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REVIEW PAPER

Theoretical support of modern issues related to laser techniques, applications of coherent radiation and modern technologies

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Abstract

Modern problems of the Earth's population are increasing in the areas related to the basic concepts of survival of living beings, but also with opposite views, if parallels are made between energy and ecology. Many new technologies are searching for their way towards development and must be viewed from several points of view. In this paper, the issue is addressed through modern laser techniques in terms of obtaining energy for various purposes concerning selected roles in medicine, as well as the impact on flora, fauna and as a support to other technologies both classical and modern. Contemporary attributes of lasers and other quantum generators in terms of coherence, power and intensity densities have significantly increased, although some predictions from the time of the first quantum generator masers, like gamma-rasers (and X raser) are still relatively far from commercial concepts. Some of the possible contemporary implementations of quantum generators in measurements control and processing schemes, along with other possible applications of various laser types, have been estimated. The paper focuses on the characterization of today's problems with Covid-19 virus, only from the engineering point of view. The lexical side of the issue is also included, as well as the social management needs with the application of modern technologies, including help from natural sciences.

Keywords: energy, hardness, laser, scattering, ecology, corona virus

1. INTRODUCTION

Starting from the reflections on the past and the present, one is divided between the global and the local, which can provide different images and groups of problems. It seems that the seasons have reduced to two, although in the past, we saw four. We are also accustomed to the usual descriptions of the seasons, and it turns out that in relation to the media and science there are narrow ranges.

From the belief/fact referring to the discussion whether climate can or cannot change globally, to the fact that we must constantly remind ourselves of the ecology (purity of the air, particles extremely dangerous for health, January 16th, 2020) in day-to-day life, observations on energy issues, or medically acute conditions related to the pandemic, which we have almost forgotten for a long time. It seems that we have returned to the Middle Ages, or further into the history of authors environment and world history. There is an ecological side of any problem in every work-trade and everyday life. Particularly important are medically acute conditions related to the pandemic. Current techniques, technologies and knowledge cannot be compared to any previous period of time; however, the events around us require asking and answering the same questions as those from a few centuries ago, again and again. The paper provides some assessments of possible realistic answers to questions that still seem to be relevant, and a reminder of work techniques and theoretical foundations of engineering approaches.

We are reconsidering the roles of scattering processes, remote sensing/detection, energy analysis, and relatively simplified schemes of required systems and devices for specific responses. There are conflicting demands between energy production and its impact on the environment. Various points of view could be analyzed, with some questions such as: *What are the consequences and do they impose limits to energy conversion? What are the new generations of nuclear reactors/plants and what are their advantages and disadvantages?* The same questions could be examined for other energy transformations, considering efficiency, storage, waste disposal, and other *pro et contra* reasons. The role of coherent sources in given tasks is the common ground throughout this paper, (Vujić J. et al, 2013; Antić D. et al., 2013, Anđelković, M.,Editor, 2013).

A lot of work has been done in the field of nuclear energy, but much still remains: with Th – reactors (instead of U) (2005) preventing long term nuclear waste; molten salt reactors, MSR; CO_2 free energy sources, such as solar energy, will have to be supplemented by capacity from a power plant, most likely utilizing nuclear energy; 2030 is now somewhere mentioned as the key year!

Besides that, other alternatives were and are combustion of fossil fuels, storage and disposal of nuclear waste, and technical-technological measures for reduction of unintended / unwanted emissions. All types of power plants (hydropower plants, wind farms, solar plants, biomass, etc.) should be accepted having in mind ecology and environment protection. The focus is always on the geo location of the power plant, however in such a way that both its advantages and disadvantages should be considered and optimized.

A few approaches provide answers for contemporary problems, without pretense that the application of lasers in problems is decisive. Some existing experimental possibilities, potential developments and the assessment of severity, diagnostics, could be presented through simulations that can be developed using modeling in laboratory conditions in a variety of cases. Analyses of scatterer sizes which can distinguish ensembles (viruses, corona, Covid–19, SARS, bacteria) or geometry (Gaussian coils, spheres, rods, etc.) could be made. Special setup with laser and *speech recording* investigates the limits of droplet movement, the state of powder in an industrial enterprise, and categorized in the field or in the laboratory with the source - lasers. Vaccine administration through particle generators for agro-flora or fauna can be practically investigated through devices/schemes whose interpretations are reliable and supported with appropriate multidisciplinary teams. Laser has a role in protective measures through LIS, for removing pollutants using the processes of interaction of pulsed coherent beams with the material, as well as other solutions with them. This relates to nuclear waste storage or reduction of local radioactivity. It has a special role in relation to nuclear energy, protection and input of fiber optic power supplies and other diagnostic roles of laser maintenance, starting from measuring wind speed, blade conditions, etc. (□urović, M., 2001).

The parallels between the modern and previous applications of lasers will be considered, and the conditions with the Covid–19, where the therapeutic biomodulation effects for recovery, disinfection, diagnostics in many laser spectroscopies, start from scattering (elastic/inelastic) in dispositions with photon beating or classic angular distribution (polarizations). Analyses and complex cases with shells around microparticles/scattering centers with sophisticated approaches have long been surpassed (Ostojić, S.2000, □urović, B.,2009). Laser fusion, LF, used (as a solution) in nuclear fusion, (Duderstadt 1984, Gojkovic, 1986) as well as laser/holographic methods for determination of seismic perturbation sources, and Rayleigh, Brillouin, Raman and Mie forms of scattering, show more classic or modern setup to give pedagogical outcomes, too, with cumulant formalisms and determining of polydispersity.

The size of the particles will determine the extent of the danger to the lungs - all that can be applied in cases of present experiments with lasers and Covid–19. One part of the paper will include a look at solutions with optical fibers, fiber lasers and solutions in terms of powering sensors in potentially dangerous areas and, in particular, new devices in plasmonics (Geddes Ch.D., ed, 2016). Fiber systems have big roles, in considering some other techniques as thermal imaging. The problem related to the application of various references and the accuracy of

translating terminology from various languages will bring closer (or more distant) the expression in them of terminology related to the topics mentioned (optics, energy and selected terms from heritology to the Space and transformation processes). Some of the experimental results obtained from the pulsed or cw lasers will be presented, concerning the mentioned problems based on the processes of scattering (elastic/inelastic / quasielastic), provoked acoustics phenomena, absorption, material modulation and diagnostics. Some results of the experiments performed with the pulse laser (Sreckovic M et al., 2001, Sreckovic M.et al., 2019) were presented. In the case of the new materials, all magnitudes and dependences appear as new, therefore, additional measurements are required, as well as finding specific dependences on the applied frequency for the specific resistance, dielectric susceptibility and magnetic permeability. The complementary measurements should follow. The way to present equivalent schema in the series of parallel or combined connections and attempt to relate macro- and microscopic cases could be certainly related to the similarity laws.

Versatile methods of energy transformation, among which some are currently used even in mass media and, of course, in researches of different contemporary disciplines, deserve further analyses from several aspects. One of the practical approaches is improving the characteristics of designed sensors or components which are present in praxis, while the other is the question of transforming energy, as some would say "from the philosophical point of view, as in positive or negative directions".

In this paper, the chosen problems are analyzed, using approaches to the solutions of current and potential significance, from the theoretical and practical viewpoints, supported with experimental approaches. Monitoring the mass media problems around the globe in the last few years and decades has shown that regardless of the fact that some processes are slow, they affect our planet and its biosphere. On the other hand, we have experienced catastrophes for a long time, some caused by the natural sequence of events, although, in some cases the human factor inevitably bore responsibility (Sweer 1967).

Regarding the *future*, the thoughts of famous people are that *it should be constructed, not just predicted*. In this paper, selected topics are observed in parallel with laser applications and non-laser solutions, without intention to conclude that there is a trend of constant dependence on coherent radiation. This opportunity will also be used to remind us of historical and modern aspects for processes that are inevitably and constantly present, but can still be used as an important choice for diagnostic techniques, such as scattering of coherent light (Balch W. M. et al., 2000, Pike E.R. et al.1997).

It is especially interesting that there are newly developed pairs of stimulated scattering, in the case of some more classical scattering processes, or other processes of laser interaction with the material, known as stimulated Brillouin, Rayleigh, Raman and other scatterings. A short description of stimulated scatterings was given.

Consideration of stimulated Raman scattering leads to parametric generators and amplifiers that give new wavelengths. The approach is made through the parametric interaction of light and the environment excitation. The paths are electronic or libration pathways. Offset changes according to frequencies, which are measurable with laser excitation. Some of these changes are very low. Mandelstamm – Brillouin scattering is associated with acoustic wave scattering; Rayleigh scattering with entropy wave excitation; Rayleigh wing scattering with a change in the orientation of molecules. At very high intensities, the processes become stimulated (VRMB).

VRMB is conditioned by parametric interactions of electromagnetic (EM) and acoustic waves, with specific processes. Brillouin scattering in liquids starts with the equation of incident waves analogous to formalisms in (Srećković, et al.2017) of the form

$$\begin{aligned}\left[\nabla_x(\nabla_x)+\tfrac{\varepsilon_1}{c^2}\tfrac{\partial^2}{\partial t^2}\right]E_1&=\tfrac{4\pi r\omega_1^2}{c^2}p^{nl}(\omega_1)\\ \left[\nabla_x(\nabla_x)+\tfrac{\varepsilon_2}{c^2}\tfrac{\partial^2}{\partial t^2}\right]E_2&=\tfrac{4\pi r\omega_2^2}{c^2}p^{nl}(\omega_2)\end{aligned}\qquad(1)$$

Optical excitation of acoustic wave equat. 2 and common presentation is:

$$\left[\nabla_x(\nabla_x)+\frac{\partial^2}{\partial t^2}-2\frac{\partial}{\partial t}-v^2\nabla^2\right]\rho=-\nabla f\qquad(2)$$

