Author's Equations vs. Already-Executed Applications and Its Related Scientific Papers

Ali Yousif Hassan Edriss

Sudan University of Science and Technology,
Physics Laboratories
Aliyousif202264@gmail.com

Abstract

This paper discusses author's equations compared with related scientific papers and already made devices that are working now, these devices are made for some purposes such as: High power energetic laser applications: Such as nuclear exploration, astrophysics, Electromagnetic Bomb or Gun, Weather controlling by high density Laser (Teramobile), and so on. Industrial applications such as: laser cutting machines, laser welding, photochemical reactions, communications, and so on. Medicines purposes: cancer medications, dentistry's applications, physiotherapy's applications, laser for LASIK, Wound healing, pain relief and healing with, laser therapy, osteoarthritis, laser for Glaucoma, and so on. I will use here in my paper some given information like (photon energies and intensities) which obtained from Device's Catalog and then substitute these information on my equations to evaluate and modify it. This strange idea came out after all my failed attempts to do confirmed experiments. In this paper I adopt the screenshots I took from advertising devices' companies with putting web links to them, then I discuss through comparing with my equations. In the beginning I will give an introduction to the author's equations and pointing to my reading about, then I will discuss with pictures- if I could- and papers why these equipment act like that. This step is servicing my situation because there are no experiments done to approve my equations so I adopt the comparison between my results and devices' parameters or papers' results. In this paper I follow a systemic graduation from high dense and energetic lasers to moderate until very low energy and density trying to give physical explanation according to my equations. Then I adopt new ideas about the optimum using of these equations especially in telecommunications and satellite efficiency.

Tuesday, October 20, 2020

Contents

Tuesday, October 20, 2020

Overview:

This book discusses my equations compared with related scientific papers and already made devices that are working now, these devices are made for some purposes such as:

High power energetic laser applications: such as nuclear exploration, astrophysics, Electromagnetic Bomb or Gun, Weather controlling by high density Laser (Teramobile), and so on.

Industrial applications such as: laser cutting machines, laser welding, photochemical reactions, communications, and so on.

> **Medicines purposes: cancer medications, dentistry's applications, physiotherapy's applications,** laser for LASIK, Wound healing**,** pain relief and healing with, laser therapy**,** osteoarthritis**,** laser for Glaucoma, **and so on.**

I will use here in my paper some given information like (photon energies and intensities) which obtained from Device's Catalog and then substitute these information on my equations to evaluate and modify it.

This strange idea came out after all my failed attempts to do confirmed experiments.

In this paper I adopt the screenshots I took from advertising devices' companies with putting web links to them, then I discuss through comparing with my equations.

In the beginning I will give an introduction to Ali's equations and pointing to my reading about, then I will discuss with pictures-if I could- and papers why these equipment act like that. This step is servicing my situation because there are no experiments done to approve my equations so I adopt the comparison between my results and devices' parameters or papers' results.

In this book I follow a systemic graduation from high dense and energetic lasers to moderate until very low energy and density trying to give physical explanation according to my equations.

Then I adopt new ideas about the optimum using of these equations especially in telecommunications and satellite efficiency.

Finally I would like to thank my God to give me the power for writing this book. And I dedicate this book to my daughter Isra and to all mankind.

Introduction: What are Author's equations

My equations are mathematical derivative equations, by mixing of Schrödinger Hamiltonian, electromagnetic wave function, and Arrhenius' equation for chemical reaction rate constant. My equations consist of one equation [1] and derivatives.

[1] To be discussed.

$$K_2 = \rho\, e^{\left(\frac{\upsilon h^2}{\sqrt{2}kT\mu\lambda^2\sqrt{nc\varepsilon_0}} - \frac{\upsilon z^2 e^2}{4\pi\varepsilon_r kTr\sqrt{nc\varepsilon_0}}\right)\sqrt{I}}$$

$$\rho = \frac{\sqrt{I}}{\lambda^2 - {\lambda_0}^2}$$

Variables definition:

K_2 = reaction rate constant, ρ is reaction rate pre-factor (analogous to Arrhenius' equation pre-factor [2]) describes number of successful absorptions, it is semi practical factor but here I expressed it like that [3], c = speed of light, ε_0 = vacuum permittivity, ε_r = relative permittivity, n = refractor index, k_b = Boltzmann constant, T = temperature, I = photon intensity watt/meter square, μ = mass of electron, r = the radius between nucleus and electrons clouds, z, e = are numbers of valence electrons and elementary charge, T = temperature in kelvin units, λ = wavelength, h = Plank's constant, υ = called primary quantum number and represents the number of orbital which electron transits into.

This equation is an exponential equation[4], relates reaction rate constant with photon variables like intensity and energy, also with matter variables like Potential Well energy. We can say this equation relates photon characteristics with matter characteristics with environment (media which photon transmits through) contained in the variable (ρ_0).

$$K_{eq} = \frac{P^{\ominus}h}{Rk_bT^2}\frac{\sqrt{I}}{\lambda^2 - {\lambda_0}^2}\, e^{\left(\frac{\upsilon h^2}{\sqrt{2}kT\mu\lambda^2\sqrt{nc\varepsilon_0}} - \frac{\upsilon z^2 e^2}{4\pi\varepsilon_r kTr\sqrt{nc\varepsilon_0}}\right)\sqrt{I}}$$

and

$$\rho_0 = \frac{P^{\ominus}h}{Rk_bT^2}\left(\frac{\sqrt{I}}{\lambda^2 - {\lambda_0}^2}\right)$$

With taking natural logarithm to both sides:

$$lnK_{eq} = ln\left(\frac{P^{\ominus}h}{Rk_bT^2}\left(\frac{\sqrt{I}}{\lambda^2 - {\lambda_0}^2}\right)\right) + \frac{\upsilon h^2\sqrt{I}}{\sqrt{2}kT\mu\lambda^2\sqrt{nc\varepsilon_0}} - \frac{\upsilon z^2 e^2\sqrt{I}}{4\pi\varepsilon_r kTr\sqrt{nc\varepsilon_0}}$$

But we know

[2] See ref. 4.
[3] Actually this assumption is a kind of (shot and miss) because I couldn't convince anyone to make experiments.
[4] To tract to derivation of this equation and other see any book of mine on references list.

$$lnK_{eq} = \frac{\Delta H}{RT}$$

Where, ΔH is the enthalpy differences between energy that photon could supply and matter's enthalpy already exist.

So

$$\frac{\Delta H}{RT} = ln\left(\frac{P^{\ominus}h}{Rk_bT^2}\left(\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right)\right) + \frac{\upsilon h^2\sqrt{I}}{\sqrt{2}kT\mu\lambda^2\sqrt{nc\varepsilon_0}} - \frac{\upsilon z^2 e^2\sqrt{I}}{4\pi\varepsilon_r kTr\sqrt{nc\varepsilon_0}}$$

And with Substitution the constants with its numbers:

$$ln\left(\frac{P^{\ominus}h}{Rk_bT^2}\right) = \ln(8 \times 10^{-12})$$

$$\frac{\Delta H}{RT} = -25.7 + ln\left(\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right) + \frac{1.32 \times 10^{-14}\upsilon\sqrt{I}}{\lambda^2} - 6.127 \times 10^{-8}\upsilon z^2\sqrt{I}$$

Or

$$\frac{\Delta H}{RT} = -25.7 + ln\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2} + \upsilon\sqrt{I}\left(\frac{1.32 \times 10^{-14}}{\lambda^2} - 6.127 \times 10^{-8}z^2\right)$$

[5] This complicated equation is just very simple, it is simply says:

If reaction is endothermic, then the term $\left(\frac{\Delta H}{RT} > 0\right)$ or positive this condition could achieved if and just if:

$$\ln\left(\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right) + \left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right) - \left(6.127 \times 10^{-8}z^2\right) - 25.7 > 0$$

The term $\left(ln\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right)$ has positive sign and the intensity in $watt/meter^2$ units.

