ISSN: 2640-4133

Research Article

Advances in Bioengineering & Biomedical Science Research

Structure Formation of Bio-Elements

Narayan Kumar Bhadra

Lakshmipur Swamiji Seva Sangh High School (H.S), Gobardanga, North 24 Parganas West Bengal, India

*Corresponding author
Narayan Kumar Bhadra, Lakshmipur Swamiji Seva Sangh High School (H.S), Gobardanga, North 24 Parganas West Bengal, India

Submitted: 02 Jun 2022; **Accepted:** 20 Jun 2022; **Published:** 24 Jun 2022

Citation: *Narayan Kumar Bhadra .(2022). Structure Formation of Bio-Elements. Adv Bioeng Biomed Sci Res, 5(2), 147-159.*

Abstract

We study a Nano-Structural 4-forces of New Atomic Model, a lithography of biological elements on the basis of Super Unified Theorem SU(11)⊃SU(6)×SU(5)×U(1) or SU(11)⊃SU(6)×SU(3)×SU(2)×U(1). The existences of up-converting quantum masses or positions or dots of colloidal lithographies from exotic matter fluid to ordinary matter through colloidal stages, have been consider as four coordinates, such as x = ω1t; y = ω2t; z = ω3t; within the three dimensional real time 't' and ω4t, a pseudo co-ordinate appearing by optical holography beams of photon-like[neutrino-likes created from the new energy sources of SU(6), SU(12), SU(24),....etc. interacting with photons creating by the group of U(1) through the respective framework of SU(6)×U(1), SU(12)×U(1),……etc. appears photon-likes quanta with ordinary photon of non-monotonic fluxes of flows (such like as laser pulses), appearing it, as incoming information through light rays with different gradient forces of multiple foci, behaving then as like different laser designated beams of holographic optical tweezers(HOT), then optimizing or controlling its potentiality for trapping multiple nano-particles fabricates colloidal lithography] fluxes of rays by new energies, an aperture or nano-hole based creation within a closed space or closed universe (an area filled with known & unknown energies, may increasing like a balloon, unfolding up-to a certain range then contraction), where ω1, ω2, ω3, ω4 are assumed to be the angular momentums. Assuming, in this model formed a General Atomic Structure where any formations was influences by exotic matter fluids through the creation of strong forces by the new energy sources of SU(6) in the framework of SU(6)×U(1) using with GUT symmetry breaking. We then find different status formation of ordinary matter atoms by the hidden interactions forces of new energies between different framework of sub-groups (as explained before) with U(1), the electrodynamics created magnetic monopole (once created does not destroyed) found it is highly polarizable particles. Thus, there created an electromagnetic force fields with appearances of "Charges" by quarks through the model of SU(5)⊃ SU(3) × SU(2) × U(1).

In this new SUT model, we study the formations of some kind of new quantum particles-like in wave status created through colloidal stages firstly before GUT model by the exotic matter fluid maintaining the entanglement of wave-wave duality. The stiffness's of different nano-particles within colloidal environment was appeared frequently by different resonance vibration mode through new light energy waves of high intensities of short wave lengths but strong strength forces created by SU(6) after the symmetry breaking of SU(11)⊃ SU(6) × SU(3) × SU(2) × U(1). According to the GUT theory, it is the low potential stage however it is high potential with respect to SUT[remembering the enthalpy of vaporization, it is like the measure of latent heat (540Cal/g) is traded or discharged in the stage move during the build-up of 1g water fume to 1g water with same temperature 100˚C]. In the theory of SU(11), new particle-likes in wave status are formed tightly bindings by the bosons of SU(6) with different quark-types but lepton-likes. These new kind of particle-like in wave characters (considering as primary nascent fundamental matter particles) are assumed to be the causes for wave-particle duality of quantum entanglement or the uncertainty principle of ordinary matter particles. These new kinds of particle-likes are then hidden in the background of all known ordinary particle interactions, may observe only by laboratory experiments. Although, ordinary matter particles are find when bosons of SU(6) changes to the bosons of SU(5) [i.e. SU(3)×SU(2)×U(1)] by exchanging the bosons of SU(11). The observing matter particles in GUT model, forming by gluons & different quarks fabricating and accelerating the ordinary quantum structures, which are therefore actually formed by up-converting quantum masses through resonance vibrations with proper interactions of background hidden forces between trapping particles with all others non-trapping nano-particles. We find then require different mobilise or immobilise elements structures, such as DNA or Protein bio-molecules, monomers, polymers etc. We thus need a Revision of Standard Model of Physics on the basis of Super Unified Theory of SU(11)⊃ SU(6) × SU(3) × SU(2) × U(1), where we positively accounting the 4th forces as gravitational force created by SU(6).

