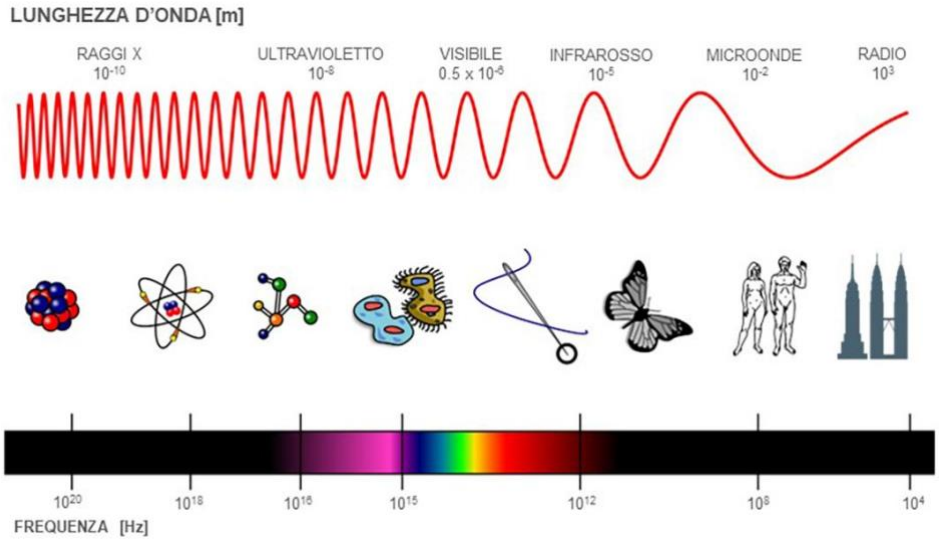


Figure S1. Spectrum of electromagnetic radiations: wavelengths, shown above, are referred to elements of similar size.

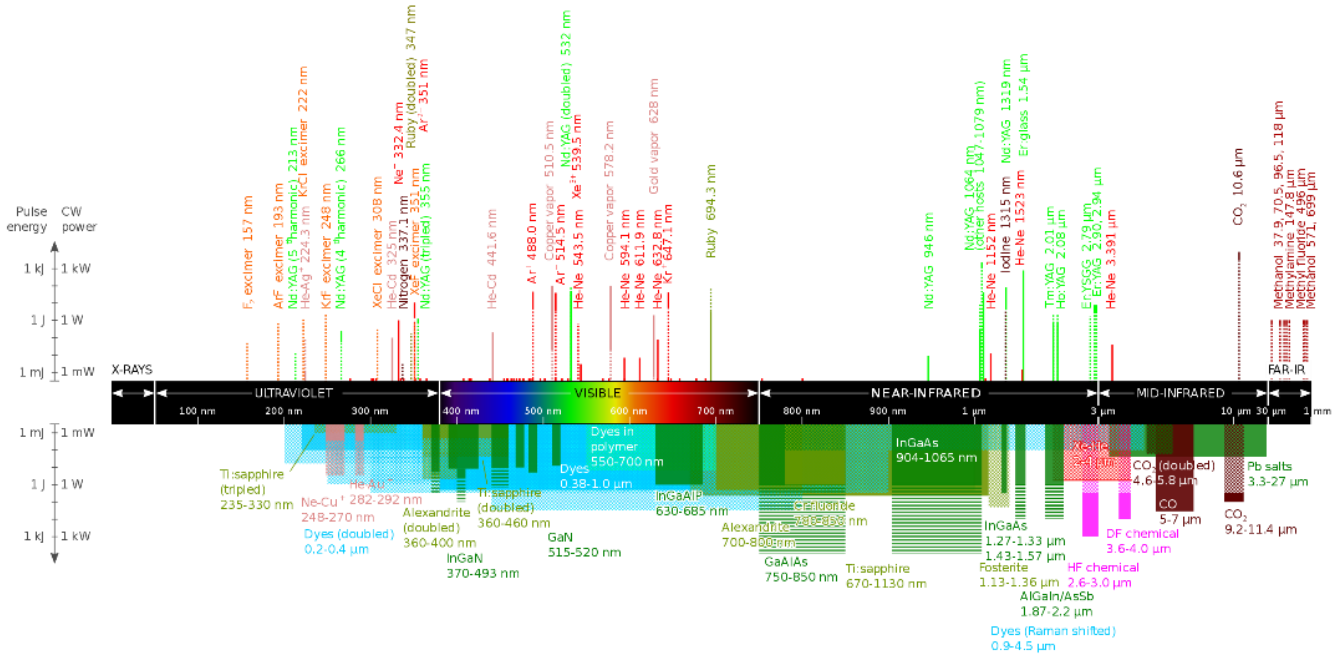


Figure S2. Main wavelengths emitted by LASER (source: Wikipedia).