Conditions' discussion:

Now for this equation to be applicable we need to determinate the minimum wavelength and intensity for any reaction, to do that we will discuss three points:

- First point is the term:

[5] These crude calculations I used Chinese calculator type fx991ES PLUS

$$\upsilon\sqrt{\mathrm{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2} - 6.127 \times 10^{-8} z^2\right)$$

this equation tell us that for positive result $\lambda^2 < 10^{-7}$ so maximum wavelength $\lambda = 464 \times 10^{-6}$ that if we didn't take on account the atomic number, and this laying on microwave and infrared region (could goes to radio wave with and atomic number), also the atomic or molecule's radius which are changes according to atom's or molecule's type. Notice that the intensity doesn't effect here.

- Second point is the terms:

$\left(-25.7 + ln\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right)$ and the term $\frac{1.32 \times 10^{-14}}{\lambda^2}$ then the term $\upsilon\sqrt{\mathrm{I}}$, with these four remained terms we can make an equation through them like:

$$\frac{\Delta H}{RT} = -25.7 + \ln\left(\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right) + \upsilon\sqrt{\mathrm{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right)$$

With the condition $\lambda < 464 \times 10^{-6}$ of course.

In this equation we see that $\frac{\Delta H}{RT}$ is the reaction enthalpy difference divided by (RT), or the enthalpy difference that obtained from photons.

We can make a conditions:

$$\frac{\Delta H}{RT} > 0 \;\; (implies)\; ln\left(\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right) + \upsilon\sqrt{\mathrm{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right) > 25.7$$

Or

$$ln\left(\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right) + \upsilon\sqrt{\mathrm{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right) > 25.7 + \frac{\Delta H}{RT}$$

And that is the photochemical reactions equation with condition $\lambda < 464 \times 10^{-6}$ of course.

If reaction enthalpy for some reaction equals $\Delta H = 250\; kilo\; joule$, then the equation becomes:

$$ln\left(\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right) + \upsilon\sqrt{\mathrm{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right) > 25.7 + \frac{250000}{RT}$$

We have notice that I is in $watt/meter^2$, if it given in watt per centimeter squared, we will need to exchange it in meter so will multiply with 10000.

- Third point: Because of the experiment is missing, I will do some addition to equation to be like that

$$\Delta H = \frac{RT}{10000}\left(-25.7 + ln\left(\frac{\sqrt{I}}{\lambda^2 - {\lambda_0}^2}\right) + \upsilon\sqrt{\mathrm{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right)\right)$$

The reason of dividing by 10000 like that:

The intensity's units is $\mathrm{watt/meter^2}$ and enthalpy deference is in $\mathrm{joule/mole}$ but it is huge because laser does its action at the surface of material so I supposed divide by 10000 to change it to $\mathrm{watt/millimole}$ or turn back the units of centimeters again so becomes $\mathrm{watt/cm^2}$, I will use the latter units if I need.

What is Rho ρ?

The reason of writing this book is rho, it is always regarded a challenge to me, Arrhenius' prefactor is semi experimentally so is mine but because of my disable to make this experiments I have make sevens editions for my equations.

In this 8th edition I supposed that:

$$\rho = \frac{\sqrt{\mathrm{I}}}{\lambda^2 - {\lambda_0}^2}$$

And I notice results approach to practical values. So I will adopt this assumption in my book.

What is the variable(υ)?

Actually this variable represents the number of orbital band that electron could occupy when shot with photon, recently my conviction get dominate on me that this variable is not important, and I put it here because it is exist on my former books, so here I will drop it.

Reaction coordinate Technique:

The above equation is general use, we can use it on light photochemical phenomena and also on high power energetic lasers, the reason of that is the wavelength has maximum limit but no limit at minimum that means no maximum limit for photon energy.

But for exact controlling of photochemical reactions for high power lasers such femtosecond and attosecond we can use the next equation which relates to bonds vibrations and excitations[6]:

$$\lambda = \frac{h}{ze}\sqrt{\frac{2\pi\varepsilon_r r}{\mu}}$$

---

[6] See my paper Ali's equations and full controlling of chemical reactions: using Reaction Coordinates Technique. https://www.academia.edu/43391207/Alis_equations_and_full_controlling_of_chemical_reactions_using_Reaction_Coordinates_Technique

Or

$$\frac{d\lambda}{dr} = \frac{h}{ze}\sqrt{\frac{2\pi\varepsilon_r}{\mu r}}$$

This equation describes the change of molecule's or atomic radius with the change of wavelength, since lambda is sinewave so bond vibration will be also so, we can use this relationship to drag (r) to which limit we want to drive reaction to which products we want.

With substitution this equation becomes:

$$\lambda = \frac{h}{ze}\sqrt{\frac{2\pi\varepsilon_r r}{\mu}} = \frac{31\sqrt{r}}{z}$$

And in term of bond's length and stiffness[7]:

$$\lambda = \frac{\mathbf{h}}{\mathbf{r}\sqrt{\boldsymbol{\mu\gamma}\,\mathbf{k}}}$$

γ is the anhamonicity of bond's vibrations, **k** is the bond stiffness, **μ** is the molecule's reduced mass, **r** is the bond's length.

Time relations

Usually we see the formation of plasma or fire above materials under laser cutting machines after few moments, this because of this equation:

$$N = N_0\, e^{-k_2 t}$$

It is tell us that the number of products (N) relates to reaction rate exponentially. So heat or fire or plasma appears after product reach to quantities that could be seen.

Continues Laser vs. Pulses Laser:

First of all we have to know this equation involves all photon and matter interactions including sun light, cellular communications, cosmic rays to some extent, x-rays, gamma rays, and laser whatever it is.

There are two characteristics for photon (energy and intensity), and they are related to each other, when we speak about high power laser, these relationships are expressed as follow:

[7] see my book Ali's Equations (5th Edition) photon and matter interactions: the perfect vision to photochemistry https://www.academia.edu/40727095/Alis_Equations_5_th_Edition_photon_and_matter_interactions_the_perfect_vision_to_photochemistry

$$peak\ power\ in \left(\frac{watt}{cm^2}\right) = energy\ density = \frac{enrgy\ (joule)}{pulse\ duration\ (second)}$$

$$average\ power\ \left(\frac{watt}{cm^2}\right) = enrgy\ (joule) \times pulse\ repition\ (Hertz)$$

$$= \frac{enrgy\ (joule)}{pulse\ off\ duration\ (second)}$$

The above relationships correlate with pulse laser but continuous laser hasn’t average power.

Ali’s equation works with just peak power or continuous laser because laser’s off durations means there is not intensity so you will find differences between laser device’s working energy and the enthalpy calculated from my equation.

Applications that agreed with my equation:

The real determinants to the correctness of Ali’s equations is the experiments and not found other way could be used like applications, in this section I will discuss these applications and we will recognize if this equation could correlate with these applications or not.

Many applications take this phenomenon (i.e. the interactions between photon and matter through Ali’s equations manner) even before the birth of Ali’s equations. I mean by the phrase (this manner) is the participation of the both energy and intensity on photochemical reaction. So the above equation regarded as the simplest equation that describes this kind of interactions let us see how that could be.

On any photochemical reaction, photon energy could not determine the exact result without its intensity, so in this section I will discuss many papers and recent devices built for various purposes beginning from medicine, explorations, industries, and even warfare equipment[8].

The using of laser by human recently took many paths:

- High dense and power energy lasers.
- Moderate dense and power.
- Low level laser therapy.
- Very low lasers.