Keywords: Laser beams, Exotic matter fluids, Colloidal lithography, Enthalpy of Vaporization, Holography optical tweezes, Particle trapping, soft matters, Lumps of matter, Photoelectric effects, Consciousness, Electromagnetism

Introduction

Many of the Scientists are said, that vacuum is the most powerful source for creation of everything of this physical universe. According to the famous scientist Albert Einstein that our matter universe appears from nothing but I think, our matter universe appears from something instead of nothing.

We assumed that our Physical Universe appeared through a dynamical process of symmetry breaking system assuming as Generalised Gaussian Energy Group (GGEG), can be expressed mathematically are as follows: $SU(5) \supset SU(3) \times SU(2) \times U(1)$; $SU(11) \supset SU(6) \times SU(5) \times U(1)$; $SU(23) \supset SU(12) \times SU(11)$ x U(1); $SU(47) \supset SU(24) \times SU(23)$ x U(1);.....so on. Thus we have, $SU(12n-1) \supset SU(6n)$ x $SU(6n-1) \times U(1)$, where, $n = 2^0, 2^1, 2^2, 2^3, 2^4, \ldots\ldots\ldots\infty$ i.e. $SU(12n-1) \supset SU(6n) \times \ldots\ldots\ldots\times SU(24) \times SU(12)$ x SU(6) x SU(3) x SU(2) x U(1).

According to the above-mentioned mathematical explanation of new energy sources, our Universe is thus filled with different kind of energies with bosons, quarks, leptons & quark-likes or lepton-likes etc. respectively to their individual subgroups. The bosons of respective subgroups are changes randomly to one-another through symmetry breaking of different unified group from Big-Rip singularity, till to the symmetry breaking of unified groups of SU(11) & SU(5), appears different phase densities of energies within infinite space-time from Big-Rip singularity. Thus, phases contained various densities of gaseous-like states, assumed to be mathematically as imaginary space-time [according to the Einstein's GRT that real time can't defined outside the gravitating sphere, again space is function of time, so outside the gravitating sphere, we can assume the space-time is mathematically imaginary, hence the actual space-time of the universe is complex as (R+iR)], the appearance like SUT of SU(11), the exotic matter phase (like it is the vapour state of matter fluid stages then appears as colloidal stage) & GUT of SU(5), the ordinary matter phase [like as liquid(assuming there created like lithium fluid states,……etc.) or solid state].Therefore, we found then our expected physical or so called real matter universe. Thus our matter universe is actually appears through 10-dimensional space-times, through the symmetry breaking of "Super Unified Gaussian Energy Group SU(11) [$SU(11) \supset SU(6) \times SU(3) \times SU(2) \times U(1)$]" which are dividing into two scales. In the large scale, lumps of matter appeared for the creation of multiple galaxies etc., initially each galaxy having a black-hole at the centre region of that galaxy and in the small scale, soft matters appears with single nano-hole or multiple nano-holes with different apertures fabricated colloidal lithography of trapping nano-particles by using laser-like light rays or different amplitudes radio wave designated rays, seem to be active classically through the holes as HOTs, associated mainly with 6th & 5th dimensional space-time of large scale then evaporating or disappearing the holes(both on large scales & small scales holes may disappearing after energy transported)slowly with the expansion or unfolding dynamical substances with creation of multiple vortices-like hole within the 4th dimensional GUT matter universe. We assume the force exerted by SU(6)[as latent energy], is believed to be potentially so large that the exotic matter fluids changes to ordinary matters through colloidal fluids with hidden background interaction forces between colloidal nano-particles, then everything find through common chemical reactions between matter particles with or without help of catalysts or enzymes (for bio-particles) etc.

