



Product Training: Laser Basics | Energy Devices

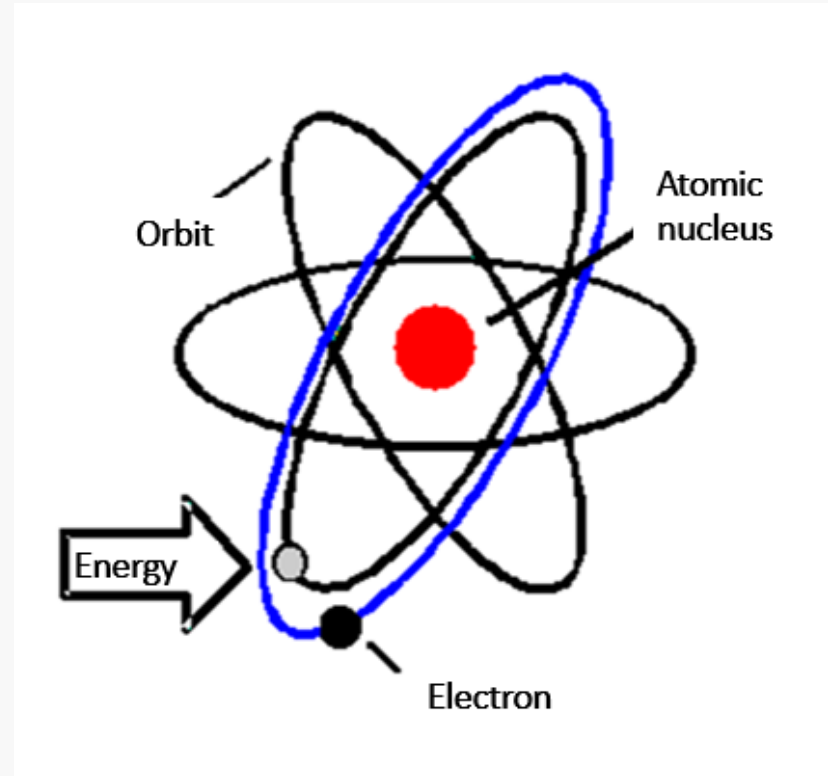
The term laser stands for:

Light
Amplification by
Stimulated
Emission of
Radiation



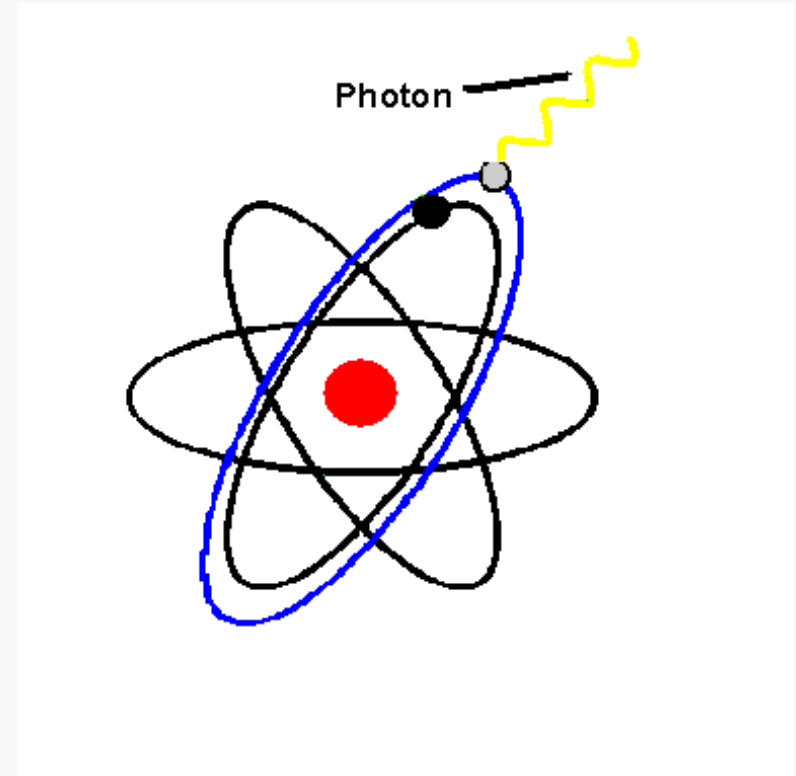
Generation of Laser Radiation

- Electrons circle around the nucleus in a **defined orbit**
- When the atom is stimulated by energy from outside an electron is induced to shift to a **higher orbit**