The acoustic wave is characterized by a change in density ρ, wave velocity v, attenuation constant, or half-width of the Brillouin line γ with spontaneous scattering. Induced or nonlinear polarization P_{NL} occurs due to nonlinear interaction of all three waves and is obtained from the relations:

$$\begin{aligned}\left(\tfrac{\partial}{\partial z}+\tfrac{\alpha}{2}\right)\varepsilon_1&=\tfrac{i\omega_1^2}{2k_1c^2}\tfrac{\partial\varepsilon}{\partial\rho}(\hat{e}_1+\hat{e}_2)\varepsilon_2 A\exp(-i\Delta kz)\\ \left(\tfrac{\partial}{\partial z}-\tfrac{\alpha}{2}\right)\varepsilon_2^*&=\tfrac{i\omega_2^2}{2k_2c^2}\tfrac{\partial\varepsilon}{\partial\rho}(\hat{e}_1+\hat{e}_2)\varepsilon_1^* A_c\exp(-i\Delta kz)\\ \left(\tfrac{\partial}{\partial z}+\tfrac{\Gamma_B}{2}\right)A&=\tfrac{ik_a}{4\pi v^2}\rho_0\tfrac{\partial\varepsilon}{\partial\rho}(\hat{e}_1+\hat{e}_2)^*\varepsilon_1\varepsilon_2^* A\exp(i\Delta kz)\end{aligned}\qquad(3)$$

Attention could be directed to couplings of nuclear physics/techniques/power engineering and solutions, in which lasers (i.e. quantum generators) have their role. It is not in the foreground to consider only visible radiation, but in a broader sense, a combination of UV/VIS/IR, or

harmonics, which can reach thousands of multiples, and then we could dive deep into other areas of the EM spectrum, at a much higher (or lower) photon energy. Observed historically, there was a lot of theoretical work that was ridiculed in certain circles, which was about:

• Calculations of the point in time when pollution and change of the ozone layer will cause changes in temperature. These calculations/analyses started from the beginning of the 20th century, which was almost viewed as frivolous, considering the disbelief that the calculations are valid, and that life on the Globe will prove it. It is not intention to recall the details, but to recall some of the roles of lasers in this area (Srećković M., Karastojković Z. et al., 2014, Srećković M., Ostojić S. et al., 2015).

• Calculations of the hair growth and hairiness (at the time of the first flights into Space, this was *recognized* as an important task).

Observing the energy issues around the golden age of quantum electronics, several concepts of perspective lasers have appeared. Some still remain, only enhanced with many new ideas and solutions, which will be addressed later. Finally, the current situation with viruses, among many other techniques, can be observed in parallel with lasers.

Another view would enumerate topics, in which energy and ecology are observed in parallel, and this would be of interest in many areas. Here are some of them:

a) New generations of nuclear reactors (and chosen energy systems), advantages and disadvantages.

b) Storage and disposal of radioactive waste. The next step is *battle against* Space waste and laser role.

c) Fossil fuel combustion: emission and technical measures for control, environmental protections –state of the art.

d) Water supply for thermal power plants TPP and wastewater discharge.

e) National, regional and worldwide experiences and prospects related to the use of hydropower plant HPP.

f) Contemporary possibilities for the use of solar energy and biomass.

g) Prospects for wind and solar energy in Serbia, Bosnia and Herzegovina, republics of ex-Yugoslavia, the Western Balkans and other countries.

h) Protection of the atmosphere in a local, regional and international framework (continents).

i) TPP and lasers (regarding potential sources of pollution of surface and ground waters by major and trace elements).

j) Social aspect; Grid-zero energy houses: Renewable energy and regional cooperation (Vujić, J.,2013).

Overall stand in observing laser technologies could be covered with: power, diagnostics, reparation, extreme high laser energy facilities, trends in contemporary life and solutions, based on an equilibrium between energy and ecology.

Preserving the environment and providing enough energy is a constant problem, reminding us that 1/3 of the population does not have access to electricity, and that underdeveloped countries use mostly fossil fuels. This situation is constantly deteriorating, and the goals are the same for ecology and energy, in a broader sense of trends. By 2035, electricity production will probably increase by 87% from 1910^{12} kWh starting in 2007, $25\cdot 10^{12}$kWh in 2020, up to $35\cdot 10^{12}$kWh., Fig.1.1; a 3% growth is projected for renewable: 18% in 2007 to 23% in 2035 (hydropower plants-HPP included), and for nuclear power plants - NPPs 2%, for TPP, an increase of 2.3% per year. The restrictions will depend on the environmental regulations. HPPs and WPPs – wind power plants will make the biggest contribution, and the rest will not reach CPP until 2035. The NPPs will increase the contribution from $2.6\cdot 10^{12}$ kWh in 2007 and $3.6\cdot 10^{12}$ kWh in 2020 to $4.5\cdot 10^{12}$ kWh in 2035.

Unknowns regarding nuclear power plants are numerous: safety, waste disposal, reduction of investment risks and prices.

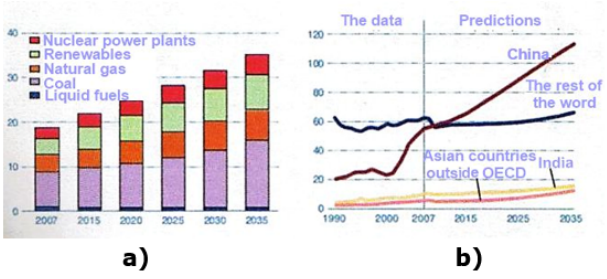

Figure 1. a) World electricity production by fuel type during 2007-2030 in billions of kWh, b) Coal consumption in the world during 1990-2035 by estimated quadrillion BTU,1W□3.41BTU/h, (Vujić, J., 2013).

Figures 1 and 2 could be objects for discussion, considering EMP, nuclear power and nuclear Regulation vs. EM pulses from H-bombs and their possible triggering of NP accidents in more than 40 years. Here these questions are stated purely from the technical point of view (Lerner E. 1981).

Considering techniques, the laser technique and engineering in general, Covid–19 could be the object of laser scattering, and its influence on humans. Examples can be found on the web, full of coupling between laser technique in diagnostics, biostimulations of patients, as well as many other applications, including sterilizations. Numerous simulations and programs/algorithms, with laser scattering, including Rayleigh, Brillouin and Raman lines,

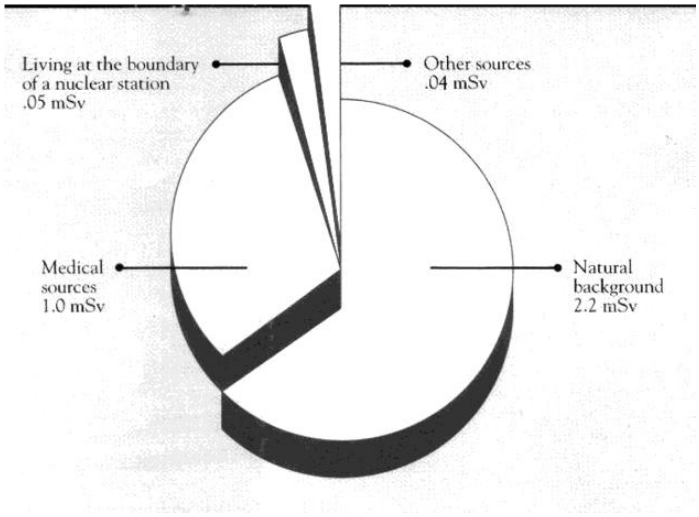

Figure 2. Radiation in the vicinity of some plant (should be compared to medical treatments (Legault B., 1989).

help in interpretations of measurements with systems of photon mixing and correlations (Refregier Ph, 1990).

New stands appeared regarding the influence of Covid–19 on global developments of certain areas, besides its influence to everyday life. For example, nanocoatings as new products show up to 99.9998 effectiveness of protection against bacteria, formaldehyde, mold and viruses (10^3 times more efficient than previous technologies) being effective on multiple levels (antimicrobial, antiviral, antifungal), (New report: The global Market for Antimicrobial, antiviral).

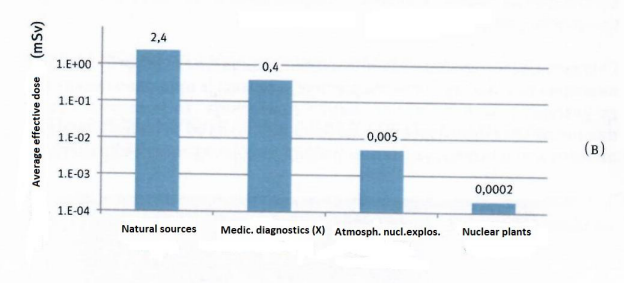

Figure 3. Some data of average eff. dose from references (Antić D., 2013).

1.1. Biological point of view to Covid 19 and lasers

Low power lasers, LPLs, modulate the parameters of biotissues and cells by provoking chemical and biological processes in various manners. Despite the vast number of papers there is still a considerable number of controversial facts (biochemical processes, shifts of inflammatory and ischemic, reparation and other processes). Generally speaking, stimulated processes can be connected to analgesic and anti-inflammatory actions.

The second trend pertaining to the role of laser can be found in laser diagnostics of biological objects (including macro and micro levels). The working parameters (dynamical regimes) of laser as sources for stimulation and diagnostics through many methods is connected to parameters of the beam, the manner of application, experimental model, divergency, wavelength, repetition frequency, spot size, polarization, power, etc. Physical processes: absorption, fluorescence, scattering, resonant and linear/nonlinear processes could be provoked in biological objects, as well (Srećković,M., Osmokrović P., et al. 2010; Latinović Z.et al.,, 1914), Babic S.,2016,Mirčevski J., et al. 1995).

1.1.1. *Application of lasers in diagnostics of biological systems and particles*

Biomass, energy and ecology, protection of the atmosphere in framework of international conventional European and Serbian regulations, TPPs as potential sources of pollution of surface and groundwater caused by major and trace elements, sustainable energy and regional cooperation are controversial topics but require specific solutions. Following the approach from a biological point of view, and then, taking into account lasers and ecology, it can be pointed out to certain formalisms and methods referring to the given subject.

Bacteria, viruses, molecules, macro-molecules, DNA, RNA, blood cells, are the subjects of investigations in many areas including those areas in which distinguishing processes are relevant as is the case with peptides, among other things. It has been claimed in the literature that laser techniques can be helpful in many applied methods (Chen, 1972).