In recent years, we observed that optical tweezers have emerged as a leading technique in the field of biophysics, due to their ability to detect and to constrain the position of micrometer-sized objects in three dimensions and exert biologically relevant Pico-Newton forces. The Experimental implementations of measurements of optical tweezers through biophysics are very much comparable with the measurements through natural optical tweezers created for the structure formations of animates & inanimate of our unfolding physical universe. The process of formation through interactions between trapping and non-trapping nano-particles of elements including bio-molecules are uses through holographical optical tweezers. Optical tweezers have found multiple application in medical sciences and particularly fruitful application to the single-molecule studies, where tethering macromolecules to optically trapped beads have enabled measurements of their response to the extension and force, revealing, e.g., mechanical response properties of DNA and free energy surfaces for nucleic acid and protein unfolding. Extending the manipulation and force measurement capabilities of optical tweezers to the mechanical probing of higher-order biological structures, such as the interactions between trap particles and other nano-particles as protein-protein, DNA-protein, antigen-antibody interaction, cells and soft biomaterials, requires the ability to stretch these higher-dimensional structures in more than one direction. Therefore, assumed the laser designated new kind of light rays exerted through nano-holes appears by new energies with ordinary light as HOTs, trapping not only the single colloidal particles but also controlled the dynamical status of single strand DNA, single proteins etc. and encapsulated of all up-converting quantum nano-particles from colloidal fluid using resonating vibration "modes", then fabricated different structures of complex bio-molecules including monomers, polymers etc. within our closed physical universe. We know from fluid dynamics or oceanography that there may be possible different motions of fluids with viscosity & surface tension, due to its various densities mixing as salinities-like with fluids of ocean, find then different oceanic current etc. we also find then various vortices, thermo-cline stages within oceanic current etc. These are comparable with the situation between colloidal stages to ordinary matter stages of the fluid of unfolding universe after arising adiabatic stages then maintaining the laws of thermodynamics, mainly the second law of thermodynamics where nano-particles are moving with Brownian motion of speeds.

We now discuss the laboratory experimental data, found by Astrid van der Horst and Nancy R. Forde, Department of Physics, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, on the basis of optical multiple traps using holographic optical tweezers (HOTs). In this technique, the laser beam is sent through or reflected off a so-called kinoform, a spatial pattern of local phase retardations that changes the wave-front of the laser beam. The modulation of the phase is transformed into a modulation of light intensity by focusing

through a microscope objective lens. Thus, by choosing a certain kinoform, multiple focal spots can be created. Dynamic modulation of the phase can be accomplished by use of a spatial light modulator (SLM) in which the kinoform can be changed in real time. The use of an SLM in HOTs allows for the individual dynamic steering of multiple optical traps. With this technique, the position in the third dimension (along the optical axis) can be controlled individually for each trap, a distinct advantage over other beam steering approaches.

The SLM can be used to compensate for aberrations in the optical system. However, the technique of HOTs has not yet found widespread application in biophysics, due to lack of evidence as to how forces exerted by holographic optical traps vary as the phase of the beam is modulated.

The force measurements require calibrated traps, i.e., knowledge of the trap stiffness (κ), the relationship between the displacement α of a particle from its equilibrium position and the force F exerted on the particle ($\kappa = -F/\Delta\alpha$). Calibration of κ is straightforward and well established for single optical traps.