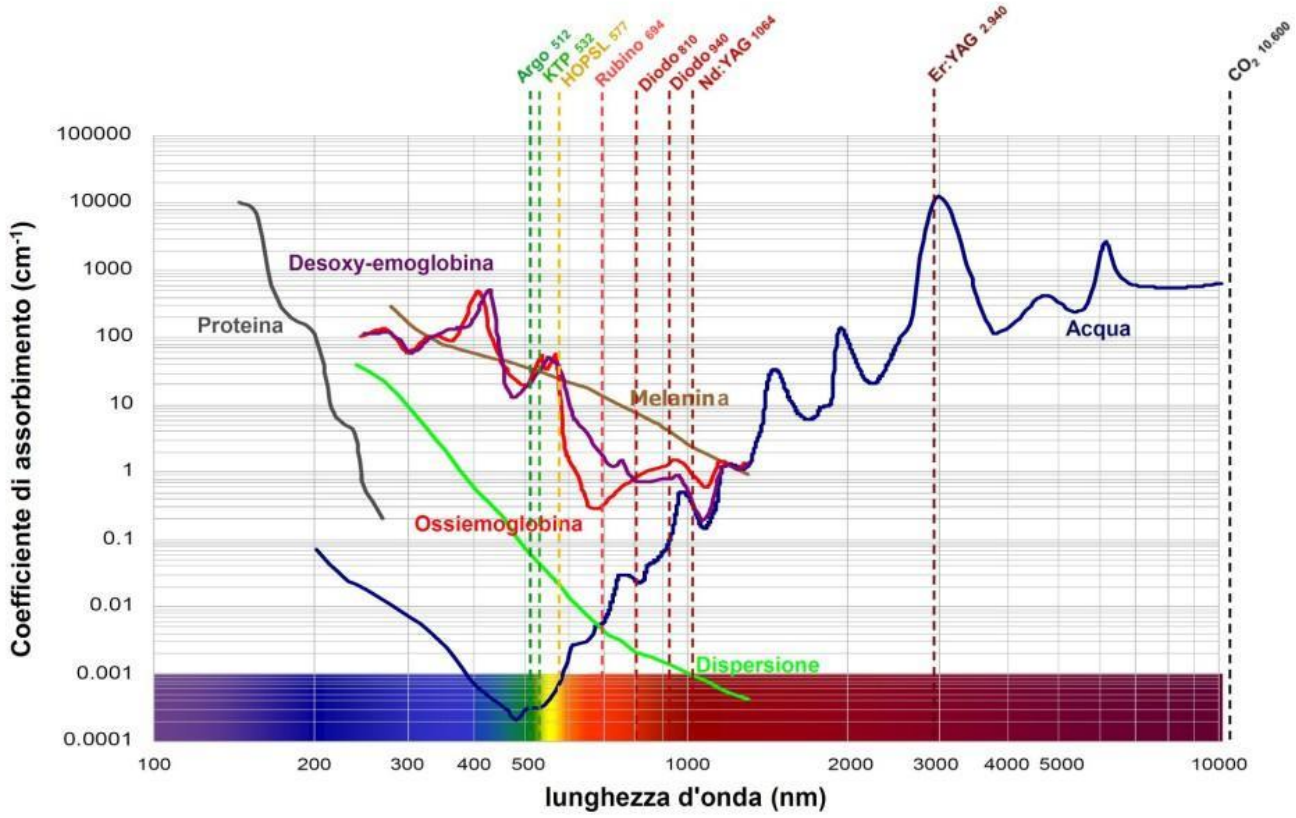


Figure S3. Absorption curve of certain chromophores (source: Asclepion - El.En. Group).

Figure S4. Divergence of a LASER beam.