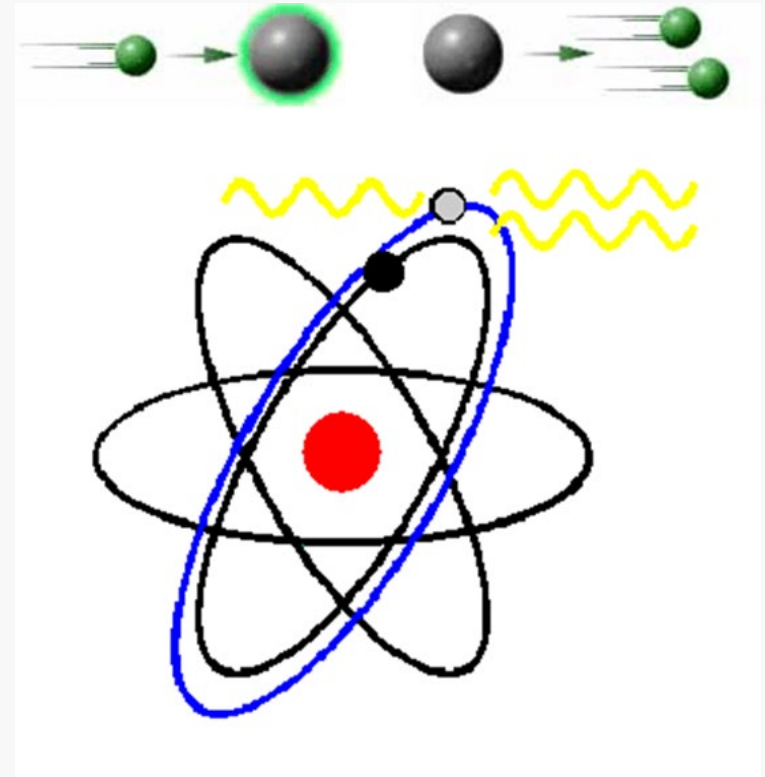
- The electron remains in the stimulated position only for a **very short period of time**.
- By shifting back into the lower orbit, the **electron** releases energy in the form of a **photon**.


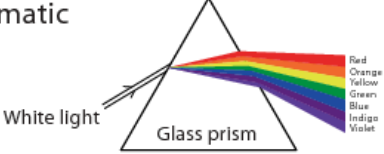

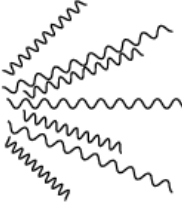

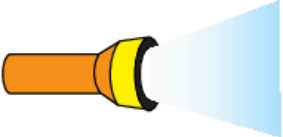
→ **Spontaneous emission**



- This photon stimulates another atom to emit a **further photon** (= Energy)
- Both photons share the same characteristics in terms of **phase, wavelength, and direction**
- Chain reaction
- Laser radiation