Monitoring the change in circular and general polarization in the matrix description as the subject of ellipsometry is a very useful method for obtaining areal performance of various materials as well as macroscopic or microscopic sizes. This is the area that the specific rotation of micro particles in solutions of a certain concentration, in optically active materials should be monitored. Circular dichroism processes have been applied for the long time. Equally, the magnitudes of the rotation power using analyses of the obtained experimental curves have also been monitored, particularly in cases in which the area under the curve is decomposed into a series of Gaussians (the sum of which provides the initial and the corresponding formalisms). Furthermore, the spectrum (i.e. dispersion of optical rotation and circular dichroism) of DOR in CD is interconnected by the Kronig-Krammers method. The DOR equipment contains a source, a polarizer, sample cells, an analyzer, a photomultiplier and a printer. To measure CDs: a source, a polarizer, a crystal, a modula-

tor, possibility to change circular polarization, and electronic/computer system for signal processing are utilized. Interpretation of optical activity, and DOR and CD curves (Bloemendal 1995) should represent a task for a specific case, (Table 1 and 2). The theory of optical activity enables obtaining the structure of proteins using the CD spectrum. With the spectra in the region of peptide bonds, the problems are: large number of configurations and the spectrum is the result of averaging. Therefore, rules for spectrum analysis have been developed. In terms of microbiology, bacteria and viruses, this study could be relevant given the fact that most of bacteria and viruses are based on peptides. It should be noted that current common knowledge about Covid 19 is still full of unknowns. In the result of this paper some description/simulation obtainable/possible by laser diagnostics are presented.

Table 1. Empirical rules for the interpretation of the DOR and CD spectra

1. DOR and CD spectra are additive thereby representing the sum of the components of the spectrum. However, this approach is not employed, but serves for approximation purposes.
2. The amplitude of the DOR curves or the rotation power, determined on the basis of CD curves, provides a measure of the degree of symmetry of the molecules. When the parameters decrease or increase, as a result caused by the action of an intermediary, the symmetry of the molecules decreases or increases.
3. A symmetrical chromophore can become optically active if it is found in a symmetrical medium. It can be accompanied by changes (or not) λ_o
4. λ_o both intensity and Δ_ε with λ_o allows identification of the chromophore because the size is close to λ_o from the absorption spectrum.

Some cases in (1) are used to confirm the existence of macromolecules (protein content of the helical structure) or to confirm that the structure was determined by X - ray analysis in solution; In addition to this, 2 and 3 are used for the interaction of macro and small molecules. The empirical approach for selected polypeptides has been carried out so that one configuration can be obtained through the X-ray analysis. The mean weight curve, corresponding to the sample can be obtained from the standard curves. Proteins occur as: poly L-lysine, α helix, β shape and Gaussian coil, spectra in Figure 4 (Kostadinovic T., 1999).

The assumption that the side chains of amino acids do not affect the spectrum is verified by a simple graphical addition. More specifically, a curve for proteins is obtained by applying all three combinations of confirmation procedure.

Some mechanisms of functioning bacteriorhodopsin were used to explain interpretations of spectroscopic data vs. transitions in bacteriorhodopsin cycle. (Krasnogolovec et al., 1985), using laser methods with sources (second harmonic of Nd^{3+}: YAG and another tuned DFB lasers (Volmer F., 2007), and other influence of photochemical transformation with external stimuli, considering λ_{Max} absorption at 570nm, and adaptation to the dark. External influences were: electric field, temperature, pH, humidity, light intensity, etc.). Laser influence means that irradiation can provoke many transformation processes with (or without) dark phase. Laser pulse provokes bacteriorodopsine activation to cis-trans isomerisation and complex state, with proton moving.

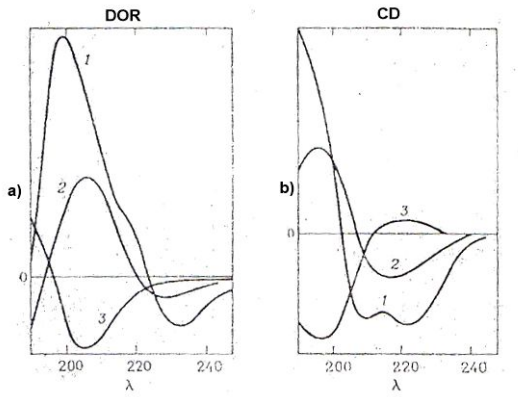

Figure 4. a) DDR (a) and CD (b) of poly L-lysine spectra in conformations: 1-□ helix, 2- □ shape, and 3- Gaussian coil.

Table 2. α-helical structures in proteins by CD method and X-ray structural analysis

Proteins	Composition of α - helical structures in proteins by CD method	Composition of α - helical structures in proteins by X – ray structural analysis
Myoglobin	77	99
Lysozyme	29	29
RNA of ribonucleic	18	19
Papain	21	21
Lactdehydrogenism	31	29
A chymotrypsin	8	9
Chymotrypsinogen	9	6

Note that among *useful* spectroscopies, Raman and IR are *very* useful for defining materials of both organic and inorganic nature, figure 5.

1.1.2. *Measurement of blood perfusion using focusing optics*

Two microscopic sensors used for measuring the perfusion of blood from the tip of the index finger (de Mul F. F.,

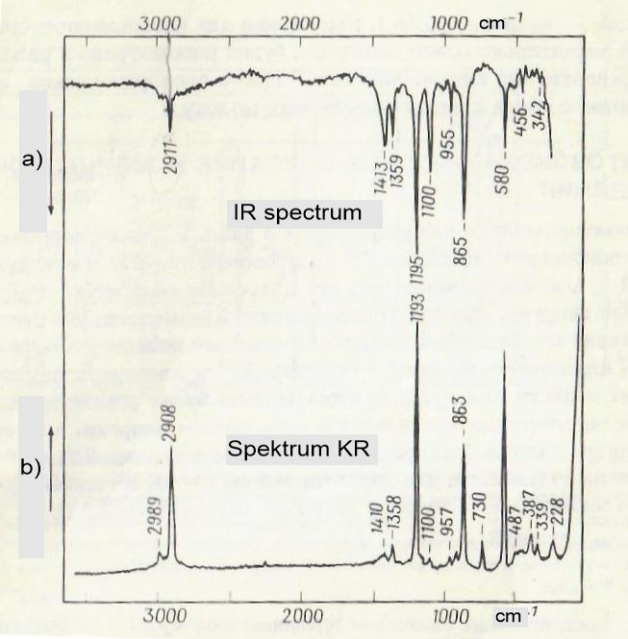

Figure 5. Raman and IR spectra (Carey P.R., 1985).

M, Koelink, M. H., 1992) were particularly relevant (Figure 6). Furthermore, these measurements are included in the still insufficiently defined variations of perfusion and opposite phases.

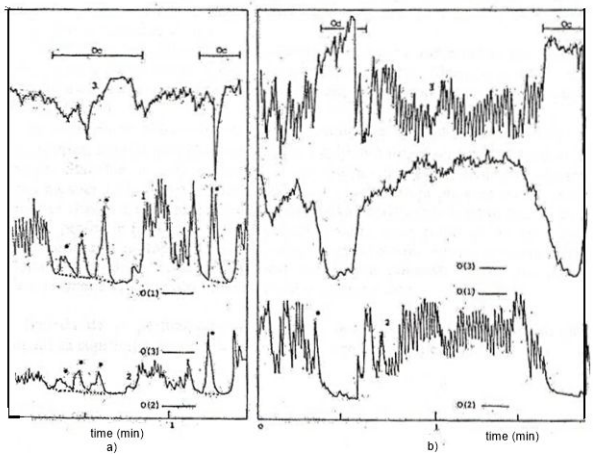

Figure 6. Focused laser beam as a source of blood perfusion measurement: 1-Perfusion signal. 2-signal proportional to the concentration of particles (density). 3-medium flow rate. a) Free surface of the tissue, b) fixed (glass) (Disorders due to variations of light reflection).

1.1.3. *Influence of various beams and fields to modification of biosamples*

To date, a number of seed-stimulating technologies based on the use of the laser, ultrasound, cold plasma, magnetic and EM fields have been developed. A preplanting treatment of seeds with low-frequency pulsed electric field (LF-PEF) was proved to have a positive effect on the seed qualities and productivity of some agricultural crops, including: lettuce, parsley, red beet, and carrot. However, the mechanisms of this effect still remain unclear. The response of 13 potato varieties to the LF-PEF treatment on several morphometric traits were assessed in one study, which was carried out at three geographical points (Ermolina et al. 2014, Stasyuk N. 2015.)

Generated electric field was used to treat plants and it was characterized by a broadband frequency range with the following parameters: carrier frequency (∼16 kHz), repetition rate of the modulating pulse pattern 200 Hz, generated field intensity 20 kV/m. According to the earlier optimized mode, the seed of potato was exposed to LF-PEF for 24 h. Protective treatments with fungicides were the same for both treated and untreated plants, used as a control group. Plant height, number of stems per plant, number of leaves per stem, fresh weight of above-ground parts, the number and total weight of tubers per plant were measured at blooming; each variant (control or treatment) included 10 plants in 4 repetitions. However, the LF-PEF treatment did not significantly influence the plant height, number of leaves per stem, and weight of fresh above-ground parts of plants in the majority of the studied variety cases. Nonetheless, the number of stems and the number and weight of tubers per plant increased, and these changes were consistent and significant for the majority of varieties (80–95 %). The variety-averaged increase in the number of stems and the number and weight of tubers per plant ranged between 27.0, 28.3 and 31.1 %, respectively, as compared to the control group. The obtained data concur with the results of earlier large-scale trials of the LF-PEF technology, arranged in different regions of Russia. Potato (*Solanum tuberosum* L.) is one of the most important crops, concerning the quality and adaptive potential of seed material. Treatment with low-frequency pulse electric field, morphometric traits, pre-planting treatment, crop capacity, were performed in Russia, as well as China, India and Serbia. There is a significant difference in productivity for both external and internal cultivation conditions.

Some plants were treated by laser, electric and magnetic fields in parallel, depending of the case, but parallel biomodulation is known in medicine, too.

1.1.4. *Light scattering as diagnostic technique in biology and medicine*

Atmospheric protection is an ongoing topic, particularly within analyses of the atmosphere performed by various methods. In these analyses, some parallels appear such as

Table 3. Contents of volcanic ash

Material	Sharp edged hard glass particles Pulverized rock, abrasive: siliceous materials, melting point below the operating temperature T of modern turbine drives at cruis thrust.
Ash cloud	Accompanied by gaseous solutions of SO_2 (with H_2O creation of sulphuric acid) Clorine (hydrochloric acid and other chemical hazardous to health)

optical, acoustic, spontaneous and coherent optics, optical control of droplet and particle propagation.