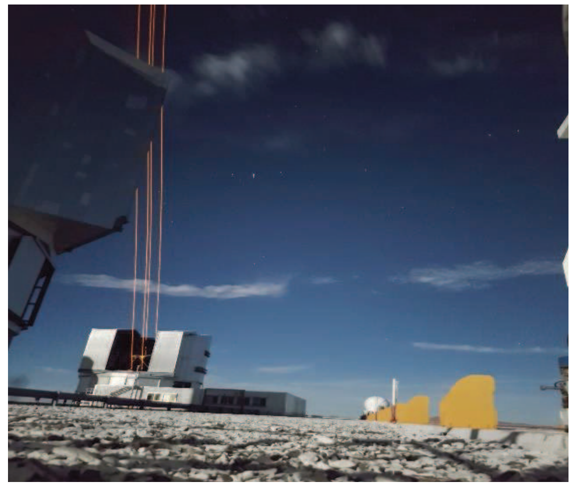
In my taking of laser applications I adopt the grade from high energetic laser which has $10^{20} watt/cm^2$ and used in nuclear science to moderate energy density $500\ watt/cm^2$ and used in industry to low energy $\frac{1}{2}\ watt/cm^2$ and used in medication and therapy until pointer laser $10^{-3} watt/cm^2$ used for education and so on.

[8] Actually this action I did because of the experiments that I couldn’t found despite of my appeals.

1. High power laser's applications:

High power lasers uses for nuclear studies and astrophysics. It has very high intensity and energy. So this kind of science is very promising in future. Here I will give four examples in astrophysics, nuclear science weather controlling, and electromagnetic bombs.

1. Astrophysics science:



Laser astrophysics is a tool for research in which the intense and ultra-intense lasers are used to study basic data of hot-dense plasmas, violent phenomena such as explosion scaled down in laboratory with appropriate similarity law, and advanced physics such as anti-matter, plasmas, laser fusion. Laser fusion is divided into six subjects, they are: Laser plasma interaction, Electron energy transport, Hydrodynamics and strong shocks, Hydrodynamic instability, Atomic physics and X-ray transport, and Laser-produced relativistic plasmas. Also astrophysics involves supernova explorations, and relativistic electron-positron plasma jets seen in active galactic nuclei, see the paper inside square below.

Astrophysics with Intense and Ultra-Intense Lasers "Laser Astrophysics"

Hideaki Takabe

Institute of Laser Energetics and Graduate School of Science Osaka University, Suita 565-0871, Japan

https://academic.oup.com/ptps/article/doi/10.1143/PTPS.143.202/1875851

18 October 2020

Here the author mentioned for some astrophysics study it is usually using continues wave x-ray in Peta wat energy so it is called high energetic laser.

We can substitute these information in the equation to see if the enthalpy energy is high and enough to be used in this discipline or not. So we have:

$I = 10^{15} watt/cm^2 = 10^{19} watt/meter^2.$

$\lambda = 1 \times 10^{-10}\text{nm}$

And we need ΔH

Now return to the equation that drove and I will write it again:

$$\Delta H = \frac{RT}{10000}\left(-25.7 + ln\frac{\sqrt{I}}{\lambda^2} + \sqrt{\mathrm{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right)\right)$$

Here we can use $\frac{RT}{10000}$ or not, so:

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{10^{19}}}{1\times 10^{-20}} + \sqrt{10^{19}}\left(\frac{1.32\times 10^{-14}}{1\times 10^{-20}}\right)\right)$$

$$\Delta H = RT(-25.7 + 68 + 4\times 10^{15})$$

$$\Delta H = 2477(4\times 10^{15}\ )$$

$$\Delta H = 1\times 10^{19}\ joule/mole$$

Or dividing by 10000

$$\Delta H = 1\times 10^{15}\ joule/cm^2$$

Look at this huge energy, it could execute pair creation (positron, electron), let us see that how could be:

1 mole of electrons and positrons = $2\times 6.022\times 10^{23} pieces.$

So

$$\frac{1\times 10^{19}}{2\times 6.022\times 10^{23}}\ \times 1.6\times 10^{19} ev = 1.\times 10^{14} ev$$

Or

$130\ Tera\ electron\ volt$

And it is bigger than pair creation which in mega electron volt.

2. **Nuclear science**

High power lasers HPL uses Energy density of ~ 10^{12} joule$/cm^3$ and the radiation intensity of ~ 10^{21} watt$/cm^2$, concentrated in a tiny plasma. The appearance of this new tool has a revolutionary significance in basic physics and also in industrial applications. New fields of science are emerging - laboratory astrophysics, and laser nuclear science nuclear engineering, medical engineering, material science, and so on, all of these applications using high-energy and high-peak power.

High Power Lasers and Their New Applications.

Yasukazu Izawa1, Noriaki Miyanaga, Junji Kawanaka1, and Koichi Yamakawa

DOI: 10.3807/JOSK.2008.12.3.178

https://www.osapublishing.org/DirectPDFAccess/46914B9F-BE23-5C64-DDA3C6093F80D949_194869/

So we have these parameters:

$I = 10^{21} watt/cm^2 = 10^{25} watt/meter^2.$

$\lambda = \ 1064\text{nm}$

And we need ΔH

Now return to the equation that drove and I will write it again:

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{I}}{\lambda^2} + \sqrt{\mathrm{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right)\right)$$

Here I dropped the number 10000 to calculate per mole.

To see how this equation predicts the kind of reaction for this kind of lasers just apply the intensity on it to see if this reaction could be or not

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{10^{25}}}{1.13 \times 10^{-12}} + \sqrt{10^{25}}\left(\frac{1.32 \times 10^{-14}}{1.13 \times 10^{-12}}\right)\right)$$

$$\Delta H = RT(-25.7 + 42.5 + 3.69 \times 10^{10})$$

$$\Delta H = 2477(3.69 \times 10^{10}\ )$$

$$\Delta H = 9 \times 10^{13}\ joule/mole$$

You can see my result is approach to his result which is ~ 10^{12} joule/$cm^3$when we use 1064 nm wave length.

Now let us try less peak power say in Petawatts 10^{15} watt/cm^2:

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{I}}{\lambda^2} + \sqrt{\mathrm{I}}\left(\frac{1.32\times10^{-14}}{\lambda^2}\right)\right)$$

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{10^{21}}}{1.13\times10^{-12}} + \sqrt{10^{21}}\left(\frac{1.32\times10^{-14}}{1.13\times10^{-12}}\right)\right)$$

$$\Delta H = RT(-25.7 + 42.5 + 3.69\times10^{8})$$

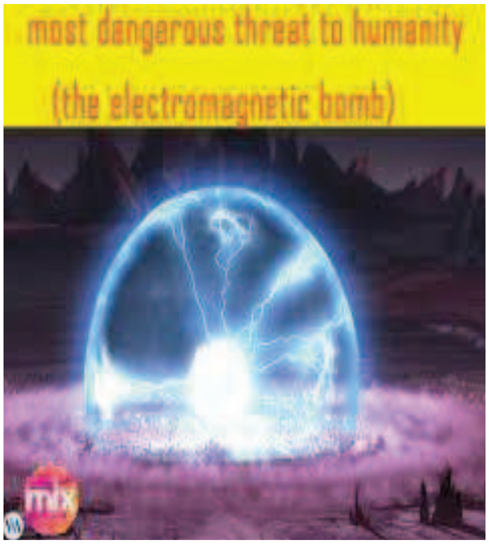
$$\Delta H = 9.15\times10^{11} joule/mole.$$

3. Electromagnetic Bomb or Gun:

Can laser make an explosion through reactions as bombs?

See the equation and will do some manipulations with T temperature.

$$\frac{\Delta H}{RT} = \left(ln\left(\frac{P^{\ominus}h}{Rk_bT^2}\left(\frac{\sqrt{I}}{\lambda^2}\right)\right) + \frac{\sqrt{2}\upsilon h^2\sqrt{\mathrm{I}}}{2\mathrm{kT}\mu\lambda^2\sqrt{\mathrm{nc}\varepsilon_0}}\right)$$



If we multiply with RT:

$$\Delta H = RT\left(ln\left(\frac{P^{\ominus}h}{Rk_bT^2}\left(\frac{\sqrt{I}}{\lambda^2}\right)\right) + \frac{\sqrt{2}\upsilon h^2\sqrt{\mathrm{I}}}{2\mathrm{kT}\mu\lambda^2\sqrt{\mathrm{nc}\varepsilon_0}}\right)$$

Or

$$\Delta H = RTln\left(\frac{P^{\ominus}h}{Rk_bT^2}\right) + \mathrm{RT}\left(\frac{\sqrt{I}}{\lambda^2}\right) + \frac{R\sqrt{2}\upsilon h^2\sqrt{\mathrm{I}}}{2\mathrm{k}\mu\lambda^2\sqrt{\mathrm{nc}\varepsilon_0}}$$

Here you can see there are many terms, $RTln\left(\frac{P^{\ominus}h}{Rk_bT^2}\right)$ term, and RT $\left(\frac{\sqrt{I}}{\lambda^2}\right)$ term, then $\frac{R\sqrt{2}\upsilon h^2\sqrt{\mathrm{I}}}{2\mathrm{k}\mu\lambda^2\sqrt{\mathrm{nc}\varepsilon_0}}$ term, the first term has negative sign, and the others are positive. Negative sign means retard the reaction and positive means enforce the reaction.

