Comparative analysis of laser image in medical & Engineering application and its harmful effect on human eye

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Abstract: A laser is device that emits light through process of optical amplification based on the stimulated emission of electronic radiation. A laser is differs from other source of light in that it emits light coherently. Lasers can also have high temporal coherence, which allows them to emit light with a very narrow spectrum, i.e., they can emit a single color of light. Temporal coherence can be used to produce pulses of light as short as a fem to second. Among their many applications, lasers are used in optical disk drives, laser printers, and barcode scanners, DNA sequencing instruments, fiber-optic and free-space optical communication, laser surgery and skin treatments; cutting and welding materials, military and law enforcement devices for marking targets and measuring range and speed, and laser lighting displays in entertainment. Lasers are installed widespread in everyday life across multiple numerous applications like CD & DVD, barcode scanners, entertainment, welding or cutting in industry, aid to fire control or alignment of roads and tunnels. In the medical field, lasers are diagnostic and therapeutic instruments that offer a whole range of solutions.

Key Words: Gas Laser, Solide State laser, Chemical Laser, Semi-conducteur Laser, Dye laser, Métal Vapor laser, Free electron laser, Gas dynamic laser, Nickel-like Samarium laser, Nuclear pumped laser, Raman laser

1. INTRODUCTION:

Laser stand for Light Amplification by Stimulated Emission Radiation, unlike a standard light beam, is a source of monochromatic, coherent and unidirectional light. Lasers are installed widespread in everyday life across multiple numerous applications like CD & DVD, barcode scanners, entertainment, welding or cutting in industry, aid to fire control or alignment of roads and tunnels. In the medical field, lasers are diagnostic and therapeutic instruments that offer a whole range of solutions. The laser which enables for greater surgical precision is less invasive and promotes healing time or cure. This technique is generally much less traumatic than traditional surgical techniques.

Fig1. Laser effect on eye

The first use of lasers in medicine was to damage the retina to understand ocular injury due to accidental exposure [1]. Since the first ruby laser, several devices have been improved placing ophthalmology at the forefront of

medical specialties using this technology. The laser has also many applications in the field of biology. Researchers take the technology to its limits by playing on two main parameters, the short laser pulses—to the fem to second—, and energy beams. Since then, pulsed lasers have become increasingly popular for their ability to ablate biological tissue. For patient diagnosis and experimental studies, biological tissue can be either analyzed under a microscope after immuno-histostaining or crushed for further molecular analysis. Laser-Assisted microdis section (LAM) provides a valuable link between these two approaches. It gives new insights into cellular mechanisms, genetic disorders, tumor biomarker identification patient-tailored therapy. The development of light-absorbing nano particles that are nontoxic to biological tissue has provided further potential for a more targeted delivery of heat with minimal damage to healthy tissue.

2. LASERS IN MEDICINE:

2.1. Laser in Ophthalmology Its advantages have been demonstrated in the treatment of myopia and cataract where they enable patients with visual impairment to regain a clear vision and forget the stress of wearing glasses or contact lenses [3].

2.2. Lasers in Dermatology Treatment of vascular lesions such as angiomas, telangiectasias, spider naevi, treatment of pigmented lesions (brown spots, naevus of ota, freckles) and tattoo or hair removal targeting the melanin stored in the hair follicles in order to destroy the hair matrix to enable permanent hair removal [4].

2.3. Laser in Surgery Laser surgery has the advantage of reducing the risk of infection and it promotes healing. It is used in cosmetic surgery to erase cellulite and superficial wrinkles. Often less invasive than conventional surgery, laser surgery is however not without risks [5].

2.4. Lasers in Other Applications Lasers can also be used in dentistry (gum care and treatment of tooth decay) [6] and phlebology (treatment of varicose veins