Light scattering has long been monitored in the Earth's biosphere. Since there is a wide range of possibilities for remote monitoring of lidars, colidars, dials and white lidars, the effects of scattering and absorption have enabled development of many schematic models and practical monitoring devices (Srećković M. et al. 2015). This is particularly enabled by the emergence of coherent radiation with quantum generators. However, it should be taken into consideration that solar radiation has a small degree of correlation (i.e. coherence increases with the length of propagation).

Based on the previously described measurements, and changes in the atmosphere as well as monitoring of volcanic ash (Table 3) and other products of eruption, (ICAO Journal) traces of desert sand, purity of the seawater and ocean, surface and depth, can be investigated in detail.

Eyjafjallajökull volcano eruption (in 2010) on Iceland, induced the generation of manual on Flight Safety and Volcanic Ash-Risk Management of Flight Operation with known Forecast of Volcanic Ash Contamination (Doc9974), because a potential hazard for flight operations was recognized (Manual of Flight, ICAO Journ, 2019).

The application of laser techniques for induction of discharge processes and parallels with the development of microwave solutions or localized changes in atmospheric discharge conditions represents a separate area of investigation. This can also be applied to the atmosphere management pertaining to large objects, construction sites, as well as trivial "operations" of cleaning the heritage sites and monuments.

Laser-induced explosions are very important area of exploration, too. (Sreckovic M. et al., 2005)

In great many cases, traces or harmfulness of a particular transformation could be found. These traces may refer to the following items:

- Application of lasers for the removal of radioactive particles from small areas with nuclear isotopes;
- Solving nuclear fusion by laser fusion;
- Thinking about laser isotope selection - LIS;
- Laser/holographic methods in searching for sources of seismic perturbations.

In the third part of the paper, several schemes for achieving relatively simple monitoring processes could be followed in terms of scattering type evaluation, angular one, Raman or Mie etc.

If one begins with the method of energy transformation, which encompasses coherent energy, then the given energy would be philosophically speaking, placed on a high position/level. On the other hand, the others would appear in the following order: nuclear – chemical – thermal, etc. In the light of this, NASA-CR-175400 construction project of a highly mobile laser ranging station could be discussed (Final Report, Nov 2, 1980). Some laser applications could be traced using table 4.

2. OTHER/DIFFERENT POINTS OF VIEW

2.1. The Laser and acceleration

Laser experiments aimed at accelerations, have been the subject of investigations for more than (20 years) (Pogorelski 2002a). Some of them, including CO_2 lasers have opened new trends.

Starting from

$|E_L|^2 = 2I_L/_o c$ (2.1),

associated transverse electric field E_L and laser intensity are linked by *classic relations*. Lasers are known by the highest obtained fields and pressures in laboratory conditions. For E=1TV/m, corresponding I_L is $\sim 10^{18}$ W/cm^2. It is the degree to which physics is relativistic, and a pondero-motive potential is thus

$W_{osc} = e^2 E_L{}^2/2m^2$ (2.1).

Some setups for the experiments are presented in 7.

STELLA scheme on figure 9 represents one of the first laser accelerated schemes based on the principle of free inversion electron laser IFEL.

Laser driven plasma wake field accelerator (LWFA) is particularly promising in achieving acceleration (Pogorelski 2002b) CO_2 laser has some advantages concerning equation (2).

$$\text{Eamax} = 2.8 \times 10^4 (\lambda/r_L)^2 \, \text{P}/\lambda_\text{p}$$

$$E_{a\,\max} = 2.8 \cdot 10^4 \left(\frac{\lambda}{r_L}\right)^2 \frac{P_L}{\lambda_y} \quad (2.3)$$

(It should be taken into account that the described relations have only been provided in order to clarify some

Table 4. Optical/coherent optical accessories (OCOA) and methods.

1.Spectral accessories	Signal transformations in optical-electronic devices, Spatial spectral filters, Basic methods for radiation composition, Monchromators, illumination systems; Photoelectric subsystems for emission spectral analysis, Interference, raster and laser spectral spectrometers and spectrophotometers. Interference raster accessories, Laser spectral accessories
2.Photoelectric accessories	Connection of light and energy quantities, Visual photometry, objective photometry, metrology and provision of energy photometry
3.Interference and shadow methods	Interference in thin films, image registration, surface shape control, micro roughness, refractive index of liquids and gases, In-homogeneities of transparent objects, Displacement interference, Holographic interferometers. Laser interferometers for plasma diagnostics, Methods of fast process registration, Two-beams in white light, Shadow and interference systems
4.Polarization accessories	Polarized radiation control, Induced anisotropy, Rotation of polarization planes, Interference, Analyzers
5.Measuring accessories	Photoelectric PhO-measuring microscopes, PhO collimators, Raster measuring systems. Scanning microscopes, colorimetry.

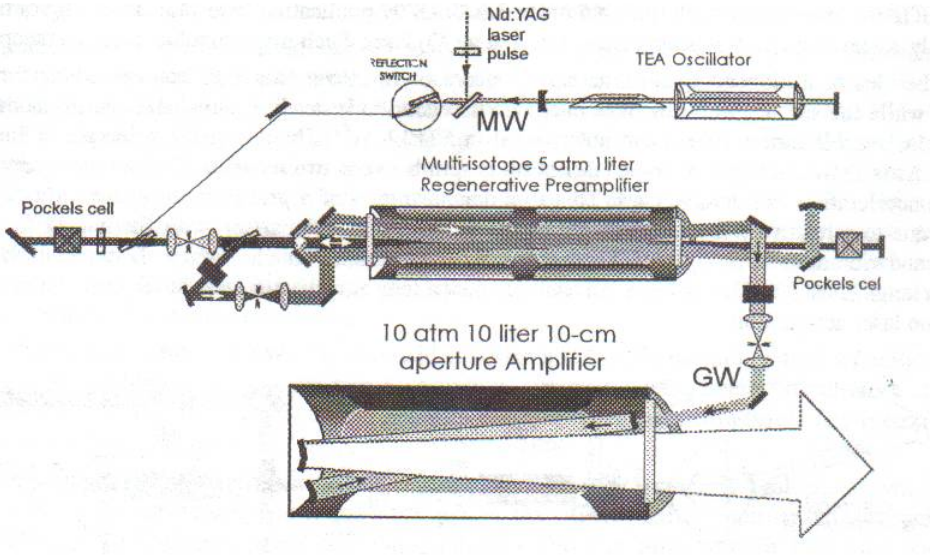

Figure 7. PITER I – ATF (Acceleration Test Facility) Laser Optical system, (Pogorelski 2002a).

trends). The units on figure 9 which are high i.e. E in [GW/m], P_L in [TW], $_p$ in [m], and

$$\lambda_p \sim n - 0.5p \qquad \lambda_p \sim n - 0.5p \tag{2.4}$$

Respectively, high acceleration gradient is connected to a low plasma density n_p. Figure 10 presents some simulations of 3ps CO_2 pulse amplifications, applicable to hypothetical combinations of the MARS and PITER I systems. (Shaben 2002).

The next interesting ultra intense laser pulse for plasma accelerators, guided by capillary tubes, is presented in figure 11, where intensity repartitions are in a focal plane for energy and output. (B. Cross et al 2002). Figure 12 present the brightness of high intensity lasers in case of various geometry, processes and solutions with plasma phenomena, relativistic Thomson scattering, systems of mirrors with related details(parabolic or other geometry) and X ray-manipulators (Annual Report 1990).

$P_{th} = (h_p(V_{eff}/l^*_c)(L_f + T + 2N_1{}^0 l)/[2_{ap}(f_1 + f_2)_f]$

2.5

with effective volume

$$sV_{eff} = 1/\iiint r_p(x,y,z)\Phi_0(x,y,z)dV \tag{2.6}$$

The relatively new terms are microchip lasers, which are presented in figure 16.

Important parameters and variables in theory are: pump energy h ν_p, T and Li input transmission coupling and resonator residual losses, respectively, l crystal

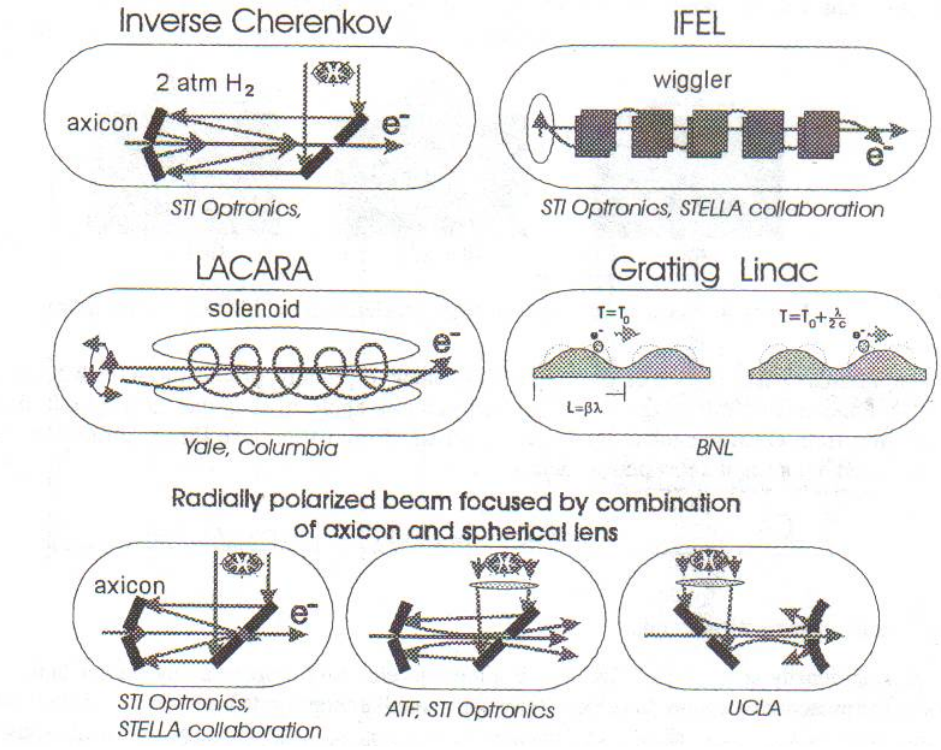

Figure 8. ATF laser acceleration experiments in institutions (Pogorelski 2002a).