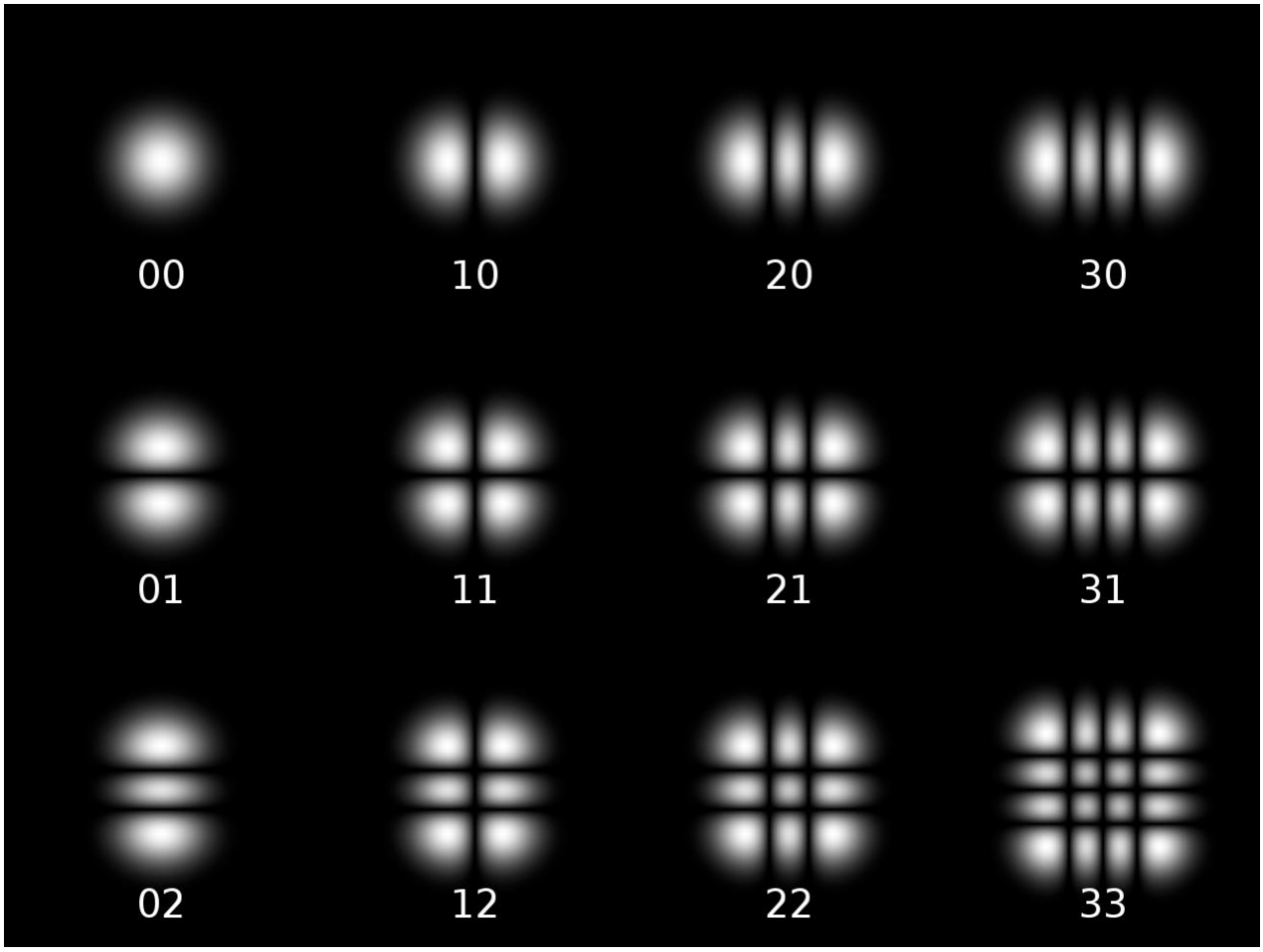


Figure S5. Transversal modes of an optical resonator (source: Wikipedia).