Practically the ability of optical trapping to immobilize and manipulate nano-particles has opened up new possibilities for manipulation at the nano-meter scale. We thus systematically characterize traps within HOTs as they are steered in two dimensional configurations relevant for studies of soft bio-materials, such as bio-molecules formations etc. We therefore interested for the study of nano-scale bio-molecules in this universe with hidden background interaction forces created mainly by the energy group SU(6) involving protein-protein interactions, antigen–antibody binding, and the manipulation of individual virus particles etc.

Other scientists, experimentally showing that double-nano-hole fabricated colloidal lithography using laser beams for trapping single colloidal nano-particles and single proteins. The cusp separation was then tuned by plasma etching the colloids prior to evaporating, and this allowed for the trapping of smaller proteins. That means a gap separation of 60 nm between the cusps of the double-nano-hole was achieved in a gold film of 70 nm thickness sputter coated on glass. The cusp separation was reduced steadily down to 10 nm by plasma etching the colloidal particles prior to sputter coating. That means cusp distances made a vital role for trapping nano-particles. Scanning electron microscopy was used to locate a particular double-nanohole and it was registered for later microscopy experiments, 30 nm polystyrene particles, the rubisco protein and bovine serum albumin were trapped using a laser focused through the aperture. Thus, double-nano-holes works are randomly located, it may be possible for use template directed assembly to place them more deterministically at a specific location by including an additional lithography (for example optical) step.

Again, some other famous scientists declared by their experimental observation that a double nano-hole (DNH) in a metal film can optically trap nano-particles such as polystyrene/silica spheres, encapsulated quantum dots and up-converting nano-particles. The studies of dynamics of trapped particles, showing a skewed distribution and low roll-off frequency that are indicative of Kramers-hopping at the nano-scale. Numerical simulations of trapped particles showing a double-well potential, normally found in Kramers-hopping systems, as well as providing quantitative agreement with the overall trapping potential. One can demonstrate a co-trapping of bovine serum albumin (BSA) with anti-BSA by sequential delivery in a micro-fluidic channel. This co-trapping opens up exciting possibilities for the study of protein interactions at the single particle level.

Matter Particle Formations

According to the Einstein's GRT or Big-Bang theory, that our physical or matter universe expanded with unfolding the folding universe from Big-Bang singularity due to the continuous supplies of dark energies or dark matters from another phase to the phase of closed universe by the phase transition system-likes, although our physical universe expanded like an expansion of a balloon with a nano-hole at the centre region. It was shown mathematically in my published articles that there are (10-7)-dimensions has flat universe no adiabatic stage arises, then 6th & 5th dimensions are aperture-based association, assumed to be black-holes base in large scales and nano-holes in small scales etc. then arises an adiabatic stage within this closed universe, which is like a closed individual body system. Exotic matter fluids influencing for changing state of phases and hence gradually appears ordinary matters with GUT symmetry breaking through colloidal stages of fluids by the hidden forces of SU(6). Considering effective photon-like quanta exerted by the interaction between photon of U(1) and neutrino-likes of SU(6) including with all other neutrino-likes from SU(12), SU(24),....etc. appears then different laser-like focusing beam of light rays of short wavelengths of different amplitudes & intensities, initially appears it through different hollow apertures of black-holes in the large scale universe within lumps of matter or nano-holes in the small scale within soft matters letter it may appears with ordinary light, there may be double nano-holes or multiple nano-holes with variable cusp distances(various cusp separation distances made a vital role for trapping multiple nano-particles & optimizing its sizes, hence creates different kind of DNA etc. with various characters, hence creates different animates), for trapping nano-particles, that are creating through up-converting quantum masses of colloidal particles by exchanging bosons between the groups of SU(6) and SU(5). Hence then symmetry breaking of GUT of SU(5) for unfolding everything of this physical matter universe.