The last term deals with photon energy and intensity and this term will overwhelm if photon energy or intensity is high, whereas the middle term overwhelm in moderate and low intensities and energies. The last term if it overcome, no reaction will happen. See my paper:

https://www.academia.edu/41223111/Using_of_Ali_s_equations_in_an_electromagnetic_weapon

If we want a very powerful damage we must work for ΔH be high, and on the other hand we need the damage cover huge area so we can reduce wave length and raise the intensity to achieve the same damage.

4. **Weather controlling by high density Laser (Teramobile):**

Researchers are making efforts to use laser pulses to create lightning and cue cloud formation, with potential applications in agriculture and public safety. The development of ultrashort laser pulses and the discovery of self-guided ionized filaments has created new opportunities in the domain of weather modulation, Teramobile is an international project that has been initiated jointly by the National Center for Scientific Research in France and the German Research Foundation to demonstrate the potential of ultrashort laser pulses and self-guided ionized filaments for weather forecasting. The project allows researchers to use the first mobile terawatt laser in the world for atmospheric studies. It has also enabled them to conduct outdoor experiments of self-guided ionized filaments for real-scale atmospheric testing.

In Teramobile trails project they use unique is its compact design that has 350 milliJoule pulses in 70 fs, corresponding to a peak power of 5 TW, centered at a wavelength of 800 nm, at a repetition rate of 10 Hz. Moreover, the compressor is adapted to impose a chirp to the pulses in order to precompensate group-velocity dispersion (GVD) in air, these values reached in laboratory but in outside these values magnified.

See this link:

https://www.researchgate.net/publication/243581774_Laser-Based_Weather_Control

To see how this equation can fitful these requirement, substitute in it these values:

$$\lambda = 800 \times 10^{-9}$$

$$I = 5 \times 10^{12} watt/cm^2 = 5 \times 10^{16}\ watt/meter^2$$

$$\Delta H = 2477 \times \left(-25.7 + ln \frac{\sqrt{5 \times 10^{16}}}{6.4 \times 10^{-13}} + \sqrt{5 \times 10^{16}} \left(\frac{1.32 \times 10^{-14}}{6.4 \times 10^{-13}} \right) \right)$$

$$\Delta H = 2477 \times (-25.7 + 47 + 4.6 \times 10^{6})$$

$$\Delta H = 1.1 \times 10^{10}\ joule/mole$$

Or

$\Delta H = 1.1 \times 10^{6}\ joule/cm^{2}$

This huge number could make lightening and ionize the atmosphere.

Let us ask can we get 350 milliJoule again or there will be deviations?

To do that substitute in this role:

$energy\ in\ millijoule = \Delta H\ joule/mole \times 70(\text{fs}) \times 10(\text{Hz}) = 1.1 \times 10^{10} = 7.7 \times 10^{-3}$

It is less than it but acceptable for pure mathematical calculations.

2. Moderate energy density laser:

Moderate laser intensity is working for $100{\sim}50\ kilo\ watt/cm^{2}$and it is uses for industrial applications, like cutting, welding, photochemical industries, communications, and so on.

1. Laser cutting machines:

In the below paper they used 1064 wave length and 500 wat intensity

So substitution on equation

$$\Delta H = 2477\left(-25.7 + ln\frac{\sqrt{5 \times 10^{6}}}{1.132 \times 10^{-12}} + \sqrt{5 \times 10^{6}}\left(\frac{1.32 \times 10^{-14}}{1.132 \times 10^{-12}}\right)\right)$$

$\Delta H = 2477(-25.7 + 35 + 26)$

$\Delta H = 87.601\ kilo\ joule/mole$

Or

$\Delta H = 8.7 joule/cm^{2}$

Laser cutting process – A Review

https://www.researchgate.net/publication/305385939_Laser_cutting_process_-_A_Review

In the blow tringle is advertisement for specialized company for laser they claim using 10.6 micrometer co2 laser with peak power 400 watt.

400 watt means 400 watt/cm squared peak power (I hope that)

https://synrad.com/en/applications/drilling_perforating

$400\ watt\ /cm^2 = 4 \times 10^6\ watt\ /meter^2$

Substitution in equation:

$$\Delta H = 2477\left(-25.7 + ln\frac{\sqrt{4 \times 10^6}}{1.12 \times 10^{-10}} + \sqrt{4 \times 10^6}\left(\frac{1.32 \times 10^{-14}}{1.12 \times 10^{-10}}\right)\right)$$

$\Delta H = 2477(-25.7 + 30.5 + 0.236)$

$\Delta H = 12.507\ joule/cm^2$

Or

$\Delta H = 12.507\ kilo\ joule/mole$

Iron fusion enthalpy is 11.7 kilojoule /mole[9] and the enthalpy of evaporation it 351 kilojoule/mole, melt point 1538 c. when gas formed from laser its pressure will effect this formula by minimizing the number -25.7.

2. **Welding ND: YAG laser**

On this paper, authors mentioned they used $12\ kilo\ watt\ /cm^2$ peak power and 1064nm wavelength and average power 300 wat with difference repetition durations for steel welding:

Effects of Pulsed Nd:YAG Laser Welding Parameters on Penetration and Microstructure Characterization of a DP1000 Steel Butt Joint.
Xin Xue , António B. Pereira , José Amorim , and Juan Liao.
https://pdfs.semanticscholar.org/205c/afa81cba81ffe3aaebff46a2627571def068.pdf?_ga=2.85171097.127510087.1602921168-124320248.1602921168

So we have:

$\lambda = 1064 \times 10^{-9} m$

$I = 12000\frac{watt}{cm^2} -= \frac{12{\times}10^7 watt}{meter^2}$

Then substitute:

[9] https://ch301.cm.utexas.edu/data/section2.php?target=heat-transition.php

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{I}}{\lambda^2} + \sqrt{\text{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right)\right)$$

$$\Delta H = 2477\left(-25.7 + ln\frac{\sqrt{12 \times 10^7}}{1.132 \times 10^{-12}} + \sqrt{12 \times 10^7}\left(\frac{1.32 \times 10^{-14}}{1.132 \times 10^{-12}}\right)\right)$$

$$\Delta H = 2477(-25.7 + 36.7 + 127.7)$$

$$\Delta H = 343\ kilojoule/mole$$

And this is approach to steel evaporation enthalpy. 250 to 400.

3. Photochemical reactions:

A Laser Driven Flow Chemistry Platform for Scaling Photochemical Reactions with Visible Light.
Kaid C. Harper, Eric G. Moschetta, Shailendra V. Bordawekar, and Steven J. Wittenberger
https://pubs.acs.org/doi/pdf/10.1021/acscentsci.8b00728

The above experiment did to show the effect of intensity of visible light on photochemical reactions beginning from very low intensity to one rank of watts, see the below picture[10]:

My equation must correlate or approach to this diagram, see the left diagram from the picture, by substitution on:

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{I}}{\lambda^2} + \sqrt{\text{I}}\left(\frac{1.32 \times 10^{-14}}{\lambda^2}\right)\right)$$

I will choose $0.2\ watt\ /cm^2$ and $1.2\ watt\ /cm^2$ peak power to see how this equation describes the enthalpy of reaction:

$$\lambda = 450 \times 10^{-9} m$$

$$I = 0.2\frac{watt}{cm^2} -= \frac{2000 watt}{meter^2}$$

Substitution:

[10] This picture taken from the same above reference.