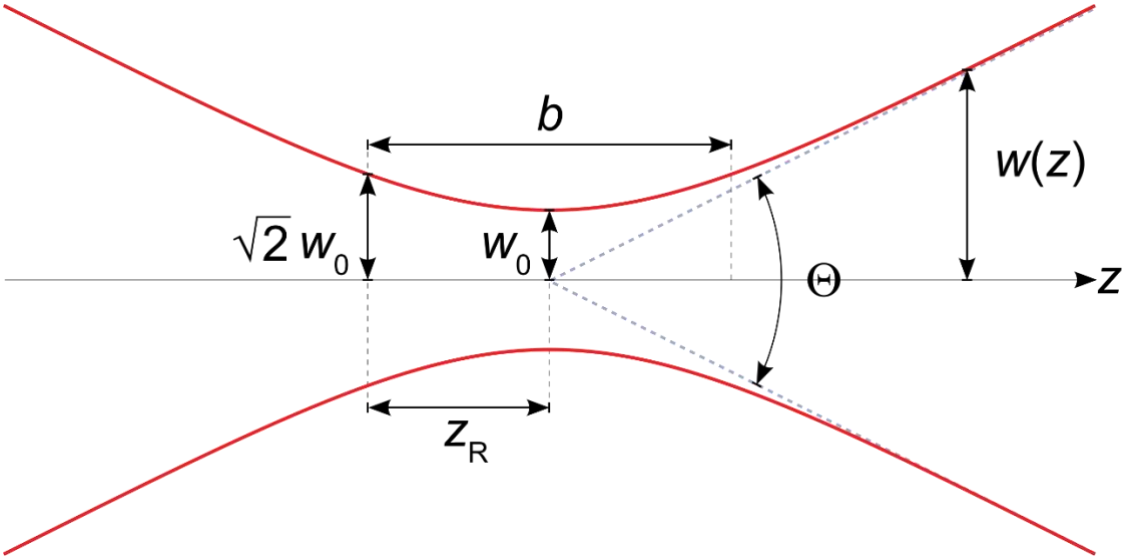


Figure S6. Gaussian beam (source: Wikipedia).

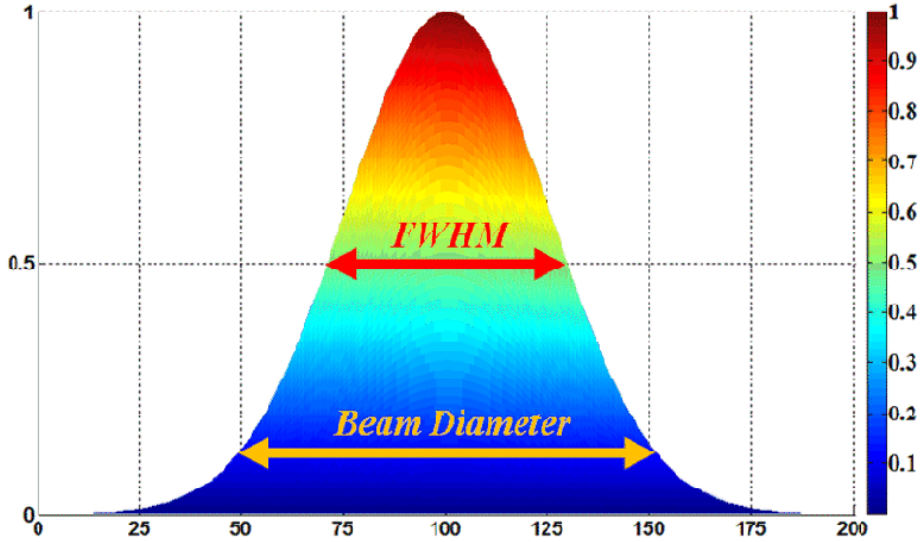


Figure S7. Energy distribution of a Gaussian beam.

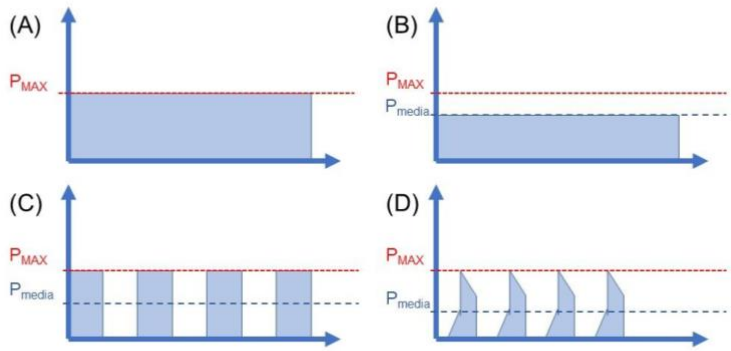


Figure S8. LASER with continuous CW (A and B) and modulated (C and D) emission.