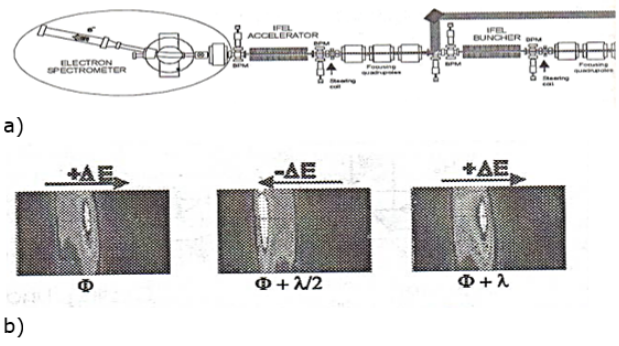

Figure 9. STELLA a) scheme , b) phase control over electron acceleration in STELLA experiment (Pogorelski 2002a).

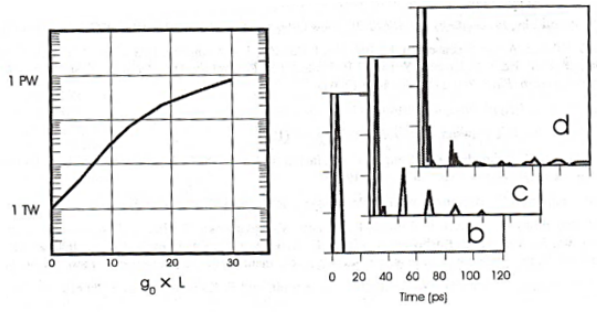

Figure 10. Simulation of the 3ps $COCO_2$ pulse amplif. for: a) hypothetic combination of the MARS and PITER systems: laser power increment with 30xbeam area expansion,b) 10MW pulse before amplification, c) TW pulse from PITER I at the input to the MARS amplifier,MA, d) 1PW pulse after the MA.

length, l_c* optical resonator, η_p quantum pump efficiency and η_a photon absorption. Contradictory requirements for crystal thickness and do-ping levels could be observed; the slope efficiency is proportional to the pump radiation absorption efficiency, which increases (lasing threshold) with the volume of dopants in the ion concentration. Dependence of re-absorption versus λ (associated with transition) is also considered as important.

Equally pertinent is the base idea of quasi-cw diode radial pumped microchip laser, which is pumped sideways by reducing the crystal size and confinement in the doped environment. It consists of an Yb^{3+}: YAG doped core, by endoped YAG, being diffusion bonded. 3 –composite crystals were applied: a) with 2-at% Yb doping; hexagonal shape, 0.5mm core dia and 10% Yb… and 2x2mm^2 and and 1.2x1.2mm^2square shape (Dascalu T.et al.2002).

2.2. Nuclear pumped lasers

Nuclear pumped lasers are further defined as fission reaction pumped lasers, utilizing the neutrons from a reactor. The representation of connected reactions is as follows:

$$_0n^1 + {}_2He^3 \rightarrow {}_1H^1 + {}_1H^3 + 0.76MeV \quad (2.7)$$

$$_0n^1 + {}_5B^{10} \rightarrow {}_3Li^7 + {}_2H^4 + 2.37MeV, \quad (2.8),$$

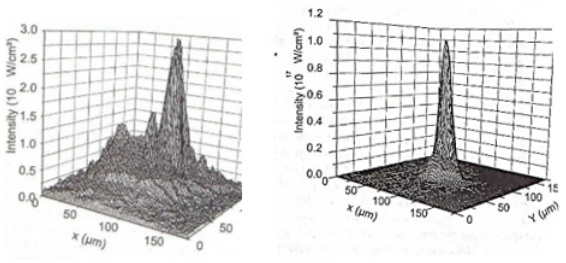

Figure 11. a) Intensity repartitions in the focal plane and energy 4.2 J at the output (25μm radius); 12 cm long capillary tube for incident energy in the focal plane of 4.3 J.

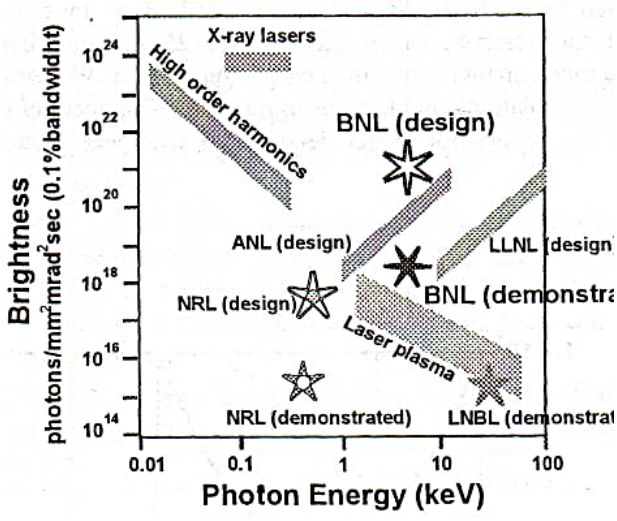

Figure 12. Brightness and photon energy in Thomson experiment (Pogorelsky b, 2002).

Another solution is charged ff_1 and heavy ff_h fission fragments(charged and heavy, respectively), which ionize the active media for lasing effects (Shaban R.Y et al., 2002)

$$ {}_{o}n^{1} + {}_{92}U^{235} \rightarrow (ff_1)^{20+}(95\text{MeV})(ffh)^{22+}(67\text{MeV}) + \text{fast neutrons} $$

$$ {}_{0}n^{1} + {}_{92}U^{235} \Rightarrow (ff_1)^{20+} $$
$$ 9_2U^{235} \rightarrow (ff_1)^{20+}(95\text{MeV})(ffh)^{22+}(67\text{MeV}) + \text{fast neutrons} \quad (2.9) $$

Related to studies of gaseous core/nuclear pumped laser, nuclear light bulb rocket component, UP laser mode of operation is with reaction:

$$ {}^{o}n_1 + {}_{92}{}^{235}U \rightarrow L_{20} + ff(95\text{MeV}) + 22 + H_{hh}(ff)^{22} + (67\text{MeV}) + \text{fast neutrons}. \quad (2.10) $$

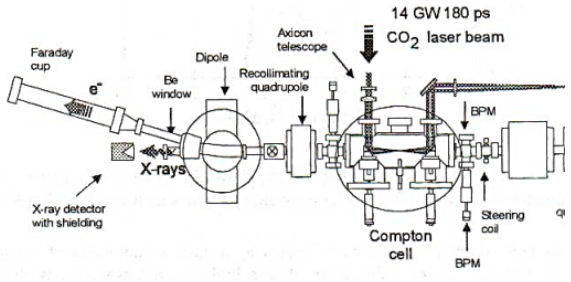

Figure 13. BNL (Brookhaven national laboratory) Thomson scattering setup.

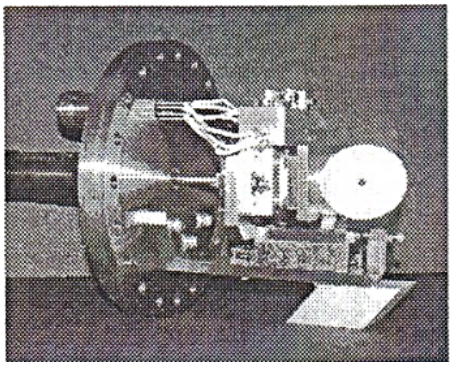

Figure 14. Parabolic mirror with a hole for e-beam and X-rays on a remotely controlled manipulator.

The roles of uranium laser, isotope shift, energy levels (optical lines/transitions) and direct system design should be analyzed, Table 5.

Note that *reactor laser* as a term has different meaning and concept in references. In some cases, the conception is close to gammaraser and its problems with realization, following numerous simulations and theoretical solutions (Visockij Y.R., 1989).

One of the first optical masers with the human hair in its resonator (figure 17) made a historical link between up to date masers and the initial stage.

Te He Ne optical maser is perturbed by placing a pair of hair sections in a resonator in order to obtain these patterns. These strings interacted with the mode structure,

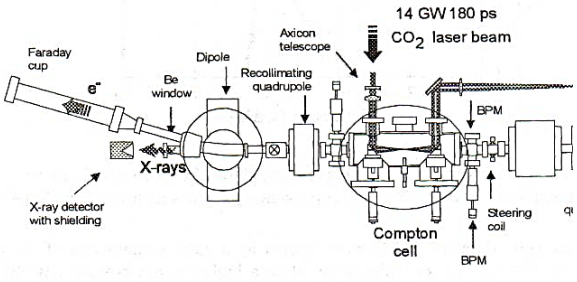

Figure 15. Experiment of Thomson scattering (Pogorelski 2002).

Table 5. Performances UCLR Nuclear Light Bulb and Solid Nuclear Engine (Shaban Y.R et al., 2002).

Performances	Nuclear Light Bulb	Solid Nuclear
Engine Mass, kg	31,800	9,100
Engine Power,MW	4,600	Not available
Total Propellant flow, kg/s	22,4	Not available
Thrust , N	410,000	334,000
Engine thrust-to-weight ratio	1.3	Not available
Specific pulse, s	1,870	830

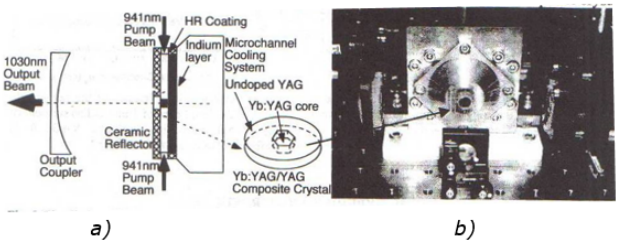

Figure 16. Diode radial pumped Yb^{3+}: YAG microchip laser a) and laser head b).

while merging with the others. By changing the angle between the hair, this interaction changed, providing the results that contain various figures. This quantum generator in the optical field has also had its development path in Bell's laboratories, after the maser (NH_3). The gas laser meant the first cw operation. This was followed by masses in gases, dissociation of oxygen in mixtures of O and He, Ne, Kr, Xe and transfer of direct contribution to gas atoms. 150 new laser transitions were produced in range of 0.594 μm up to 34.5 μm (yellow range→ FIR), which was high number for the time being (according to *Physics Today*), including the title as in (Chiad 2013).