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{2000}}{2\times10^{-13}} + \sqrt{2000}\left(\frac{1.32\times10^{-14}}{2\times10^{-13}}\right)\right)$$

$$\Delta H = 2477(-25.7 + 33 + 2.9)$$

$$\Delta H = 27.100\ kilojoule/mole$$

Or

$$\Delta H = 2.7\ joule/cm^2$$

Choosing 1.2 density and 450 nm

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{12000}}{2\times10^{-13}} + \sqrt{12000}\left(\frac{1.32\times10^{-14}}{2\times10^{-13}}\right)\right)$$

$$\Delta H = 2477(-25.7 + 33.9 + 7.1)$$

$$\Delta H = 37.989\ kilojoule/mole$$

Or

$$\Delta H = 2.8\ joule/cm^2$$

Now let us choose density less than 0.1 watt, say 0.05 watt. So:

$$\Delta H = RT\left(-25.7 + ln\frac{\sqrt{500}}{2\times10^{-13}} + \sqrt{500}\left(\frac{1.32\times10^{-14}}{2\times10^{-13}}\right)\right)$$

$$\Delta H = 2477(-25.7 + 32 + 1.4)$$

$$\Delta H = 21.67\ kilojoule/mole$$

Or

$$\Delta H = 2.17\ joule/cm^2$$

I searched on this paper about the chemical reaction enthalpy and I didn’t found, I wanted to compare this value with my result to identify the incomplete of reaction line on the diagram. I suppose 21.67 kilo joule not enough to dissociate the compound’s bond to commence reaction.

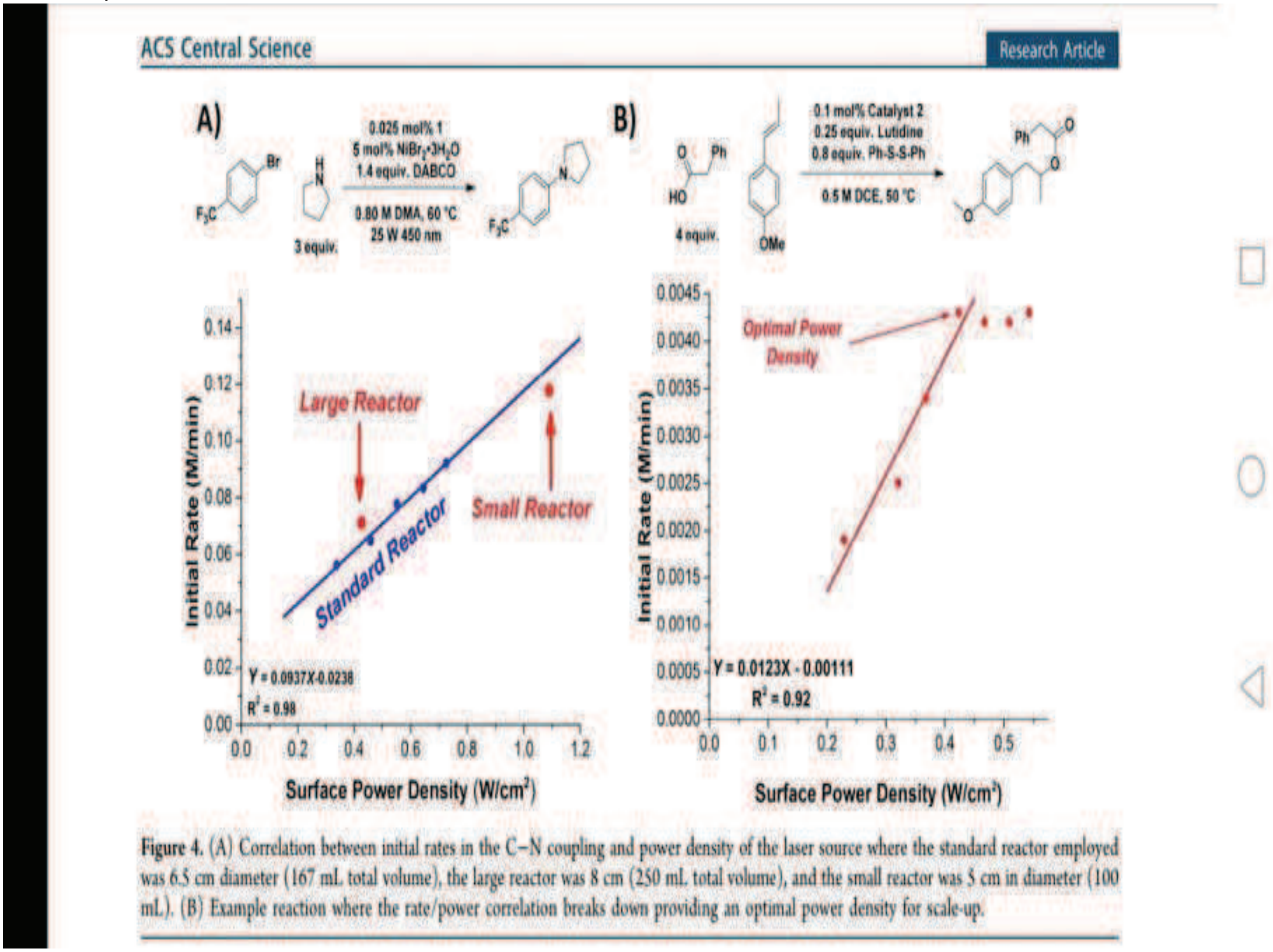


Figure 4. (A) Correlation between initial rates in the C−N coupling and power density of the laser source where the standard reactor employed was 6.5 cm diameter (167 mL total volume), the large reactor was 8 cm (250 mL total volume), and the small reactor was 5 cm in diameter (100 mL). (B) Example reaction where the rate/power correlation breaks down providing an optimal power density for scale-up.

4. Communications[11]:

This equation can give huge information about some techniques of Antennas' material design and improve the signal and carrier wave for telecommunications.

Recently I heard there are some companies like SpaseX and ULA and others intended to invest on satellite and far communications around earth circumference. It is better to involve Ali's equations in this investment, to see how that fallow me:

[11] See my books on https://www.academia.edu/44117306/Enhancing_Solar_Cell_Technologies_by_Using_Alis_Equation
Or on https://www.academia.edu/44097884/Alis_equations_and_Tesla_Experiment_for_Free_Electricity_Wardenclyffe_Tower

Tuesday, October 20, 2020

The above equation – I will write it again- is concerned on photon behavior when touch matter.

$$\Delta H = RTln\left(\frac{P^{\ominus}h}{Rk_bT^2}\right) + RTln\left(\frac{\sqrt{I}}{\lambda^2 - \lambda_0{}^2}\right) + \frac{Rh^2\sqrt{I}}{\sqrt{2}k\mu\lambda^2\sqrt{nc\varepsilon_0}} - \frac{Rz^2e^2\sqrt{I}}{4\pi\varepsilon_r kr\sqrt{nc\varepsilon_0}}$$

This equation has five terms:

The first term is ΔH which represents the enthalpy that photon could supply with its energy and intensity. For material engineers (communications engineer one of them) who working with mechanical characteristics of matter, they dislike these chemical reactions because they destroy the material so for them it is better to keep ΔH minimum as they could.

The second term is $RTln\left(\frac{P^{\ominus}h}{Rk_bT^2}\right)$ which represents the environment interactions with this system has minus sign, this means it retard the chemical reaction and it is one advantage to communications.

The third term is $+RTln\left(\frac{\sqrt{I}}{\lambda^2-\lambda_0{}^2}\right)$ and we see it is inside logarithm so its affect appears in low or moderate intensity and large energies. It has positive sign then it is un favorable for engineers, it is related to photon characteristics.