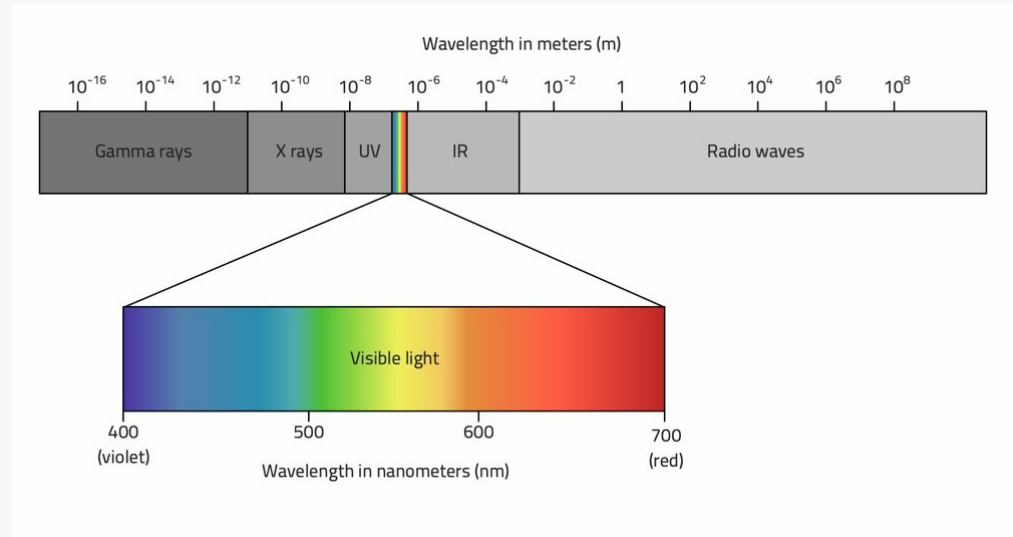
→ **Stimulated emission**



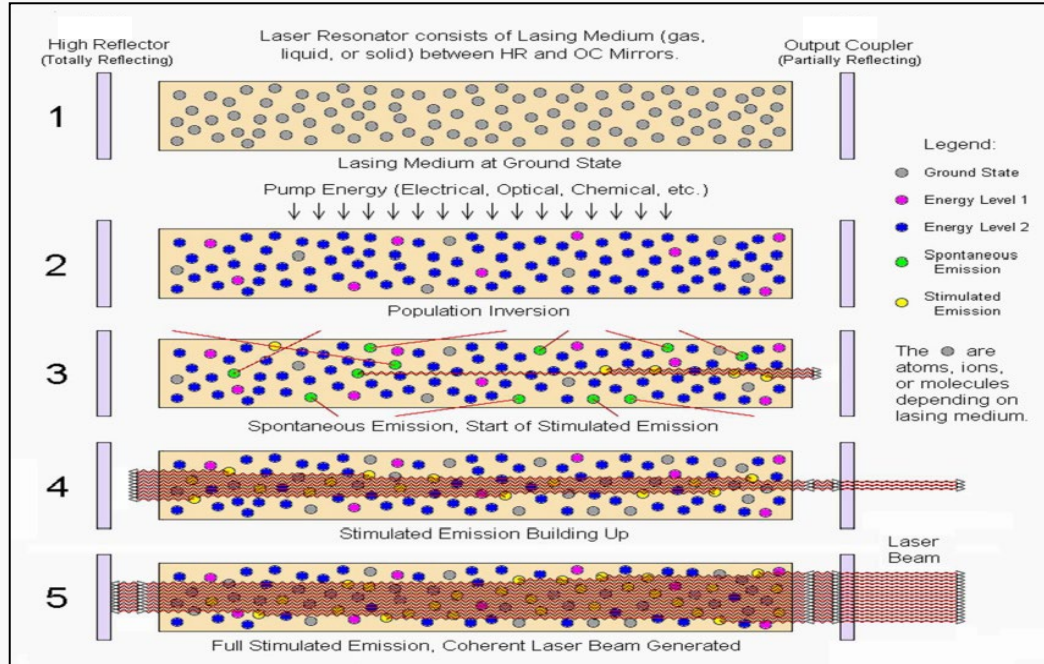
Laser light	Non-laser light
<p data-bbox="498 334 716 361">Monochromatic</p> 	<p data-bbox="973 334 1166 361">Polychromatic</p> 
<p data-bbox="498 519 625 547">Coherent</p> 	<p data-bbox="973 519 1122 547">Incoherent</p> 
<p data-bbox="498 756 645 784">Collimated</p> 	<p data-bbox="973 756 1108 784">Divergent</p> 