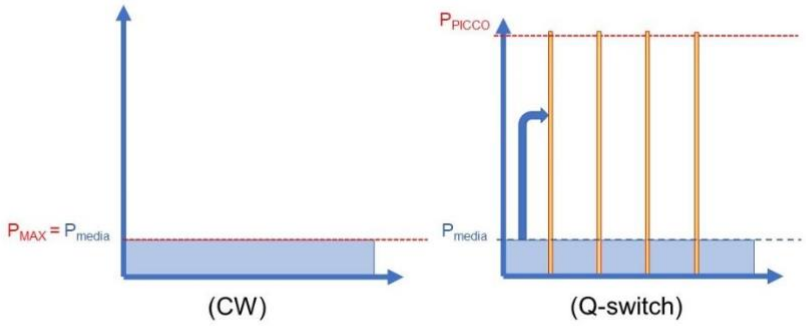


Figure S9. Comparison between CW and Q-switch modes.

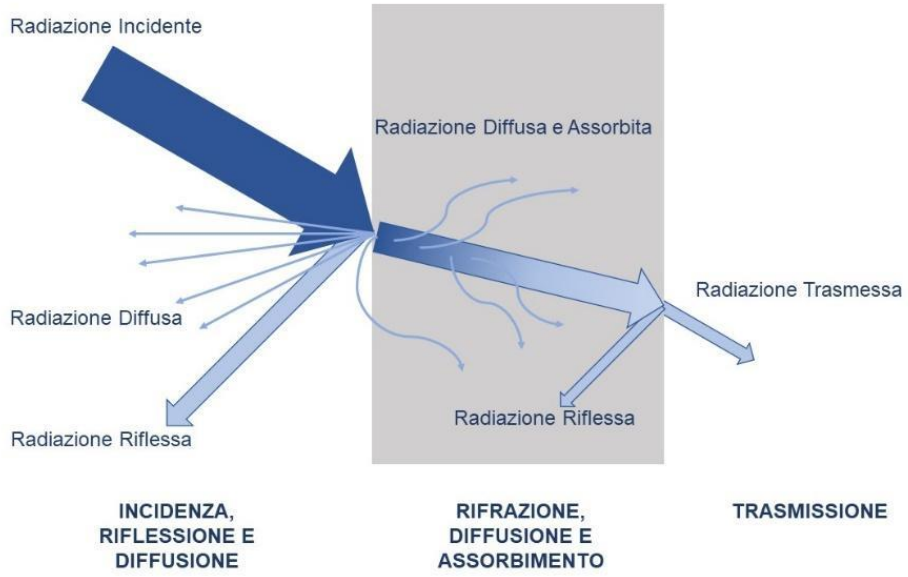


Figure S10. Diagram of interaction processes between radiation and a thin layer of matter.

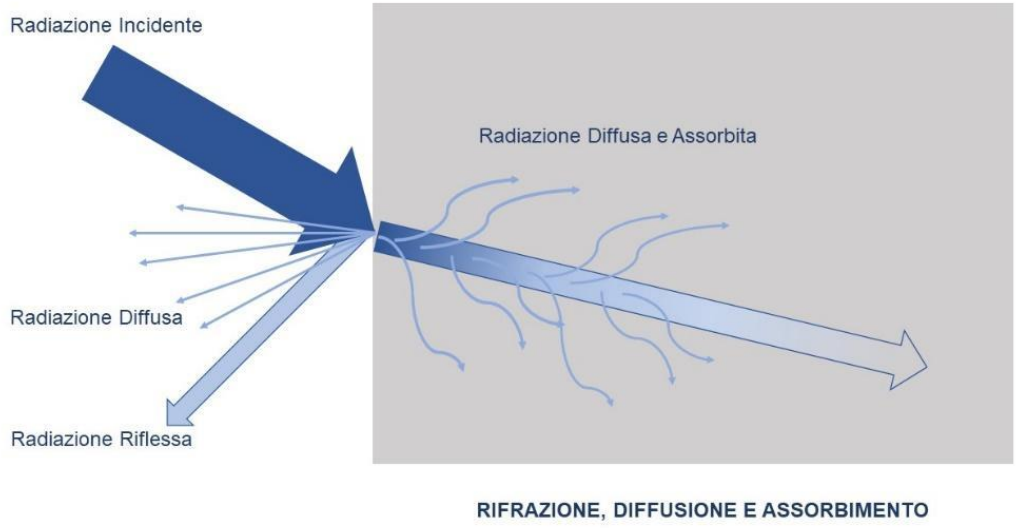


Figure S11. Diagram of the interaction processes between radiation and a thick layer of matter.