The incoming informational different laser designated light rays appears not only through single aperture of different sizes nano-holes for trapping nano-particles but also appears through double or multiple nano-holes (because, any kind of empty or vacuum spaces are always filling up different densities new energies with different phases explained details in my published articles)behaving like as holographic optical tweezers using laser designated light rays with variable cusp distances, then trapping natural nano-particles and fabricated the initial structures of bio-molecules and then unfolding our beautiful physical universe of animates & inanimate. It is therefore possible to de-

scribe by consideration of SUT model of symmetry breaking instead of only GUT, when HOTs trapping all small nano-particles creating by GUT symmetry breaking and tuning the size of particles requiring for achieving the goal of appropriate structure formations through up-converting masses of nano-particles, where using non-monotonic light rays as like laser pulses. As the flows of transmission of light rays of new energies with ordinary light are non-monotonic behaviour, which then gives an opportunity to take the time of formation of particles sizes as requires or associates with nano-particles through resonance of vibrations fabricated structures like ssDNA, single protein etc. then all others like by DNA-Protein interaction, protein-protein interaction etc. All creations are seemed to be appear only with unfolding the closed physical universe towards the expansion like closed body system, which is only possible due to the aforesaid hidden background interaction forces. Similar observation was noticed when expansion or increments of the closed live body system, like as human's body etc. We may thus compare the expansion of human body or any other closed live body system with the expansion of our physical universe where we observe the human body attaining a critical or singular point (a certain age) like as Big-Brake singularity [see my article "The Complex Quantum and Classical Pseudo-Tachyonic Universe"] of the large-scale expanding universe, after then contraction(both internally & externally of the human body or any other live body) appears and continuing till it reaching the Big-Crunch singularity(such as before the moment of death), avoiding any other noise circumstances(affected by any kind of complexity or diseases) which can disturbing the smoothly running of body-system otherwise breakdown partly or fully before reaching like the Big-Crunch singularity. It receives holography incoming informational data through new energies light rays for successful & all round development of individual closed body system from tiny stages to death by randomly trapping nano-particles with successful running of living-body mechanism under hidden interaction forces [there also may be developed some unwanted cell etc. such as cancer cells or parasite-like(bacteria or viruses) living substances along with the normal expansion or development of the body system by the same system of trapping nano-particles which can disturbed the smoothness's of live-body-systems (as like as noise substances or unwanted software arises through online network-systems on computer and then disturbed smoothness of programming, called then it was affected by virus etc. we thus use antivirus as precautions of computer etc. for protecting smoothness of computer run) or may be dangerous for livingness. But it can be possible to stop the increment of unwanted living cells and cure or protects the original live by using artificially refining the incoming informational data of new light rays as ray-therapy etc. including by applying suitable drugs for strongest the existing data], which is require for expansion or all round development of close live body system (the incoming informational data with existing data is subject to the memory), but observation is that gradually decline the existing data along with contraction of live body as human i.e., externally as well as internally squeezed the body parts & brain parts etc. (decline the efficiency of brain neurons etc. or gradually folding the memory cell which are unfolding normally with the development of child). Then losing memory etc. with feeling weakness through mind, produces mainly by SU(2) in the framework of SU(2) x U(1), however consciousness by SU(6) in the framework of SU(6) x U(1) are continuing, because the incoming informational energies of different intensities are always supplying energies for recovering or repairing the affected body parts(if there occasionally arises abnormality or any kind of breakdown of the body system by creating some unwanted cells etc. or affected through bacteria & virus which are harmful for smoothness of livingness but there sufficiency of existing data then it is possible to recover by medical treatments from outside medicine or by the same new kind of light ray therapy of different wave-amplitudes as required etc.) and trying to improve the feeling of strong till it reaching the another singular point like as Big-Crunch singularity. Ultimately, when the existing data totally decline, then mind feels fully weakness and unable to receive or utilize the incoming informational signalling data called proper death.

