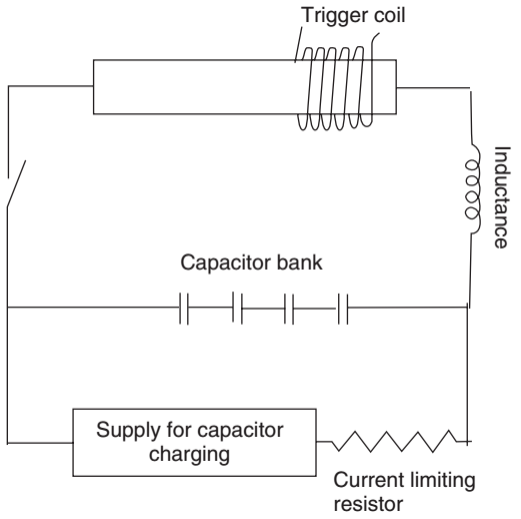


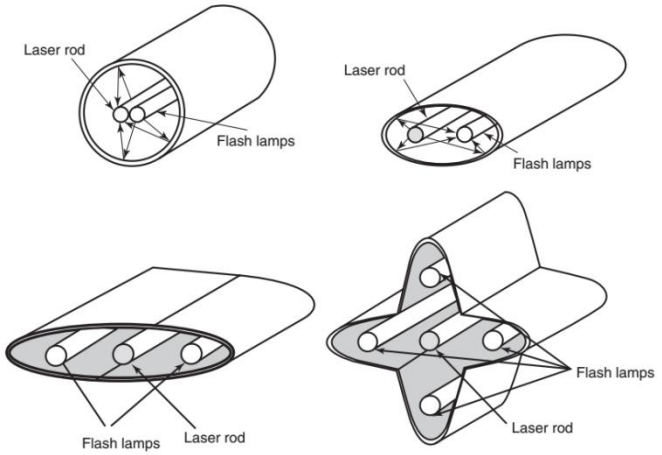
Diode Pumped Solid State Lasers (DPSSL)