3. ENGINEERING APPLICATION OF LASERS:

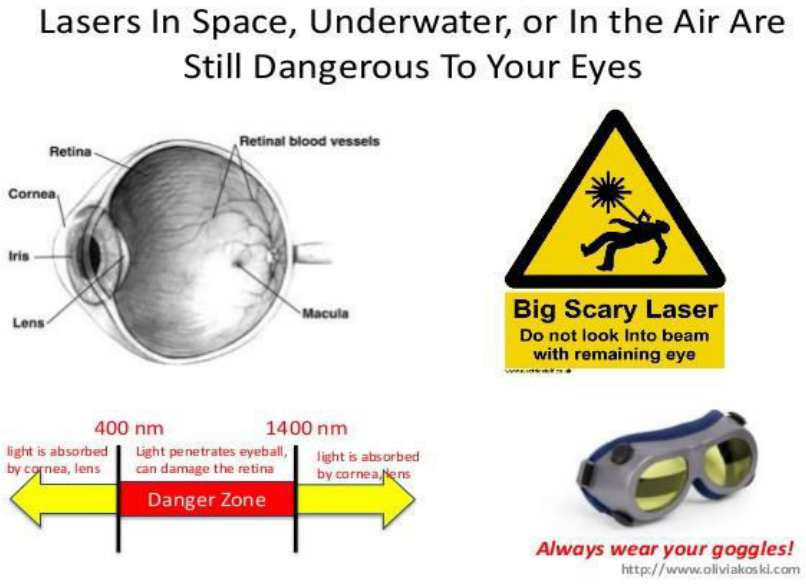

Fig2. Laser effect in space or space

Krypton laser its operating wavelength are 416 nm, 530.9 nm, 568.2 nm, 647.1 nm, 676.4 nm, 752.5 nm, 799.3 nm .Pump source used is optical discharge. it is used for Scientific research, mixed with argon to create "white-light" lasers, light shows

Xenon ion laser: it is gas laser operates on wavelength many lines throughout visible spectrum extending into the UV and IR. Pumping is done by electrical discharge method Xenon ion laser has research applications.

Nitrogen laser operating wavelength is337.1 nm electrical discharge pumping method is used..Nitrogen laser is used for Pumping of dye lasers, measuring air pollution, scientific research. Nitrogen lasers can operate super radiantly (without a resonator cavity). Amateur laser construction. See TEA laser.**Carbon dioxide laser** .:this laser has operating wavelength 10.6 μm, (9.4 μm).Pump source used is Transverse (high power) or longitudinal (low power) electrical discharge this laser is used for Material processing surgery, dental laser, military lasers.

Carbon monoxide laser :it is the laser which operates on wavelength 2.6 to 4 μm, 4.8 to 8.3 μm which uses electrical discharge pump source. & is used in Material processing (engraving, welding, etc.), also in photoacoustic spectroscopy.

Excimer laser: This gas laser operates on wavelength 193 nm (ArF), 248 nm (KrF), 308 nm (XeCl), 353 nm (XeF).pump sourcr used is Excimer recombination via electrical discharge.it hsa several application like Ultraviolet lithography for semiconducto rmanufacturing, laser surgery, LASIK.etc

Chemical laser They are used as directed-energy weapons. They are classified as follows

Hydrogen fluoride laser : this laser has operating wavelength 2.7 to 2.9 μm for Hydrogen fluoride(<80% Atmospheric transmittance).pump source used is Chemical reaction in a burning jet of ethyleneand nitrogen trifluoride (NF_3).it is used in research for laser weaponry, operated in continuous wave mode, can have power in the megawatt range.

Deuterium fluoride laser: its operates on ~3800 nm (3.6 to 4.2 μm) (~90% Atm. transmittance) pumping is done by chemical reaction . It is used for US military laser prototypes.

COIL (Chemical oxygen–iodine laser): This chemical laser has operating wavelength 1.315 μm (<70% Atmospheric transmittance).its pumping process is done by chemical reaction in a jet of singlet delta oxygen and iodine .It has several applications like Military lasers, scientific and materials research. Can operate in continuous wave mode, with power in the megawatt range.

Agil (All gas-phase iodine lasers): this gas laser operates on 1.315 μm (<70% Atmospheric transmittance).Pumping is done by Chemical reaction of chlorine atoms with gaseous hydrazoic acid, resulting in excited molecules of nitrogen chloride, which then pass their energy to the iodine atoms.it's have several applications in Scientific, weaponry, aerospace.

Dye laser Dye laser is another type of laser its operating wavelength is390-435 nm (stilbene), 460-515 nm (coumarin 102), 570-640 nm (rhodamine 6G),its pump source consist of many others Other laser,& flash lamp it is used for Research, laser medicine, spectroscopy, birthmark removal, isotope separation. The tuning range of the laser depends on which dye is used.

Metal Vapor laser: Helium–cadmium (HeCd) metal-vapor laser:
Its operating wavelength is 441.563 nm, 325 nm. & pump source used as electrical discharge in metal vapor mixed with helium buffer gas. It is useful in many ways like Printing and typesetting applications, fluorescence excitation examination (i.e. in U.S. paper currency printing), and scientific research.Helium–mercury(He Hg) metal-vapor laser:This laser has operating wavelength 567 nm, 615 nm. Pump source used as electrical discharge in metal vapor mixed with helium buffer gas. It is used in Rare, scientific research, amateur laser construction.

Neon–copper(Ne Cu) metal-vapor laser: Its operating wavelength 248.6 nm. Pumping is done byelectrical discharge in metal vapor mixed with neon buffer gas. It has application in scientific research. Copper vapor laser: It works on operating wavelength 510.6 nm, 578.2 nm .pumping is done by electrical discharge method .It has several application in Dermatological uses, high speed photography, pump for dye lasers.