The family of optical lasers is growing, including Xraser (X ray *lasers*) and other applications of laser produced plasmas. Shortening of X-ray laser pulse, assisted by counter propagating plasma deserve attention, as well as photo-sensitisers for Cancer Therapy, laser photolysis, Time Resolved resonance Raman spectroscopy of hemoglobin protein model systems lysozyme, thiol, DNA damage and repair.

The topics, which nowadays have an impact on our planet, historically are interlinking for millennia. In (Sreckovic M. 2019, Dunskaya, 1989), the parallel is drawn between some of the main contemporary energy sources – renewable or not – and the application of coherent /non coherent elion beams. Application of laser irradiation for increasing performances of components, detectors, solar cells, fibers and systems, beside many experiments with nuclear pumped lasers EMPs and nuclear power, exist for a long time (more than 2–3 decades) (Djelloul, 2014, Hida 2017, Nuclear pumped laser 1981-1991, Sogoyan, Solar light 2912)).

Figure 17. Physic Today, 1963.

2.2.1. *Reactor /Nuclear and Solar Pumped Lasers*

Various combinations and the methods of excitation exist. A nuclear-powered fluorescence, combined with a photolytically driven laser has had some advantages. Thus, one system developed in 1980 – 1985 had fluorescer gas; and it worked with Xe in XeBr and XeF and I photolytic laser. The study with an aerosol core nuclear reactor with a flash lamp was designed on a system illustrated in table 6 (Nuclear Pump.).

Table 6. Performances of some systems

Fuel	UC, UO_2,PuO_2
Moderator	Be, stainless steel (fast reactor)
Reflector	Be and stainless steel
Fluorescer	Xe
Laser	I and Ar^+
	Fused silica and stainless steel

The thermal reactor with Pt oxide and Be has the least critical parameters (sphere with 1m core radius and 0.2m Be reflector are with k_{eff} = 1.5022.). U and Be reactor were considered slightly poorer with k_{eff} = 1.299. Pu with a stainless reflector, spherical geometry is predicted with radius 15m and U with the same reflector 22m. The mean neutron lifetime was calculated, k_{eff} in fast reactors has a pulse width of the order of several hundred of ms. In

terms of pulse size and width, the Pt thermal reactor has better performance. The required power of the swallow will force the reactor to be much larger.

2.3. Solar Pumping II

The design of solar CSP systems concentrator, its characteristics, advantages and disadvantages tend to combine in optimal systems. This is principally important for the realization of solar -powered/pumped lasers, based on CO and Nd^{3+} : YAG active materials and other (Landis, G.A., (1992, 1994; Payziyeva; Sh). 4 types of CSP: Solar towers, parabolic troughs, linear Fresnel reflectors LFR, Dishes, exist (Bakhramov et al., 2005; Graham-Rowe, D., 2007). A notion can be found: *New solar laser could be instrumental in the quest. Use magnesium as a source of energy* (Duncan Graham, De Young M. 1987).

A new kind of efficient, solar-powered laser has been developed by researchers at the Tokyo Institute of Technology, in Japan. Usage of laser helped them to realize their goal of developing a Mg combustion engine. Solar energy categories also include Directed-energy weapons and military lasers. Some concentrators and other laser components solutions are in many references: (Stojicevic, M., Jeli, Z., Obradovic, M. et al., 2019; Damian, R., 2019, Norozi, M., 2019).

2.4. Lasers and nuclear detection

Investigations from long ago, aimed to ameliorate and thus modify the characteristics of components such as detectors, fiber, and waveguide by laser irradiation, have been well structured and organized accordingly. Namely, solid state nuclear trace detector, solar cell and many other components were processed by laser techniques. Performances of dye-sensitized solar cell based on hydrothermally deposited laser irradiated carbon nanotubes network counter electrode had undergone changes. Moreover, the same was found in the case of reading techniques, the material cracking monitoring, not to even mention the drilling and cutting of scintilator (inorganic, organic and plastics), laser active materials, carbon fabric cuts, drills and transforms the laser beam. CR 39 after CO_2 laser treatment had higher efficiency than the other nuclear detectors. On the one hand, these types of materials could give some answers concerning lasing threshold, too, including progressive waves (Pencoffer).

On the other hand, development of the systems for destruction of missiles, aimed for aircraft application during polygon tests, i.e. other air defense system elements (Sreckovic et al., 2019), have the same problems, as they implement laser weapons. ”Laser tank” that has optoelectronic devices could detect and attack the target. The laser strike was supposed to disable the enemy’s guidance systems, making it unfit for use, and to blind the gunner, damaging the retina of the eye. Systems were the mobile laser complex to blind enemy optics and human personnel, but not more than that. Nonetheless, one should dwell on this issue at this point. More precisely, the area is still being developed, and it follows that more and more pulses of uncontrolled high energy density in relatively lower frequencies have been gaining the momentum. Additionally, this could be compared with the great possibilities of lasing and transitions, the printed data of which would be provided as a means of corroboration with certain delay, although certain data were already presented in 2021.

In 2018, laser systems became much more advanced, but the problems of excess heat remain. The dispersion of the beam due to smoke (dust, fume) particles presents the striking problem. For devices used in space, a single pulse melts some components of the device and the system overheats. Bearing in mind that the current technological stage is still insufficiently developed, these problems are still insurmountable. However, in 2018, *weak* lasers were able to safely disable tactical small drones thereby suppressing opto-electronic systems and detecting reflection from optical sights, binoculars, lenses of viewing devices, etc.

A number of states are working to create promising weapons on mentioned *new physical principles*. Such activities are very important and in this sense, cleaning the Space waste can be mentioned, which is very important for ecology, as well as rocket launchers and other professions that deal with space research and astrophysics topics about the quantity of waste up there.

Extensive examination of the effectiveness of laser weapons, with the mysterious ”laser-based carbine rifle,”(1995) continues. There was even a quarrel that combat lasers were a real psychological factor, given that they pose a threat to enemy scouting units, aircraft (operators), artillery gunners, snipers, and other personnel that uses optical systems. They had laser locator to detect low-level atmospheric chemical contamination and a nonlethal system to temporarily blind enemy. Note that the new materials developed for space, are also used in medical prosthetics, and today the virus Covid–19 spectra are measured from the sample of human saliva, having the carbon nanotubes as carriers.

The problem of the action of electromagnetic impulses from a nuclear explosion on electronic and energy systems was a current topic at the end of the 20^{th} century. During a nuclear explosion, in addition to shock, heat and radioactive effects, electromagnetic pulse is created, which has a detrimental effect on electronic and

electric power means and systems. The discovery of quantum generators, in the middle of the 20th century, brought some new ideas. In the next section, we discuss some results and propositions.

3. SOME RESULTS, PROPOSITIONS AND DISCUSSION

In this part of our paper, some sketches, results from experimental cases or simulation are presented.

3.1. The linguistic part of the paper with authors reflections - Lasers

The term "laser" has evolved, as well as the use of the word "laser". Moreover, the term "laser" (and maser) has been traditionally regarded as a language element that is typically found in informal styles and non-standard language varieties. Additionally, the lexical item "laser" representing a word and not an acronym was used to denote many things, such as an item for medicinal purposes in Ancient Rome, as a form of protection against many dragons, etc., up to a *culinary* ingredient. It also exists as the name of some villages and it is even found in the plant families. Laser, maser, vaser, iraser, uvaser and many other items containing the term 'laser' belong to the 'laser' word family.

We have also found the recent meaning of LASER, which refers to Natural Language Processing (NLP) applications and serves as a sort of Language-Agnostic Sentence Representations toolkit. The issues related to some aspects of translation accuracy and translating terminology from various languages will bring closer the expressions related to the mentioned topics (optics, energy and selected term from laser technique application). The impact of compressed message on the translation recipient could be assessed by means of a statistical analysis. Certain problems related to American and British, i.e. dual spelling could also be tackled. An attempt could be made to evaluate some problems and consequences in the domain of polysemy, particularly the one occurring in specific language registers covered by this paper. The linguistic problems related to the precision and accuracy of translating the laser terminology from various languages into diverse languages may analyze more thoroughly the expressions containing the term "laser". Statistical models in linguistics and techniques (particularly those models in the mathematical and computational frameworks) may have many repercussions on many other linguistic areas (Abercrombie, 1965; Bauer, 2004; Biber, 1995; Bott, 1971; Bromberger, 1990; Carston, 1989; Catford, 1974; Chomsky, 1965; Chomsky, 1995; Davidson, 1974; Di Sciullo, 2005; □urić, 2017; Jurafsky, Martin, 2000; Kager, 1999; Krstev, 2008; Levi, 1978; Polanyi, 1989; Smith, 1989; Sperber, Wilson, 1988; Pustejovsky, 1996; Vijayarani, Janani, 2016).

3.2. Optical Fibers. Some experimental results.

A handful of fastidious papers have been written so far, related to the topic of optical fibers, sensors and systems and ensembles based on them.

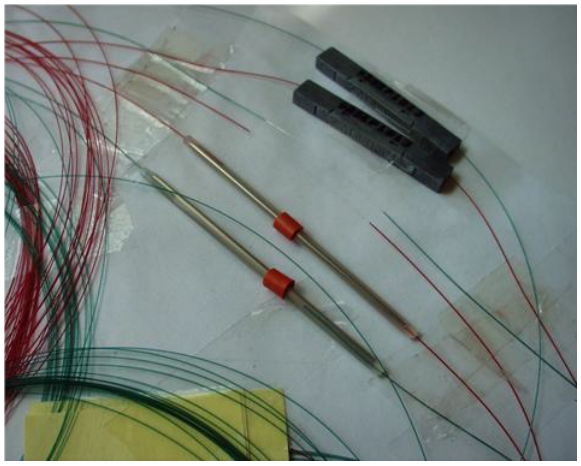

Figure 18. Single-mode optical fiber and performed optical joints by various manner.

Mechanical joints and connectors have been engineered and machined in different ways thereby determining the characteristics of a system and device service life. They have a special role in nuclear and other power plants. However, it is necessary to thoroughly and then inspect and confirm that nothing can affect optical fibers. Namely, this should be observed in case of propagation, depending on the environment in which they are found in a wider sense. Besides, connectors and joints, made by different techniques and materials, will also act in a different way, irrespective of the fiber itself, (Pantelić, S., 2012), figure 18.