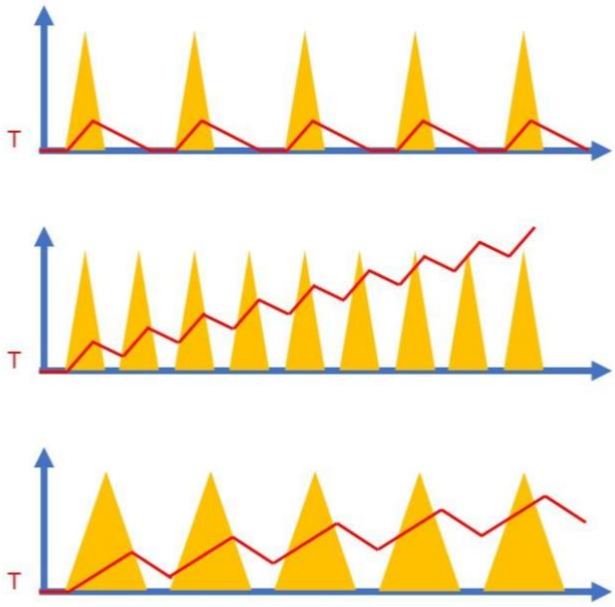


Figure S12. Superposition trend of thermal effects on temperature related to energy and pulse frequency.