The fourth term is $\left(+\frac{Rh^2\sqrt{I}}{\sqrt{2}k\mu\lambda^2\sqrt{nc\varepsilon_0}}\right)$ which represents also the photon characteristics like energy and intensity, this term is the direct driving force for photochemical reactions in high energy or intensities, this term if possible to be less as we can is good for communications.

The fifth term is $\left(-\frac{Rz^2e^2\sqrt{I}}{4\pi\varepsilon_r kr\sqrt{nc\varepsilon_0}}\right)$ which represents the matter characteristics which the antenna could be made from. So this term is very important to communication engineers.

So for efficient antennas ΔH must be as less as possible and that could be by choosing the materials and accurate the energy of electromagnetic signal.

Heat influence:

If you reviewed the equation again you will find that heat exist on two terms $RTln\left(\frac{P^{\ominus}h}{Rk_bT^2}\right)$ and $+RTln\left(\frac{\sqrt{I}}{\lambda^2-\lambda_0{}^2}\right)$ they are oppose each other, the first is negative whereas the other is positive, so at moderate energies and near low the second term will dominate then heat can minimize the efficiency, whereas at high energies and intensities the term $+\frac{Rh^2\sqrt{I}}{\sqrt{2}k\mu\lambda^2\sqrt{nc\varepsilon_0}}$ which is not contain temperature will dominate. At very low energy and intensity the first term $RTln\left(\frac{P^{\ominus}h}{Rk_bT^2}\right)$ will dominate and that will magnify the efficiency.

Is 5th generation of cellular communication harmful to human tissues? Was it the cause of COVID 19 virus mutation?

Ali's equation could give the answer for this question also, as we know ΔH describes the chemical reaction whatever it could be, so we can determine the enthalpy of DNA mutation and we have the wavelength or the energy of 5th G signal then we can calculate easily to know if this the cause of this crisis or not.

3. Low Level laser (LLL):

On contrary to high power lasers, low power lasers used in sensitive materials like medicine, living tissues, fine structure manufacturing, electronic architecture engineering, pharmaceutical industries.

1. Low-level laser therapy (LLLT) for medicine:

It is a form of medicine that applies low-level (low-power) lasers or light-emitting diodes (LEDs) to the surface of the body. Whereas high-power lasers are used in laser medicine to cut or destroy tissue, it is claimed that application of low-power lasers relieves pain or stimulates and enhances cell function.

The effects of LLLT appear to be limited to a specified set of wavelengths, and administering LLLT below the dose range does not appear to be effective.

Despite a lack of consensus over its validity, some studies suggest that LLLT may be modestly effective, in relieving short-term pain for rheumatoid arthritis, osteoarthritis, chronic low back pain, acute and chronic neck pain, tendinopathy, and possibly, chronic joint disorders. The evidence for LLLT being useful in dentistry, and in the treatment of wound healing is unclear

Variations of LLLT have gone by a variety of alternate names including low-power laser therapy (LPLT), soft laser therapy, low-intensity laser therapy, low-energy laser therapy, cold laser therapy, bio-stimulation laser therapy, photo-bio-modulation, photo-biotherapy, therapeutic laser, and monochromatic infrared light energy (MIRE) therapy.

A typical using of laser's intensity from $\frac{1}{2}\sim 10^2\ watt/cm^2$ and the wave length in visible to ultraviolet region $500\times 10^{-9}\sim 140\times 10^{-9}nm$

2. Laser in Cancer

In the blow paper scientist documented their experiences with the treatment of malignant tracheobronchial tumors. Results indicate that the Nd-YAG laser treatment may provide immediate palliative relief for up to one to six months in 87% of patients treated for- incomplete malignant airway obstruction, as opposed to 36% improvement with complete malignant obliteration of the airway.

The author indicated he used power of 40 to 60 W in the infrared wavelength 1064 nm with an individual pulse time of 0.4 to 0.7 seconds.

Nd-YAG Laser in Lung Cancer

ARTHUR F. GELB, MD, and JOEL D. EPSTEIN, MD, Lakewood, California

1984 Mar; 140:393-397)

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1021695/pdf/westjmed00187-0057.pdf

Substitute in the equation we have wavelength 1064nm.

We need to convert from joule watt/cm square peak power:

$$= \frac{energy}{\text{duration}} = \frac{60}{0.4} = 150\, watt/cm^2$$

And convert from cm to meter

$$150 \frac{watt}{cm^2} = 150 \times 10^4 \frac{watt}{meter^2}$$

$$\Delta H = 2477 \times \left(-25.7 + ln \frac{\sqrt{150 \times 10^4}}{1.132 \times 10^{-12}} + \sqrt{150 \times 10^4} \left(\frac{1.32 \times 10^{-14}}{1.132 \times 10^{-12}} \right) \right)$$

$$\Delta H = 2477 \times (-25.7 + 34.6 + 14)$$

$$\Delta H = 58.500\, kilo\ joule/mole$$

Or

$$\Delta H = 5.85\, joule/cm^2$$

$58.500\ kilo\ joule/mole$ can make a powerful heat enough to destroy the cell and tissue.

The author mentioned here that “40 Watt is used for coagulation of tissue or bleeding vessels, whereas higher wattage results in vaporization and excision”.

The proof of that like this:

90% of human cells is water, if we could compare the vaporization of one mole of water with this value we can realize our result.

Water vaporization enthalpy is 40.8 kilo joule / mole.

Water enthalpy to raise its temperature to 100 c:

H= enthalpy for raise 1 mole of water from 37.5 to 100c =

$$= \frac{4186(heat\ capacity.kg)}{1000(gram)} \times 18(mole) \times 63(temperature\ \text{difference})$$

$$H = 4746$$

So total enthalpy

$$H_{total} = 4.746 + 40.8 = 45.5\ kilo\ joule/mole$$

And this less than laser enthalpy 58.5.

3. Laser for LASIK:

LASIK or Lasik (laser-assisted in situ keratomileusis), commonly referred to as laser eye surgery or laser vision correction, is a type of refractive surgery for the correction of myopia, hyperopia, and astigmatism. LASIK surgery is performed by an ophthalmologist who uses a laser or microkeratome to reshape the eye's cornea in order to improve visual acuity. For most people, LASIK provides a long-lasting alternative to eyeglasses or contact lenses.

Excimer lasers

Laser	Reagents	Emission peak
XeCl	$Xe + Cl_2$	308 nm
KrF	$Kr + NF_3$	248 nm
ArF	$Ar + F_2$	193 nm

In the below two experiments (See the next tringle), they demonstrate using 160 to180 millijoules and a pulse rate of 5 to 10 pulses per second excimer laser with wave length 193 nm.

And in the second they said 1millijoule/cm square.

Excimer laser refractive surgery.

E E Manche, J. D. Carr, W. W. Haw

August 1998 Western Journal of Medicine 169(1):30

https://www.researchgate.net/publication/13601789_Excimer_laser_refractive_surgery

See also:

Excimer Laser and Femtosecond Laser in Ophthalmology.

By Liang Hu, Yiqing Huang and Meng Lin.
Submitted: December 10th 2015Reviewed: May 13th 2016Published: September 7th 2016
DOI: 10.5772/64238
https://www.intechopen.com/books/high-energy-and-short-pulse-lasers/excimer-laser-and-femtosecond-laser-in-ophthalmology

Now substitute in Ali's equation

We have

$\lambda = 193 \times 10^{-9} m$

$peak\ power = 180 \times 10^{-3} joule\ \times 10\ Hz = 1.8\ watt/cm^2$

And convert from cm to meter

$$1.8 \frac{watt}{cm^2} = 18000 \frac{watt}{meter^2}$$

Substitution:

$$\Delta H = 2477 \times \left(-25.7 + ln \frac{\sqrt{18000}}{3.72 \times 10^{-14}} + \sqrt{18000} \left(\frac{1.32 \times 10^{-14}}{3.72 \times 10^{-14}} \right) \right)$$

$\Delta H = 2477 \times (-25.7 + 36 + 46)$

$\Delta H = 141.189\ kilo\ joule/mole$

Or

$\Delta H = 141\ joule/cm^2$

You can see the high enthalpy despite of the low energy and because of UV range of excimer emission.