3.2.1. *Carbon fiber. Some experimental results*

Active FIBERS Carbon textile materials of different shapes (fabric, cloth, felt) are interesting for studying, due to a large number of good properties: they are thermally and chemically stable; they can have large electrical conductivity, and are easily cut and shaped. The widest applications are for personal protection, environment protection, medicine, etc. In particular, active carbon materials obtained by controlled oxidation in the process of manufacturing are of interest in ecology. (Kaludjerovic, B., 2005). In figure 19 can be seen laser damage and transformation of fibers due to laser action and accision.

Figure 19. SEM microphotograph of laser damage,Nd^{3+}:YAG, 60 J/cm2,1060 nm.

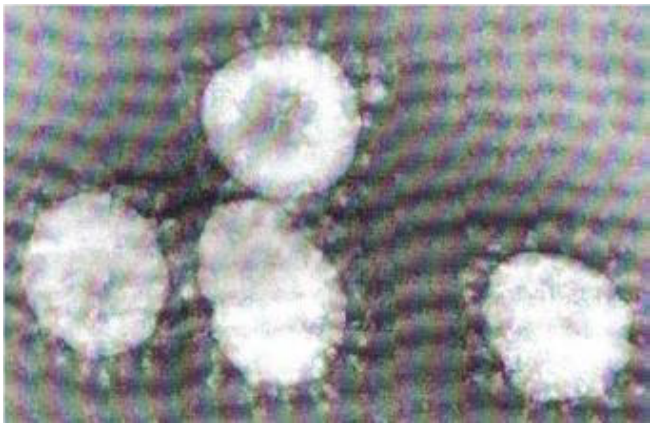

Figure 20. Corona viruses recorded by an electron, microscope CDC, (Fred Murphy).

3.3. Some performances of corona viruses, simulations and usable measuring methods

Corona viruses - CV (one of the features is the presence of a number of spike proteins on its surface, Corona (2021) [6-9] around the virus) have resemblance of solar corona figure 20 With these spikes, CV enters into host cells. The number of spikes increases contagiousness. Changes in T (temperature) and pH leaving large areas of virion relatively free of spike proteins. The methods used encompass the following: real time fluorescence-based quantitative PCR; virus number detection, regardless of the virion structures (decreasing spikes). A mathematical model has been developed simulating the shape of corona virus with a given number of protein spikes.

It affects the scatterer's characteristics (the unpolarised case). In diagnosis of CV and in evaluating the effect of a variety of vaccines on their contagiousness (almost all look like a deformed sphere with spikes) by simulation, it should be assumed that the object of scattering is a deformed sphere with spikes.

Besides laser scattering LS methods, SEM micrographs (electron microscopies) represent another method for evaluation and characterization of viruses. Note that the data from LS and from image analysis should be corrected due to aerodynamic reasons. Next few paragraphs will illustrate the possibility of virus simulation, virus quantity definition, or similar objects.

The instances of LS for light green Algae in 3.9 (Lopatin V. N., 1985) should be modeled through formalisms with special functions or by approximate expressions, with matrix formalisms, polynomials, etc. For spherical geometry, the modeling with single and multilayered structures has been successful so far, as well as inclusion of anisotropic cases for scattering centers (Sreckovic et al, 2014; Ostojic et al, 2014).

Simulations of LS (virus as an object) are performed for chosen case parameters: n∼1.06 (for many viruses). Set values are n=1.06 for multiple according to reference (Virus). Various results were obtained for the virus diameter of 100nm, 140nm, and 300nm (UV range). From the theoretical prediction formalisms of object presentations (Mueller matrix, Intensities λ or angular distribution, dependence of incident polarization/depolarization, spectral distribution…), and the diagrams obtained using Mie Plot software some results are represented in figures 21–24 (air as the medium), and figure 22 e–h (for water as the medium).

3.3.1. *Application of Program for induced light scattering*

Simulations of induced light scattering could be evaluated by various programs. An example of a GPU-based parallel algorithm for interaction induced light scattering in fluid has been presented (Dawid, 2019). The purpose of the proposed algorithm is to accelerate calculations of the 4-body polarizability anisotropy correlation functions, which are important for estimating the interaction induced light scattering spectrum.

3.3.2. *Application of Raman spectra and its interpretation*

Raman spectra have been presented in figure 25 as well as scattering and fluid motion (see: Trrones 2020). It would be of interest to present further details of the virus geometry in addition to objects for Raman scattering, including spikes. A graph illustrating the virus has already been presented (see: Cvetkovic, 2020).

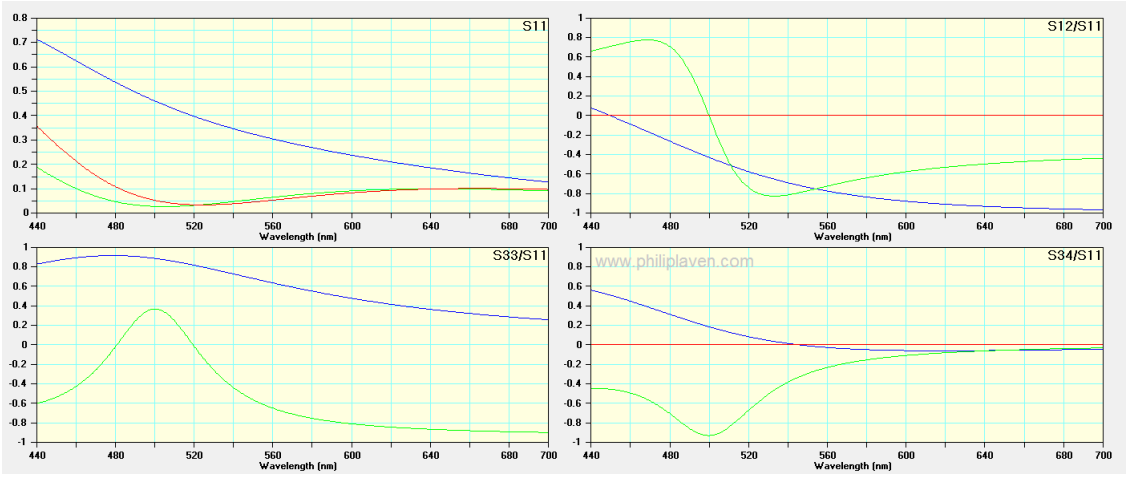

Figure 21. Scattering matrix vs λ of Covid virus in air (101325Pa, 25°C), dia = 140nm, linear horizontal scale, λ(440-700)nm, Mie scattering, scattering angle blue 90°, green 135°, red 180°.

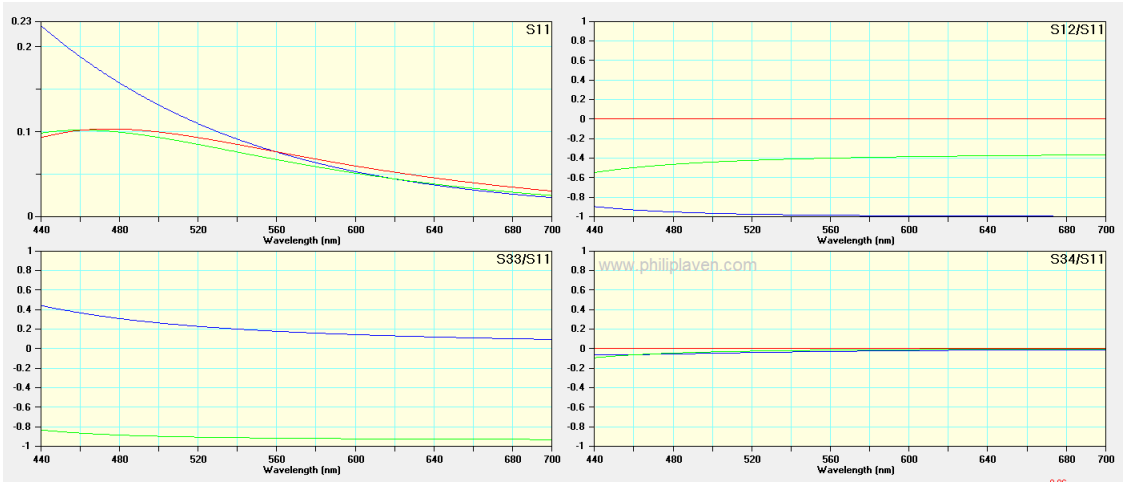

Figure 22. Scattering matrix vs λ of Covid virus in air (101325Pa, 25°C), dia=100nm, linear horizontal scale, λ(440-700)nm, Mie scattering, scattering angle blue 90°, green 135°, red 180°.

3.3.3. *Scattering intensity curves, photon beating /correlation*

Static and dynamic light/laser scatterings have existed for several decades so far and represent irreplaceable tools for biological object analysis. Historically, first correlations were carried out with visible photons, immediately after the first experiments in general. Soon, they became a powerful tool in medicine, for measuring the dynamics of human and animal cells, blood flow, blood composition, etc. It was a relatively simple process, proving that they were Lorentzians who had different interpretations, depending on the measurement environment. These laser methods have been widely used to provide data containing both static and dynamic scattering. In figure 27. chronologically older formalisms and data processing (almost manual) for obtaining half-width and spectrum can be observed, used along with correlator/analyzer systems. Transforming the coordinates of expected Lorentzian to straight line, a (scattering) line of width γ should be obtained. From γ and various interpretations for very low and concentrated solutions, dynamic of the scattered object should be quantitatively evaluated. In case of a pure liquid, thermal characteristics of the material could be obtained (Rayleigh line). Other data include: coefficient of diffusion, polydispersity, etc. (Sreckovic, M et al. 1989, Sreckovic M., 1979.