Gold vapor laser. : Its operating wavelength is 627 nm.& pumping is done by electrical discharge method .It has Rare, dermatological and therapy uses.

Manganese (Mn/MnCl2) vapor laser: Its operating wavelength is 534.1 nm. Pumping is done by Pulsed electric discharge used in

4. EFFECT ON BIOLOGICAL TISSUES:

There are three types of in biological tissues can be discuss above for analysis their used

4.1. Thermal Effects The laser on biological tissue results from the conversion of light to heat, heat transfer and a tissue reaction to the temperature and the duration of the heating [34]. This interaction leads to distortion or the destruction of a tissue volume. Depending on the degree to which time is heated, and the heating time, the thermal effect of the laser produces coagulation necrosis as in the treatment of angiomas with Nd:YAG laser, or volatilization as in the treatment of skin lesions with CO2 laser.

4.2. Mechanical Effects They are obtained with lasers emitting extremely short pulses, in the nanosecond to picosecond range on very small surfaces, which causes a destructive shock wave mainly induced by the mechanism of explosive vaporization of the target as used to treat haemangiomas [35]. In this case, the vessels of the angioma explode, which explains the vessel wall rupture, and hemorrhage. This is also what happens during a tattoo removal when large fragments of pigment explode and give birth to smaller fragments.

4.3. Photo-Ablation An effect that requires high-energy photons (wavelength less than 300 nm), with extremely short pulses (10 ns to 100 ns). It induces a clean ablation of tissue without thermal lesions. Photo-ablation is the most recent light−tissue interaction to be exploited clinically. It is used to treat corneal pathologies such as ulcers and scars, and its use in keratorefractive surgery has become a rapidly evolving field [36]. The operation is performed under local anesthesia (using topical drops). The first step of the procedure involves cutting a corneal flap surface (90 to 180 micrometers).

5. LASER EFFECTS ON VISUAL PERFORMANCE:

Lasers interfere with vision of human eye either temporarily/ permanently in one or both eyes. At very low-power levels, lasers may produce reduction in visual performance in critical tasks when driving a vehicle. At very high-power levels, greatly exceeding exposure limits, they may produce serious long-term visual loss or permanent blindness

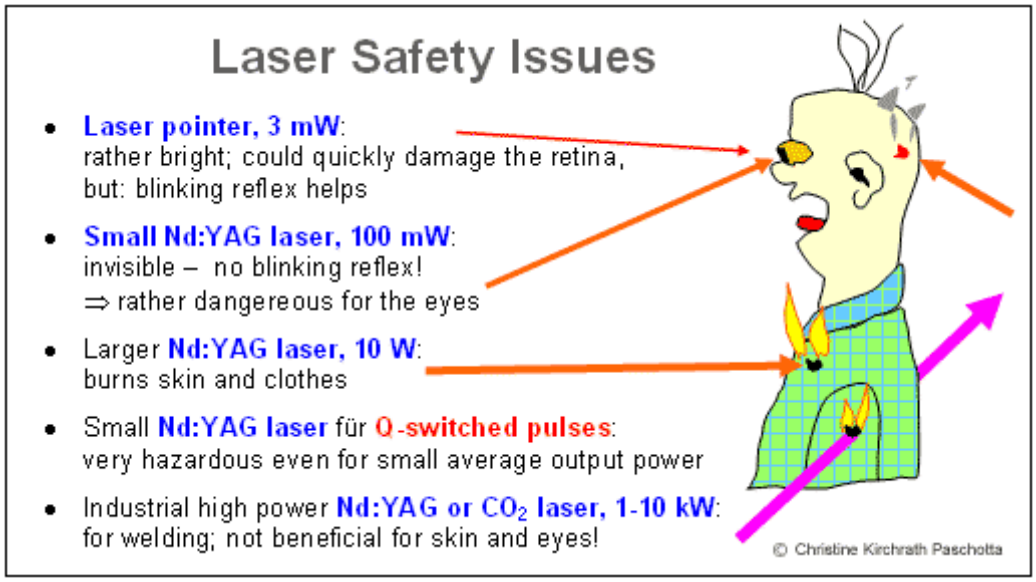

Fig3. Laser safety issues

6. CONCLUSIONS:

The SIGNAL deliver by the laser is much important to society for various applications that is in medical and engineering fields. In this paper we survey the various application of laser, and then we conclude that laser is very important for analyse the digital system. The laser signal is very harmful for vision of human eye .so we cannot detect laser beam through naked eyes .For removing the noise in image for better visual appearance we come ACROSS FINAL CONCLUSION THAT IMAGE DE-NOISING USING PARTICULAR TRANSFORM IS USED FOR REMOVING THE NOISE IN SIGNAL.

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