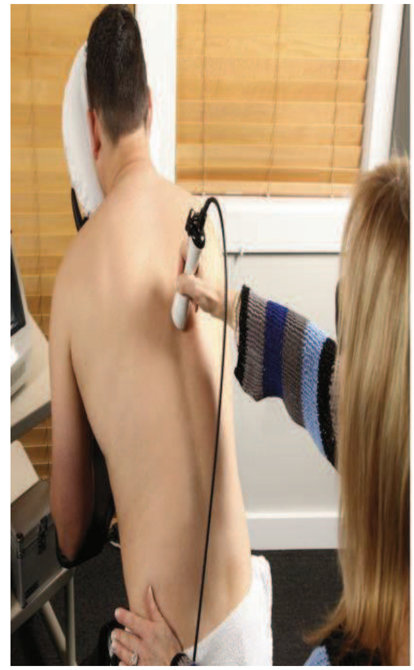
4. Wound healing

Low-Level Laser Therapy LLLT for Wound Healing: Mechanism and Efficacy, LLLT is defined by several parameters. The primary defining factor is power with a range of 10^{-3} to 0.1 W. Other significant parameters include a wavelength between 300 and 10,600 nm, a pulse rate of 0 (continuous) to 5,000 Hz, a pulse duration of 1 to 500 milliseconds, an interpulse interval of 1 to 500 milliseconds, a total irradiation time of 10 to 3,000 seconds, an intensity (power/area) of 10−2 to 10 W/cm2, and a dose (power × irradiation time/area irradiated) of 10^{-2} to 10^{2} joule/cm^2. Differences in the parameters used in various studies complicate the issue of making meaningful comparisons. Various substrates have been used to create the lasers used for LLLT. Initial research used lasers based on inert gases, including helium neon (HeNe; 632.8 nm), ruby (694 nm), argon (488 and 514 nm), and krypton (521, 530, 568, and 647 nm). Subsequent studies have used semiconductor laser diodes, including gallium arsenide (GaAs; 904 nm) and gallium aluminum arsenide (GaAlAs; 820 and 830 nm) devices. Most LLLT research studies, perhaps owing to cost and availability issues, have used HeNe lasers, but many newer studies are preferentially employing the newer GaAs lasers. Although much of the mechanism of action of lasers on the skin is mediated via photothermal effects, LLLT typically causes low or imperceptible temperature changes, giving rise to the terms “low intensity” or “cold” lasers. Although a noticeable temperature increase does not occur, biologic change may be produced by LLLT. Were this to be substantiated, it would not be surprising given that various types of electromagnetic radiation and light have been used to treat various dermatologic conditions via photochemical and other mechanisms. Examples include the use of ultraviolet therapy for psoriasis and hyperbilirubinemia and photodynamic therapy for actinic keratoses. Recent advances in light-based dermatologic therapies have reinvigorated interest in the potential of LLLT, including its applications in wound healing. See the next link.

https://onlinelibrary.wiley.com/doi/full/10.1111/j.1524-4725.2005.31086

https://doi.org/10.1111/j.1524-4725.2005.31086

5. Pain Relief and Healing with Laser Therapy



The concept that light energy from a laser can reduce pain and inflammation, accelerate healing in damaged tissues, relax muscles, and stimulate nerve regeneration seems farfetched. Science, however, tells us these effects do occur. The question is, to what extent and is this based on wavelength and power?

"Wavelength and power determine the capacity of the laser to penetrate into the body. Once you are in the infrared spectrum and above 800 nanometers in wavelength, laser energy penetrates like x-rays, but to achieve depth you need significant power or energy," Dr. Bruce Coren *told* Spine Universe.

There are two classes of lasers being used in physical therapy; class 3 and 4. "Class 3 lasers are less than 500 milliwatts (mw) in power while class 4 lasers are greater than 500 mw," Dr. Coren said. Class 3 lasers are sometimes referred to as cold lasers, and the therapy may be called LLLT for low-level laser therapy. In contrast, class 4 laser therapy is sometimes called HPLT for high-power laser therapy.

The majority of neuro-musculoskeletal conditions respond better to a higher power and a higher dosage, which is a function of power output and time," Dr. Coren commented. "The best results are going to be obtained with a laser that has 30 watts of power or more. A 10-minute treatment with a 30-watt laser will produce 18,000 to 30,000 joules, which gives a significant pain relieving, anti-inflammatory and healing effect." See the below article.

Relief and Healing with Laser Therapy Expert Commentary By: Bruce Coren, DVM, MS *Written by Christopher Chalk, DC, MPH* https://www.spineuniverse.com/treatments/physical-therapy/pain-relief-healing-laser-therapy

Pain

Now return to my equation and substitute intensity = 30 watt/cm and wavelength 800 nm

$$\Delta H = 2477 \times \left(-25.7 + ln\frac{\sqrt{300000}}{6.4 \times 10^{-13}} + \sqrt{300000}\left(\frac{1.32 \times 10^{-14}}{6.4 \times 10^{-13}}\right)\right)$$

$$\Delta H = 2477 \times (-25.7 + 34 + 11)$$

$$\Delta H = 49.5\ kilo\ joule/mole$$

Compare this value with 30.000

6. Osteoarthritis

In patients with RA, relative to a separate control group, LLLT reduced pain by 70% relative to placebo and reduced morning stiffness by 27.5 min (95% CI -52.0 to -2.9), and increased tip to palm flexibility by 1.3 cm (95% CI -1.7 to -0.8). Other outcomes such as functional assessment, range of motion, and local swelling were not different between groups. There were no significant differences between subgroups based on LLLT dosage, wavelength, site of application, or treatment length. In RA, relative to a control group using the opposite hand, there was no difference between control and treatment hand, but all hands were improved in terms of pain relief and disease activity. For OA, a total of 197 patients were randomized. Pain was assessed by 3 trials. The pooled estimate (random effects) showed no effect on pain (standardized mean difference -0.2, 95% CI -1.0 to +0.6), but there was statistically significant heterogeneity ($p > 0.05$). Other outcomes of joint tenderness, joint mobility, and strength were not significant.

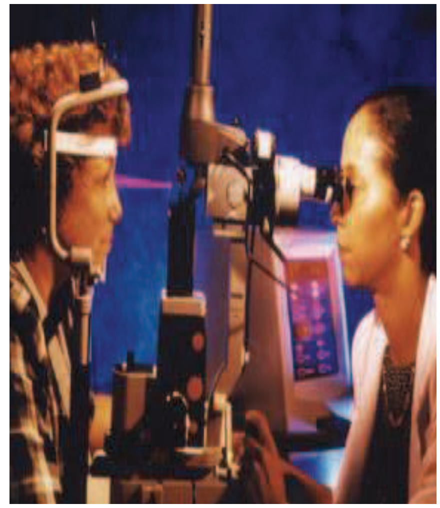
Low level laser therapy for osteoarthritis and rheumatoid arthritis: a metaanalysis

L Brosseau , V Welch, G Wells, P Tugwell, R de Bie, A Gam, K Harman, B Shea, M Morin

PMID: 10955339
https://pubmed.ncbi.nlm.nih.gov/10955339/

7. Laser for Glaucoma:

Glaucoma is a group of eye diseases which result in damage to the optic nerve and cause vision loss. The most common type is open-angle (wide angle, chronic simple) glaucoma, in which the drainage angle for fluid within the eye remains open, with less common types including closed-angle (narrow angle, acute congestive) glaucoma and normal-tension glaucoma. Open-angle glaucoma develops slowly over time and there is no pain. Peripheral vision may begin to decrease, followed by central vision, resulting in blindness if not treated. Closed-angle glaucoma can present gradually or suddenly. The sudden presentation may involve severe eye pain, blurred vision, mid-dilated pupil, redness of the eye, and nausea. Vision loss from glaucoma, once it has occurred, is permanent. Eyes affected by glaucoma are referred to as being glaucomatous[12].