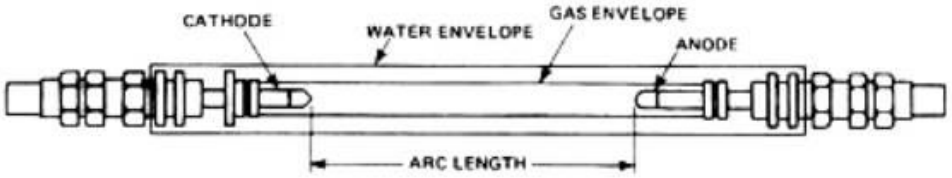
Vishal Kumar

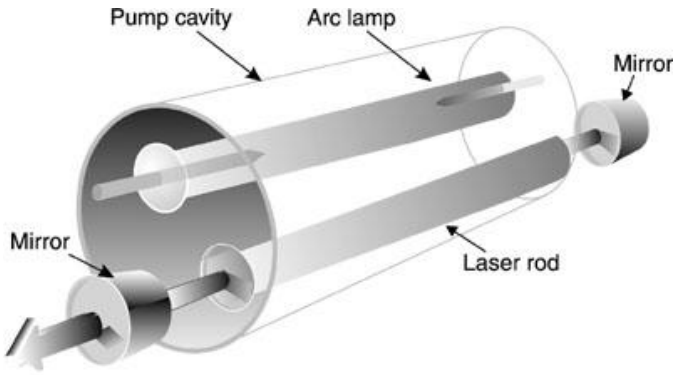
20/05/2017

Optical Pumping

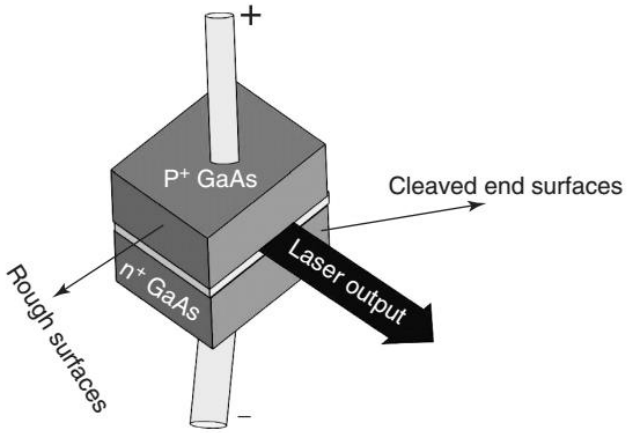






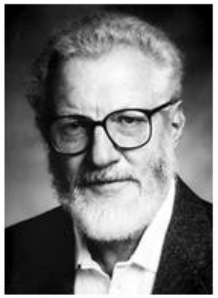


Semiconductor Diode

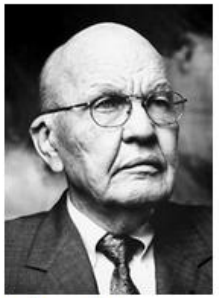


The Nobel Prize in Physics 2000

Zhores I. Alferov
Prize share: 1/4



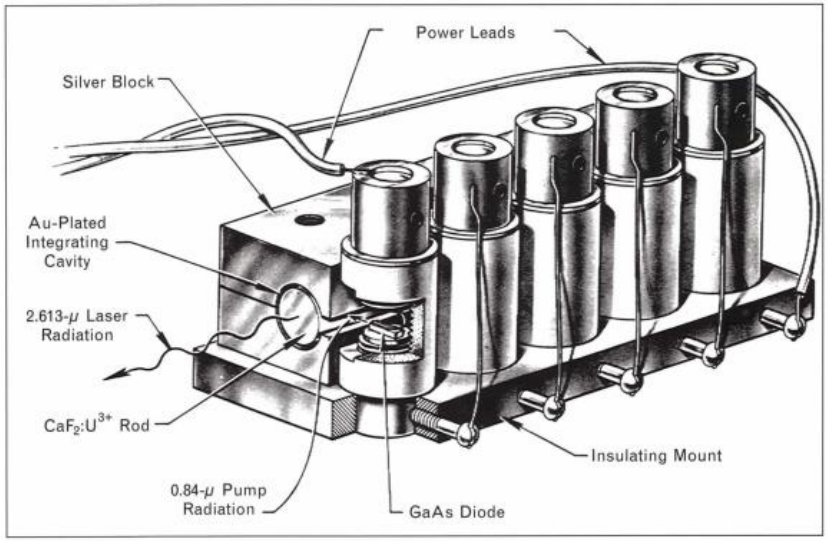
Herbert Kroemer
Prize share: 1/4



Jack S. Kilby
Prize share: 1/2

The Nobel Prize in Physics 2000 was awarded *"for basic work on information and communication technology"* with one half jointly to Zhores I. Alferov and Herbert Kroemer *"for developing semiconductor heterostructures used in high-speed- and opto-electronics"* and the other half to Jack S. Kilby *"for his part in the invention of the integrated circuit"*.

DPSSL



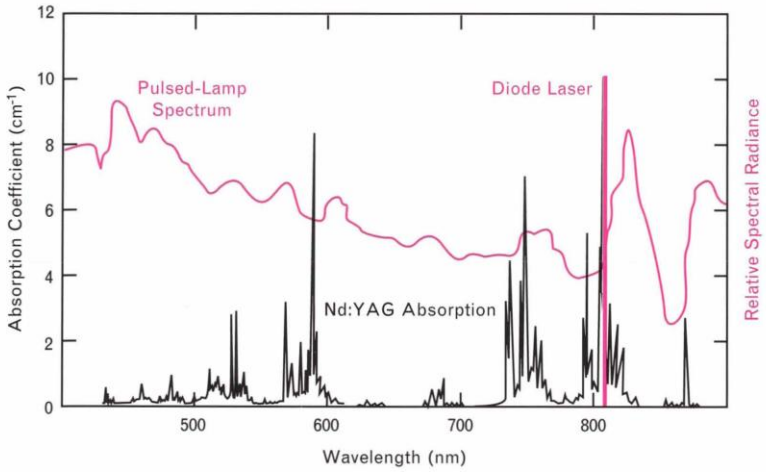
Schematic of the first diode-pumped solid state laser. This laser used five pulsed GaAs diode lasers to pump the U^{3+}-doped CaF_2 laser rod that was 3 mm in diameter and 4 cm long.

- Flash Lamp pumped solid state laser are inefficient with typically 1% output efficiency, and the lamps need replacement after approximately 200 hours when operated continuously.
- Diode pumped laser allow operations at higher efficiency (10%) and longer lifetime (20,000 hrs).

In pulsed operation, diode laser lifetime is on the order of 10^9 shots compared with pulsed-flash lamp lifetimes of 10^7 shots.

Reduces thermal load

Reduces cooling requirements and allows the use of conduction cooling instead of flowing liquid in many cases.

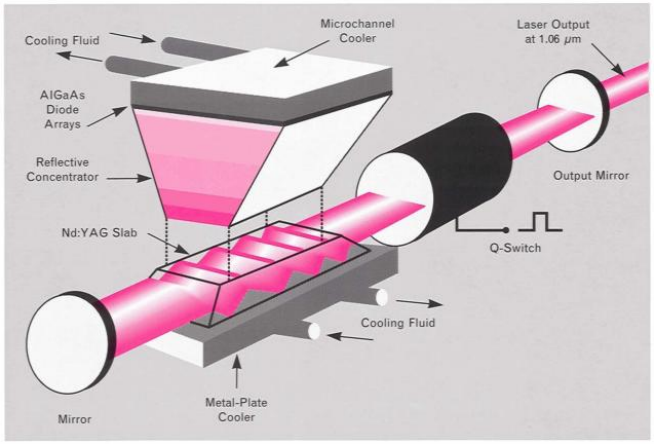


Absorption spectrum of Nd:YAG and the emission spectra of a diode laser and a pulsed flash lamp. The absorption spectrum is for 1%-doped Nd:YAG. The pulsed flash lamp emits radiation at all wavelengths while the diode laser emits radiation at essentially a single wavelength that can be tuned to a particular absorption line of the Nd:YAG.

Advantages of SSL over diode laser

1. Can operate in wavelength ranges in which diode lasers either are not available or have poor performance.
2. Higher radiance and more coherent than the diode laser pump source.
3. High quality factor, Q.

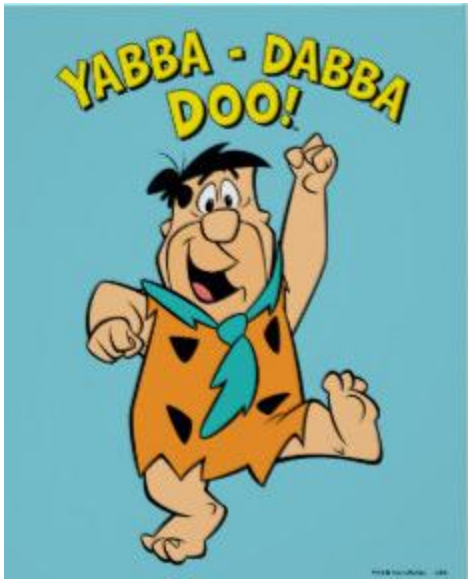
High Power DPSSL



The concept of a diode-laser-pumped zig-zag slab laser

Zig-zag configuration

- 1d heat flow
- Reduces the thermal effects due to temperature gradient



Thank You