Spectrum of light

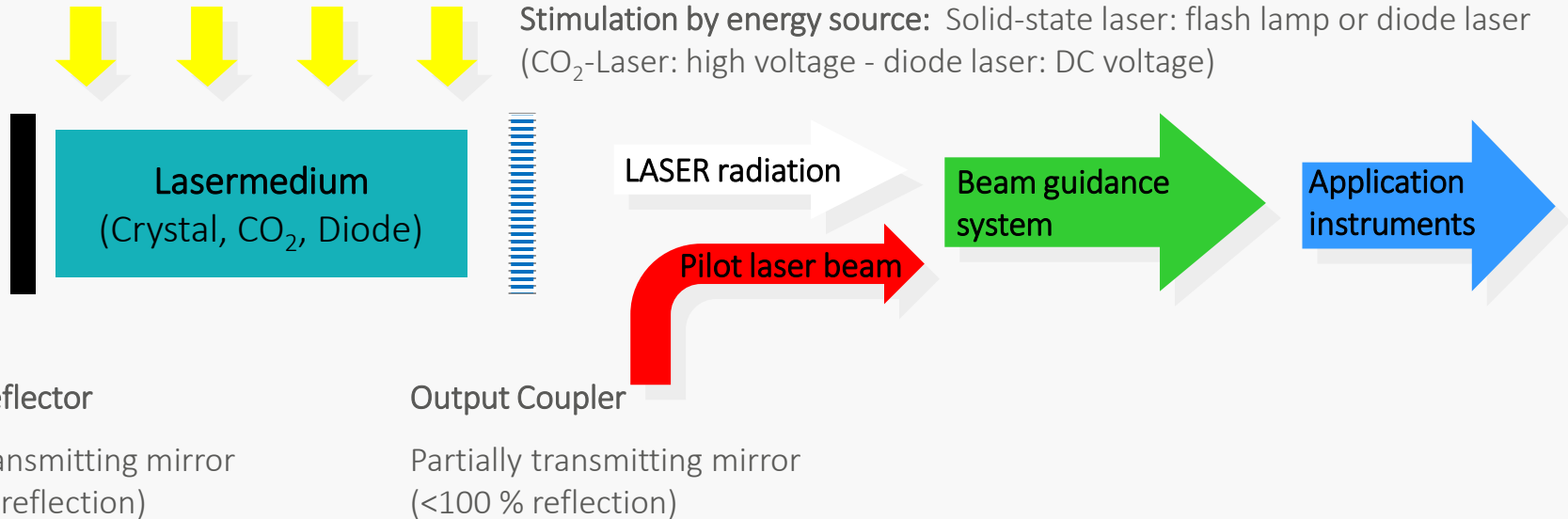
- The visual range for the human eye lies between 380 nm and 780 nm.
- Wavelengths outside of this range are invisible for humans.
- Laser light is mostly invisible for the human eye.