3.3.4. *Angular scattering, size and microbiology*

Many characteristics of microscopic scattering centers are modeled using special functions and very often angular distribution is calculated, since there is incidence of variation greatly depending on the geometry. Other tasks refer to absorption data and thus, can be obtained experimentally or on the basis of models. Nevertheless, there are

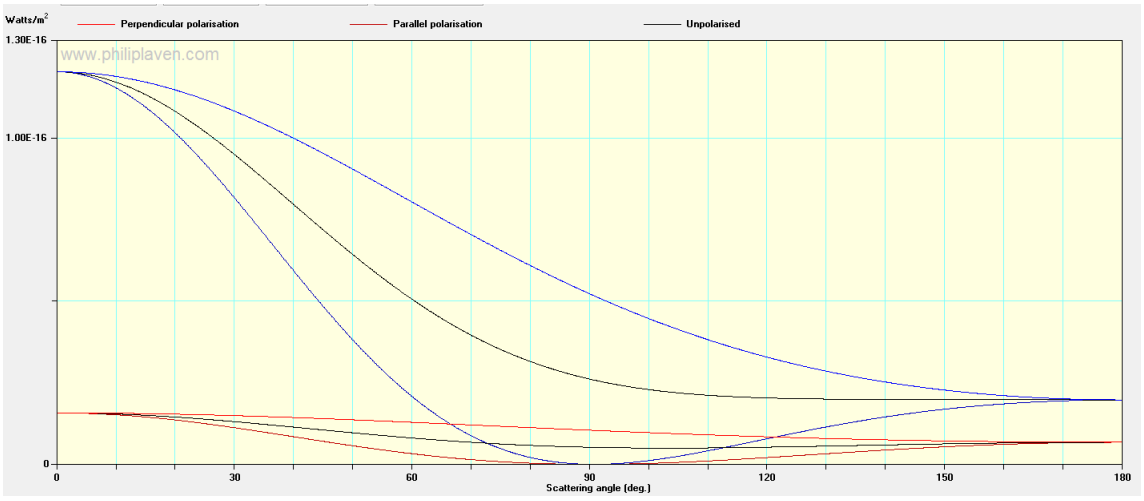

Figure 23. Intensity vs scat. angle Covid virus in air (101325Pa, 25°C), dia= 100nm (red+black, bright red, red, black present ⊥, || and unpolarised case) and 140nm (blue+black, bright blue, blue, black represent ⊥,||and unpolarised case), linear horizontal scale, λ= 632.8nm, Mie scattering, scattering angle 0-180° (step 0.1°).

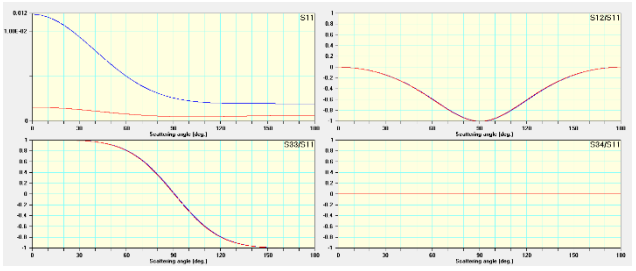

Figure 24. Scattering matrix for Covid virus in air (101325Pa, 25°C), dia = 100nm (red) and 140nm (blue), angles 0-180° (resolution 0.1°), linear scale, 632.8nm.

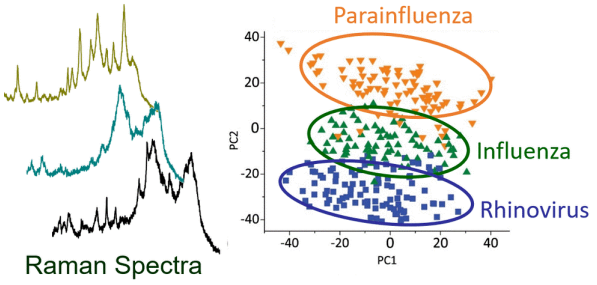

Figure 25. Raman spectra of influence, Rhinovirus and Covid 19. (Trrones 2020) and b) Tracker.

solved cases for characteristic shapes, cylinders, spheres and Gaussian coils.

The next steps occurred while moving from homogeneous to anisotropic centers of various geometries, so a device / formalism for a spherical geometry with layers of other optical characteristics was specially developed, implementing similar, more complex approaches.

According to the approach of interpreting the obtained theoretical and recorded experimental mathematical functions, complex forms overlapping with modern algorithms and digitizers have been utilized. Ultimately, some description of the real object could also be obtained, including: size, gyration radius, polidispersity, solution ideality, molar mass, etc.

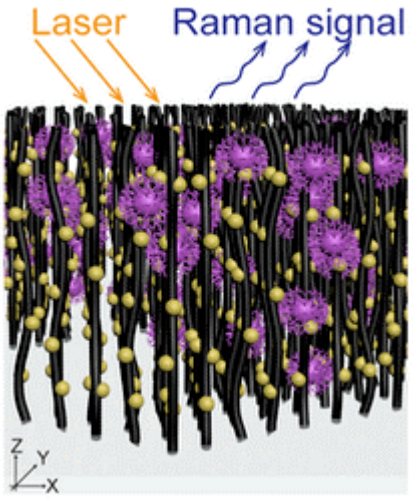

Figure 26. Raman signal illustration.

Here is a modified case from references aimed at arriving at some generalization that can be further refined for educational purposes. This is an illustrative approach for several geometries and dimensions related to green algae, with manually selected characteristic data. The first set of data for characterization and generalized curve generation is presented in figure 28.

In the case of Covid–19, according to the SEM micrographs, there is a small deformed spherical shape with a

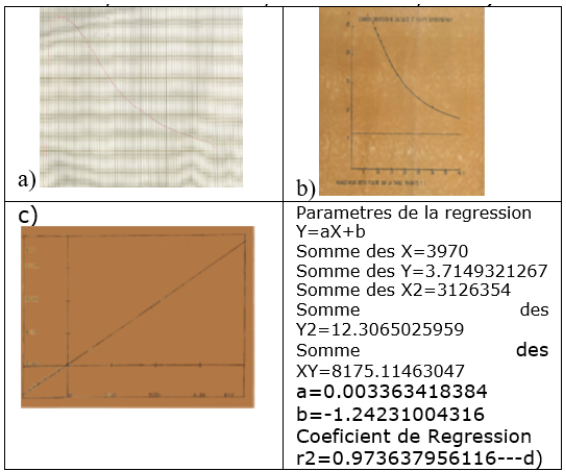

Figure 27. Some details with data obtained for photon correlations measurements of Quinoline a) and data transformations to obtain line width with fragment of linear regression analysis (b-d)-older version (in processing and measuring systems in Saclay-France.

series of spikes. It seems that one of the approaches could consider the virus as an instance of spherical geometry with one layer of halo.

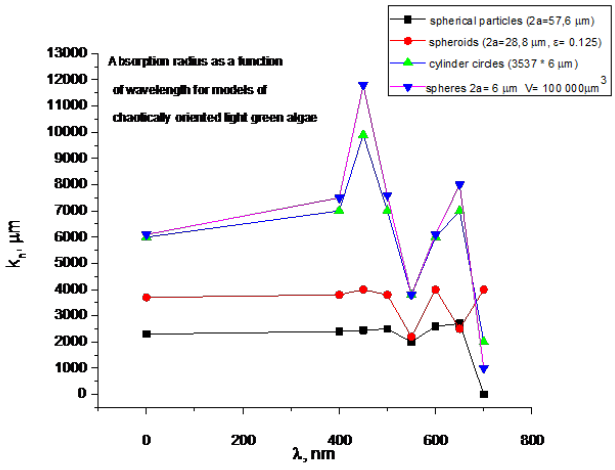

Figure 28. Absorption radius as a function of λ and models of chaotically oriented light green algae for various geometries: spherical particles, spheroids, cylinders- spherical particles 2a=57.6μm.

3.4. Artificial intelligence

Artificial intelligence (Al) eliminates information silos occurring in organizational processes internally and externally (Latinović & Chatterjee, 2019). AI transforms B2B (business to business) models and enhances the effectiveness of both organizational processes and managerial efficiency, due to more rational time management. Still, accepting AI fully is a major challenge for many organizations and further observations should be made as well as some practical applications.

4. CONCLUSIONS

Numerous methods of energy transformation in use today as well as research in various modern disciplines deserve analyses from several different aspects. One practical aspect may refer to performance and characteristics improvement of sensors and other electronic components. Another important aspect is the issue of energy transformation and philosophically observed ”positive or negative direction” of problems, approaches and solutions of current and potential significance. Biotechnology, the industry that uses the molecules of life (DNA, RNA, and proteins mostly) to diagnose and treat disease, including the latest biomedical science and technological research is another topic that has been addressed in the present paper.

In addition to this, presentation of disasters, reflection coefficients and energy diagrams could be coupled with the previous solution, too. The subsequent question is whether tunable solid-state lasers could help decrease our dependence on fossil fuels.

Various accidents in the World, current energy sources and ecosystem impacts, deserve discussion, monitoring and new solutions.

The authors have explicitly presented the following items:

- Some experimental material and components, related optical connections and technologies of optical fibers and improvement material developed in laboratories (carbon fiber based), and one has been reminded of the roles the listed items can play in today’s problems;

- Light scattering on micro objects is simulated on (viruses) with assumed dimensions and environment in scattering processes and quantification of results,

- Some old measurements with first corrections in the time of starting first techniques of correlation and photon mixing,

- Those techniques, and the accompanying theory developed with full experimental support are capable of recognition of various objects in biology and in general; the similar systems can be of use in various laser scattering applications in environmental dynamics and objects propagations (range, concentrations, etc.)

- The utilized sketched figures related to algae and required optical image processing in analysis experiments and theory make procedures simpler in reference to properties (geometry, size and categorization).

Our simulations of scattering and evaluations are highly dependent on the constants. Nevertheless, the general characteristics can be obtained from the taken values,

from references. Furthermore, evaluation with water as environment, instead of air does not change or limit the possibilities of methods.

The authors have tried to connect situations, processes and fields of work with the role of lasers and certain contemporary issues related to lasers. Establishing such a connection started from examining thoroughly the comprehensive literature, in which the name of the 'laser' is mentioned in diverse semantic and pragmatic contexts in various languages. Laser damage and laser welding attempts at optical fibers applications were observed with composition data related to the interaction. Additionally, simulations with scattering and angular distribution related to possible dimensions of "microscopic" objects found in the literature, results of experimental displays with correlation type measurements for liquids with an emphasis on processing, sketches for approaching the shape of microscopic scatterers were also observed. Moreove, binding with complex formulas with Bessel functions, which form the basis of that part of the pertinent theory in relation to data on the scattering center have also been considered with due attention.

It is impossible to shortly summarize all the possibilities of lasers application in various processes, diagnoses and treatment, not only in the context of energy, but also from the ecological point of view, as well as the biomedical context. We believe that the Olympic fire in Fukushima will inspire and lead to a new ecological future.

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