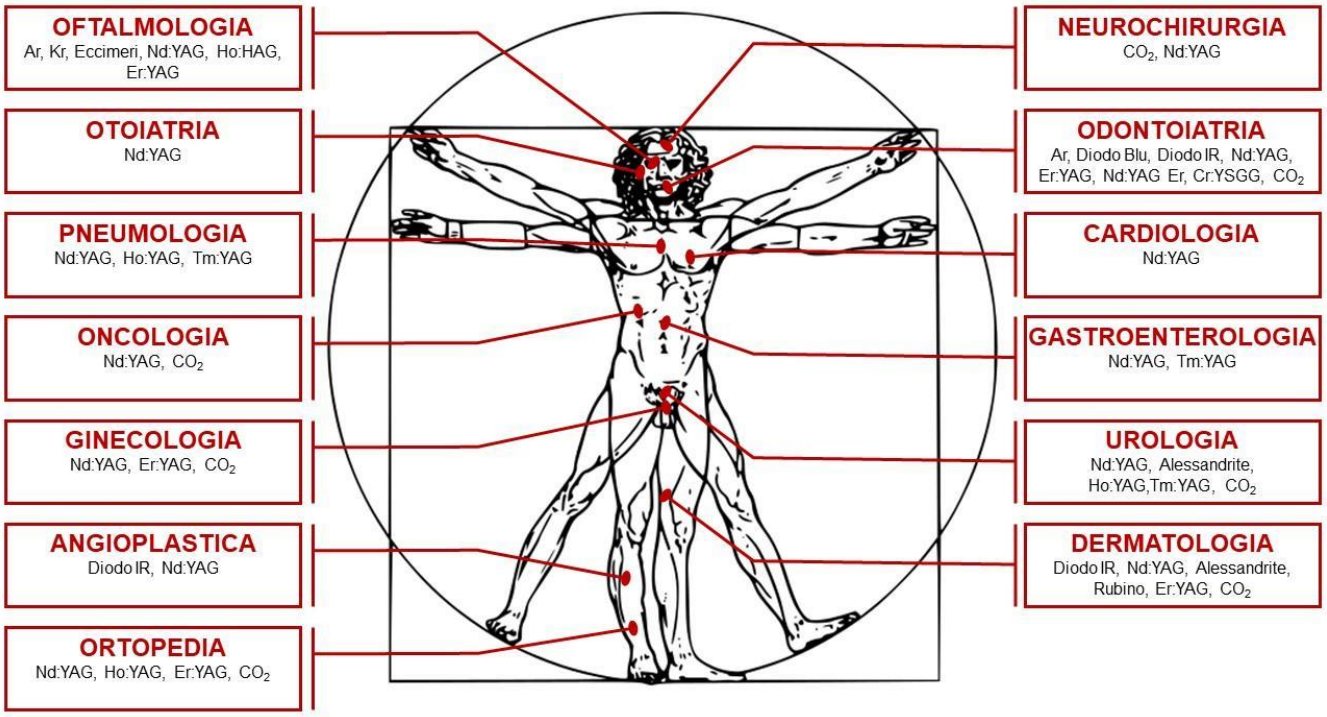


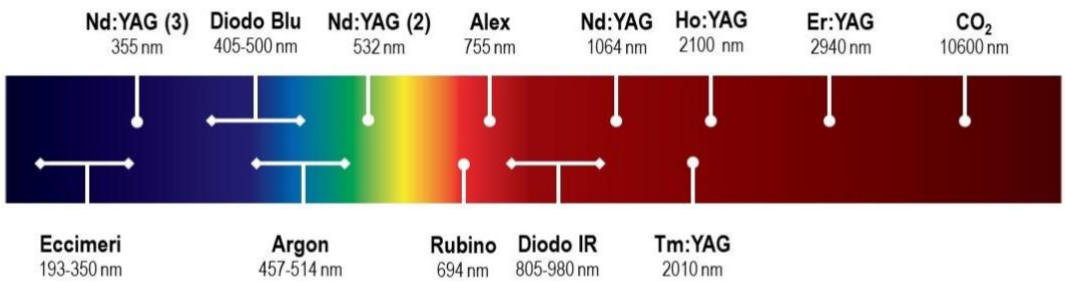
Figure S13. Main applications of LASER in medicine.

Parameter	Symbol /Formula	NOTES
Wavelength	Λ	nm (10-9m) ÷μm (10-6 m)
Energy of a Photon	$\boldsymbol{E = \frac{h}{\lambda}}$	
Beam diameter	ω(z)	μm (10-6 m)
Beam divergence	Θ	Mrad
Product of beam Parameters	$\boldsymbol{BPP = \theta\, \omega_0}$ $\boldsymbol{BPP_{GAUSS} = \theta\, \omega_0 = \frac{2\,\lambda}{\pi}}$	Product is a constant
Quality Factor	$\boldsymbol{M^2 = \frac{BPP}{BPP_{GAUSS}}}$	M2 of a generic beam is greater than 1
Emission mode	Continuous Modulated	 ms (10-3 s) ÷ μs (10-6 s)
	Q-switch pulses Ultra-short pulses	ns (10-9 s) ps (10-12 s) ÷ fs (10-15 s)
Duty-cycle	$\boldsymbol{Duty\ Cycle = \frac{T_{on}}{(T_{on} + T_{off})}}$	Ratio of time used to total time
Frequency	Hertz	Pulses per second
Energy	Joule	
Average Power (CW)	Watt	Energy per time unit
Average Power (Modulated or Pulsed)	Watt	Single-pulse energy per frequency
Peak power (Pulsed)	Watt	Single-pulse energy divided by pulse duration

Table S1. Main parameters of a LASER beam.

Temperature	Main effect	Description
43°-45°	Hyperthermia	Changes in molecular conformation, breaking of bonds, membrane alterations
50°	Reduction of enzyme activity	Reduced energy transfer, cell immobility, inhibition of repair phenomena
60°	Protein and collagen denaturation	Coagulation and cell necrosis
80°	Membrane Permeability	Irreversible biochemical alterations
100°	Vaporisation	Formation of vapour vacuoles, thermal decomposition, cooling, dehydration
>100°	Carbonisation	It follows complete dehydration
~300°	Fusion/Ablation	Dependent on the specific tissue

Table S2. Photothermal effects on biological tissues.



LASER type	Wave length [nm]	CW	Modulated	Q-switch	Ultra-short
Nd:YAG	1064	X	X	X	X
Nd:YAG Second Harmonica	532	X	X	X	X
Nd:YAG Third Harmonica	355	-	-	X	X
CO2	10600	X	X	-	-
Excimers	193-350	-	X	-	-
Argon	457-514	X	X	-	-
Blue Diode	405-500	X	X	-	-
IR Diode	806-980	X	X	-	-
Rubin	694	-	X	X	-
Alexandrite	755	-	X	X	-
Thulium (Tm:YAG)	2010	X	X	-	-
Holmium (Ho:YAG)	2100	-	X	-	-
Erbi (Er:YAG)	2940	X	X	-	-

Table S3. Main types of medical LASERs and their operating methods.

LLLT, Low-level LASER Therapy