Basic Structure of a Laser System



Basic Structure of a Laser System

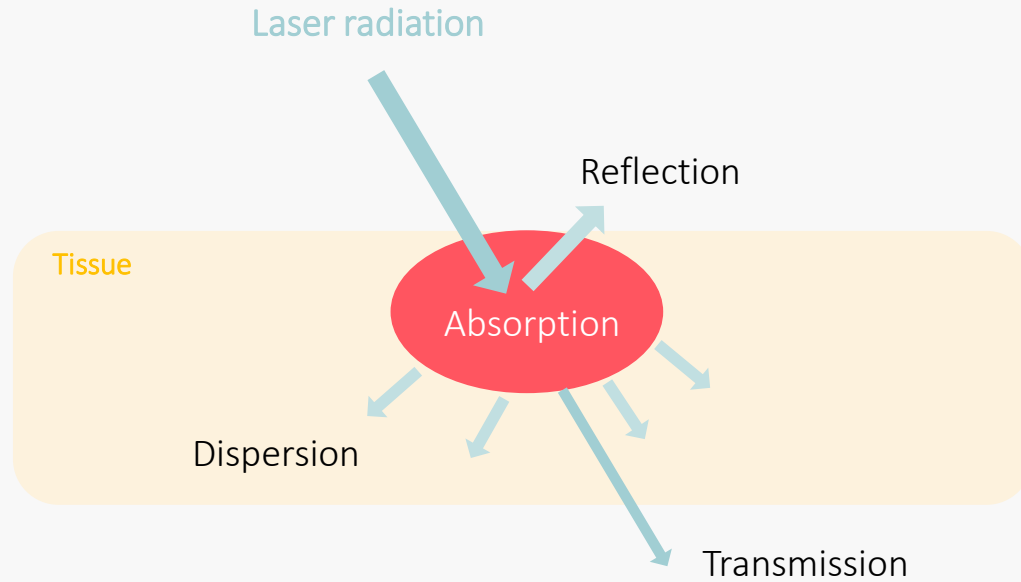


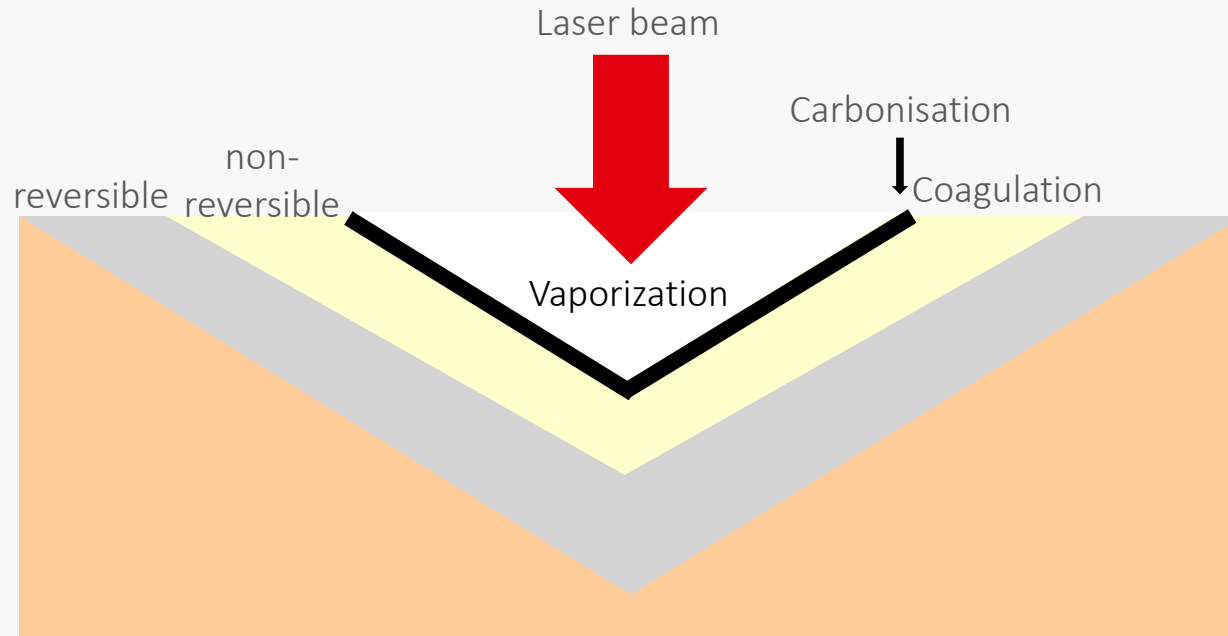
High Reflector

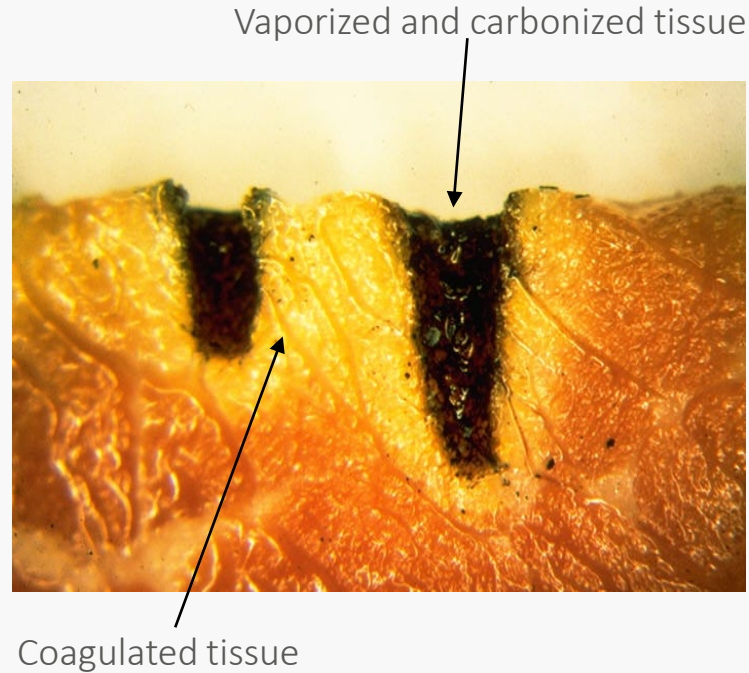
Non-transmitting mirror
(100 % reflection)

Output Coupler

Partially transmitting mirror
(<100 % reflection)