So, the appearances of DNH (double nano-hole) or multiple nano-holes in small scale of quantum stages of soft matters or black-holes in large scale of lumps of matter of the universe, fabricated lives or galaxies between particle horizon around the event horizon of the closed universe or closed body system within the polarized electron-ocean of colloidal fluids or electromagnetic ocean after interacting with new kind of optical beam of light rays as of different amplitudes radio-wave designation. Therefore, it is to be considerable that in the early stages and thereafter from the Big-Bang singularity, our physical universe or matter universe unfolding around the hollow black-hole or hollow nano-hole for advancing the matter universe, as well as DNH or multiple nano-holes creates laser designated new kind of light rays for optically trapping nascent smaller and smaller size's nano-particles which remaining with Brownian motions within phase transited colloidal fluids. The incoming informational light rays appears mainly by SU(6), which are then assumed to be as "Consciousness", which playing a crucial role for the construction of everything within our closed physical universe as well as within the closed live bodies like human till before death, however it is connected with other informational energies as "Fundamental Consciousness" appears through new light rays formed by neutrinos of SU(12), SU(24), SU(48),….. etc. which also ruled everything before and after the appearances of our physical universe.

We may illustrate the above scenario with an analogy of function with a simple computer, where we found hardware including hard-disc with installing software from outside, maybe through network-systems. Considering software is equivalent to the incoming informational data or consciousness may be as laser designated light rays, hard-disc as existing data relating to the mechanical structures of closed live-body-system as hardware and electricity (power) is like the fundamental consciousness. The reason for death of computer must depend mainly on hardware & hard-disc not on software, only noise or unwanted software can anomaly or affected the smoothness of running of the computer after connected mainly with network systems and therefore may have death or require for repairing the computer.

According to the above explanation, we found then variable

non-monotonic flows of energy of tiny waves through quanta-like packets of energies constructed by interacting with photons and neutrino-likes of the new energy sources of SU(6), SU(12), SU(24),…etc. within our closed physical universe, these incoming light rays with different gradient forces of invisible energy-waves (as it is radio-designated different wave-amplitudes) with different signaling amplitudes then broadcasting through the electrons-ocean of our physical universe. According to the inclinations, it is measuring as different laser-like holographic optical beams maybe comparable with just like the laboratory experiments of trapping different nano-particles using laser-light and hence we found holographic optical tweezers (HOT) with various cusps-distances[which plays a crucial role for the construction of different sizes of bio-molecules through trapping nano-particles] beyond two or more galaxies or multiple universe having hollow black-holes etc. then with colloidal fluid fabricated various structures of bio-molecules through soft matters with the resonance mode of vibrations such as DNA-vibrations, DNA-Protein interactions etc. Then unfolding the expected close live body through protein-protein interactions, etc. such are explains details in biophysics. Similar observation was found between event horizon and particle horizon for the case of large-scale matter universe with lumps of matters when trapping particles for the constructions of matter body system.

It is remembering that if we advance towards the symmetry breaking of GUT of SU(5) i.e. SU(3) × SU(2) × U(1) from the symmetry breaking of SU(11), the strong strength of special force of SU(6) may have unchanged from (10-7)-dimensional flat universe and large potential strengths (within 5th & 6th dimensional black-Hole stage within event horizon) then strong strengths interaction forces are found as hidden in the background of ordinary matter particles after the symmetry breaking of SU(5)(in our 4-dimensional stages of particle horizon). Hence the strength of force of SU(6) were able to associates like monomers, polymers and exert new particle-likes, then bending the requiring shape through quantum gravitational forces with trapping nano-matter particles. It was observed by GUT symmetry breaking, the strength of weak force of SU(2) decreases as the strength of strong force of SU(3) increases for constructing ordinary matter particles by tightly binding through quarks & gluons while the large strength of force of SU(6) may invariant and hidden(or latent) in the background of ordinary particle interactions but partly transported for new constructions. Hence, all kind of matter particle formations is under the supervision of SU(6), that means any kind of assemble(synthesises or by chemical reactions) with its dynamical parts achieving towards the goal of completion of close body or apparently close body of animates or inanimate are always requires these hidden forces of SU(6).