Laser trabeculoplasty:

Both argon laser trabeculoplasty (ALT) and selective laser trabeculoplasty (SLT) types, is used to increase aqueous outflow facility through the trabecular meshwork (TM) in order to lower intraocular pressure (IOP) in cases of ocular hypertension and glaucoma.

In ALT, the argon green laser is typically set at a 50-micron spot size, 0.1-second duration, while the power setting can vary between 300-1000 mW, depending on response. The desired endpoint is blanching of the trabecular meshwork or production of a tiny bubble. If a large bubble appears, the energy should be titrated downward. The ALT procedure can also be performed with a diode laser. In this case, typical settings are 75-micron spot size, 0.1-second duration, and 600-1000 mW power.

In SLT, the laser is a frequency-doubled (532-nm) Q-switched Nd:YAG laser (Selecta 7000, Coherent Medical Group, Santa Clara, CA). The laser settings are fixed except for the power. Spot size is 400-microns and pulse duration is 0.3 ns. The large spot size results in low fluences (mJ/cm2). In more lightly pigmented angles, initial energy can be set at 0.8-1.0 mJ. In more heavily pigmented angles, the initial power can start off lower at 0.3-0.6 mJ.

Look up into the next link:

Trabeculoplasty: ALT vs SLT:

Ahmad A. Aref, MD, MBA, Daniel B. Moore, MD, JoAnn A. Giaconi, MD, Leonard K. Seibold, MD, Oscar D. Albis-Donado, MD, Sarwat Salim MD, FACS and Tiago Morais-Sarmento, M.D.

https://eyewiki.aao.org/Laser_Trabeculoplasty:_ALT_vs_SLT

They Saying they used Nd: YAG laser working in green light, wavelength 523 nm, pulse duration = 0.3 nano second, energy from 0.03 to 0.6 milli joule. So we can apply Ali's equation to know if it could be:

Calculation peak power $p = \frac{energy}{\text{duration}} = \frac{0.6\times10^{-3}}{0.3\times10^{-9}} = 2 \times 10^{6}\ watt/cm^{2}$

[12] Wikipedia.

$$\Delta H = 2477 \times \left(-25.7 + ln\frac{\sqrt{2 \times 10^{6}}}{2.7 \times 10^{-13}} + \sqrt{2 \times 10^{6}} \left(\frac{1.32 \times 10^{-14}}{2.7 \times 10^{-13}} \right) \right)$$

$$\Delta H = 2477 \times (-25.7 + 36 + 68)$$

$$\Delta H = 195.683\ kilo\ joule/mole$$

Or

$$\Delta H = 19.5\ \ joule/cm^{2}$$

So this enthalpy could ignite a chemical reaction.

8. Dentistry's applications:

This is study to show the solidification of light filer dental composites have nomenclature 2,2-bis-[4-(2-hydroxy-3-methacryloxypropyl-1-oxy)-phenyl] propane (Bis-GMA) and triethylene glycol dimethacrylate (TEGDMA). Paper authors' used LED apparatus and halogen lamp to evaluate the effect that light on their solidification. The lamp has 600 $milliwatt/cm^{2}$ power density for 40 seconds on each specimen. And the energy dosage for both was 24J/cm, wavelength 400 to 452 nm, see the below link.

Kinetic Parameters during Bis-GMA and TEGDMA Monomer Polymerization by ATR-FTIR: The Influence of Photoinitiator and Light Curing Source

Aline B .Denis, Cristina A .Diagone, Ana M. G. Plepis, and Rommel B. Viana

https://www.hindawi.com/journals/jspec/2016/6524901/

Return to the equation:

Wave length = 452nm

Intensity = $\frac{600 \times 10^{-3}}{cm^{2}} \times 10000 = \frac{6000}{m^{2}}$

$$\Delta H = RT \left(-25.7 + ln\frac{\sqrt{I}}{\lambda^{2}} + \sqrt{I} \left(\frac{1.32 \times 10^{-14}}{\lambda^{2}} \right) \right)$$

$$\Delta H = 2477 \left(-25.7 + ln\frac{\sqrt{6000}}{2 \times 10^{-13}} + \sqrt{6000} \left(\frac{1.32 \times 10^{-14}}{2 \times 10^{-13}} \right) \right)$$

$$\Delta H = 2477(-25.7 + 34 + 5)$$

$\Delta H = 34.678\ kilo\ joule/mole$

$\Delta H = 3.5\ joule/cm^2$

The author mentioned that for reaction to complete initiator must be exist why?

Light obey Beer Lambert laws so it will attenuated when it come across materials so solidification will happen at the surface of filer but the initiator will complete the reaction deeply into filer.

4. Very low energy lasers

1. Light pointer laser

In this link the national environment agency for some government gives cautions to its people saying for educational pen pointers it is better to use 5 milliwatts power laser, it is safe.

https://www.nea.gov.sg/our-services/radiation-safety/lasers/information-on-laser-pointers

Let us ask Ali's equation, is that true?

We have

Wave length = 452nm in green color for example .

Intensity = $5 \times 10^{-3}\,\frac{watt}{cm^2} \times 10000 = 50\,\frac{watt}{m^2}$

$$\Delta H = 2477\left(-25.7 + ln\frac{\sqrt{50}}{2 \times 10^{-13}} + \sqrt{50}\left(\frac{1.32 \times 10^{-14}}{2 \times 10^{-13}}\right)\right)$$

$\Delta H = 2477(-25.7 + 31 + 0.46)$

$\Delta H = 16\ kilo\ joule/mole$

Or

$\Delta H = 1.6\ joule/cm^2$

You can see 1.6 $joule/cm^2$ not big for human body but it can harm the eye comparing with Glaucoma surgery which 19.5 joule.

Conclusion: more promising applications waiting

This work I did is compensation for experiment, I know experiment is important but the investment or the goodness of these equations make me see the human rights to use it in goodness is more important and anticipated.

These equations have more Majestics applications that uses photons intensity and energy could be executed such as:

- Cosmic Microwave Background CMB spaceships: it uses CMB as fuel.
- Earth laser guns defense, many satellites with guns oriented at falling meteors.
- Climate change modifications.
- Alternate current farms, like solar cell farms.
- Photonic computers.
- Solar shine collector airplanes.
- New generations of telecommunications.
- Laser depending medications.

Finally, I hope someone look after these equations and use his abilities for utilize it in human goodness.

Thank you

Ali Yousif Hassan Edriss

My others books and papers:

1. **Ali's Equations (5th Edition) photon and matter interactions: the perfect vision to photochemistry.**
   Ali Yousif Hassan Edriss.
   Sudan University of Science and Technology, Physics Laboratories.
   Academia.edu
2. **Ali's Equations (Photon & Matter relationships) fourth edition**
   Ali Yousif Hassan Edriss.
   Sudan University of Science and Technology, Physics Laboratories
   Academia.edu
3. **Ali's equation: the validity through the interpretations of Multiphotons Ionization and Above Threshold Ionization theories**
   Ali Yousif Hassan Edriss.
   Sudan University of Science and Technology, Physics Laboratories
   Academia.edu
4. **Ali's equations: the boundaries of Multiphotons interactions (high density photons) phenomena.**
   Ali Yousif Hassan Edriss.
   Sudan University of Science and Technology, Physics Laboratories
   Academia.edu
5. **Wikipedia.**
6. **Diamonds production using Ali's equations: A comparison with experiment**.
   Ali Yousif Hassan Edriss.
   Sudan University of Science and Technology, Physics Laboratories
   Academia.edu
7. **Using of Ali's equations in the treatment of global drinking water problem.**
   Ali Yousif Hassan Edriss.
   Sudan University of Science and Technology, Physics Laboratories
   Academia.edu
8. **Using of Ali's equations in Mercury to Gold conversion.**
   Ali Yousif Hassan Edriss.
   Sudan University of Science and Technology, Physics Laboratories
   Academia.edu