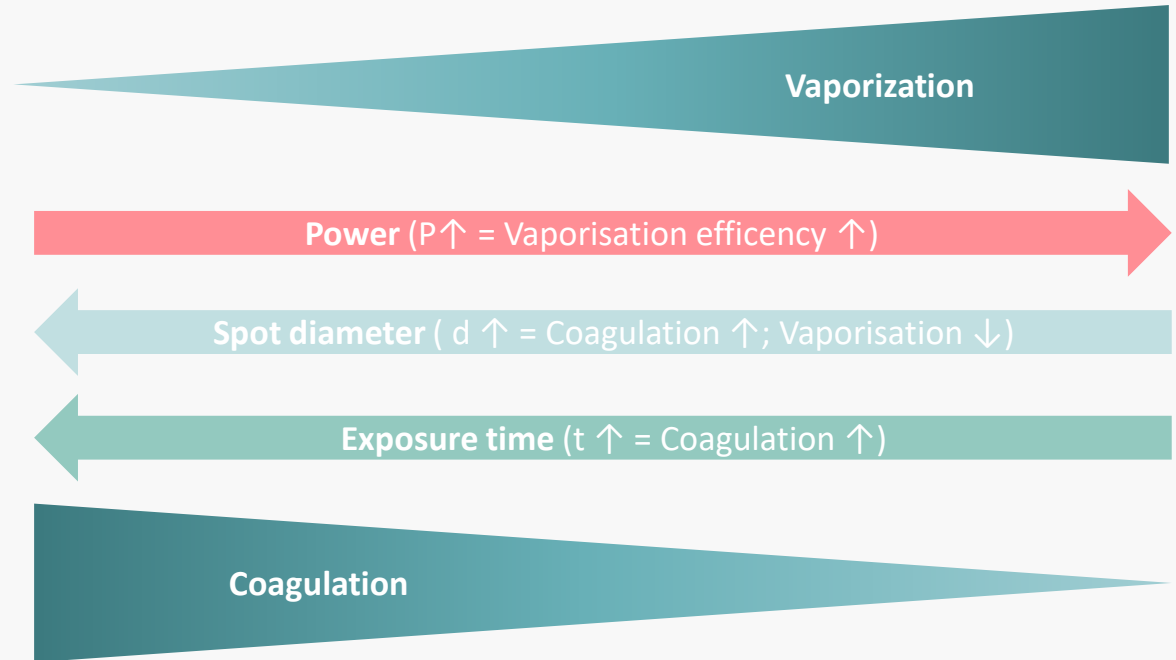
The **effect** on the tissue depends on the:

- Wavelength
- Absorption behavior
- Output power (Watt)
- Applied energy (Joule = watt per sec)
- Energy density (Joule/cm³)
- Application time
- Application accessories
- Cooling



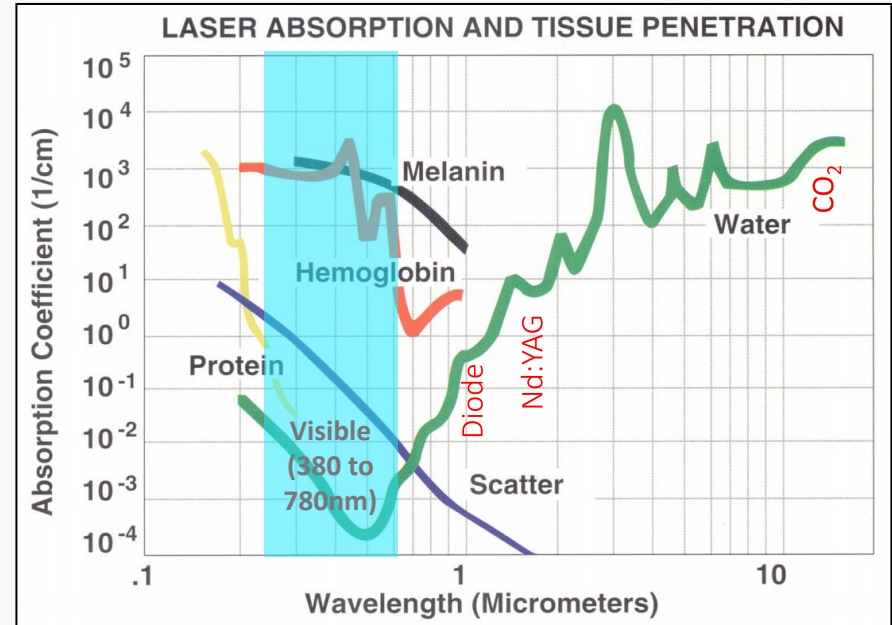
Coagulation and vaporization depends on

- Power
- Spot diameter
- Exposure time



Laser Tissue Interaction: Selective Absorption

Different wavelengths of light react differently to individual substances in the target tissue



- **Medium: Solid-state laser**
Neodym:Yttrium-Aluminum-Garnet crystal
- **Energy source**
Laser diode
- **Wavelength**
1.320 nm (infrared)



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Main advantages:

- **10x higher absorption in water** than for classic Nd:YAG laser
 - Ideal for simultaneous coagulation, cutting and sealing with application in the lung parenchyma
- Transmission through flexible **quartz fibers possible**
- Cutting with
 - quartz fiber **in contact**
 - focusing handpiece **in non-contact**



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Thank you for your attention.
Let's connect!



@klsmartin