Thus experimentally or physically observed matter particles forms by quarks & gluons etc. in our present physics of "Standard Model of Physics" does not accounted the hidden background interaction forces created by SU(6). Hence therefore, it is very hard to construct artificially the original DNA, Protein etc. of lives without accounting the forces created by SU(6).

Interpretations of Background Hidden Forces

In the theory of SU(11) ⊃ SU(6) x SU(5) × U(1), we have five neutral bosons Jk3, Jk8, Jk15, Jk24, Jk35 of SU(6) corresponding neutrino-likes are as $Z_{k3}°$, $Z_{k8}°$,$Z_{k15}°$,$Z_{k24}°$,$Z_{k35}°$ [considering the notation are as usual like as Z° of the traditional weak neutrinos of the group SU(2) of GUT model] with respect to the five diagonal matrices I3, I8, I15, I24, I35 of SU(6) having like zero mass and without any charge. However, the photon does not interact with the neutrinos of SU(2), while considering here photons does interact with the aforesaid neutrino-likes of SU(6), however there is a similarity between SU(2) and SU(6). We find bosons of SU(6) from the theory of SU(11) [⊃ SU(6) × SU(5) × U(1)] of SUT symmetry breaking, are tightly binding by quark-types but lepton-likes forms new particle-likes while from the GUT symmetry breaking of SU(5) find particles of matter atoms like proton, neutron, electron etc. which are formed tightly binding by quarks & gluons of SU(3), that means in the theories of SU(5), we found quarks & leptons and in the theories of SU(11), we found quarks, leptons with quark-types but lepton-likes. Therefore, neutrino-likes of SU(6) were interacted with photons through the framework of SU(6) × U(1) created photon-likes, which are potentially large strengths[comparing it is like water vapour having latent heat of 540cal/g with same temperature of boiling water at 100˚c] of high intensities quanta of radio-wave designated light rays of beams like as laser pulses, it is then accelerated everything of our physical universe. Considering the strong strengths forces of SU(6) created "Quantum Gravity" in small scales or "Gravity" in large scales universe, which are therefore, providing a kind of electromagnetic forces with strong-pseudo-currents through the interactions between $Z_{k3}°$, $Z_{k8}°$,$Z_{k15}°$,$Z_{k24}°$,$Z_{k35}°$ and W1, W2, W4, W5, W6,……..,W34, such forces are also hidden in the background of ordinary matter particle interactions with strong current, observing it then like an electric circuits along the close live body neural network system starting with brain neurons or Wi-Fi region throughout the electrons-ocean of closed physical universe etc. through the framework of SU(6) x U(1). Again, the new kind of strong interaction forces exerted by two type of bosons of SU(6), such as charge-like of 30-number bosons & 5-number of neutrino-like neutral bosons, which are does not involve with any kind of electric charges, but if we imagine it still seems like to demand the bosons of Jk1, Jk2, Jk4, Jk5, Jk6…….Jk34 [as like between Z° & $W_1^{\pm}$ in SU(2)] with respect to the non-diagonal matrices I1, I2, I4, I5, I6…….I34 are permitted an interchange or rearrange the wave energy between the two types of bosons i.e. charge-likes(W^±-Types) & neutrino-likes (Z°-Types) bosons of SU(6). Hence, this circumstances prompted efforts to link with a new kind of electromagnetic interaction, that means a hidden-electro-strong interaction working by the link SU(6)XU(1) i.e. brings the photons of U(1) [the electrodynamics U(1)], which are inevitable arises particles that have the characteristics of a magnetic monopole. Monopoles are highly stable particles and once created they are not destructible and so they would survive as relics to the present epoch, thus found an electron's-ocean, which are therefore brings very closer to the bosons of SU(6).

An analogy will illustrate the scenario that if we imagine an ordinary light of quanta are in wave of electromagnetic ocean

and be quite successful at it, wouldn't be much of a stretch for us to image electrons as something like tethered buoys floating in an electromagnetic harbor. Along come the waves (new kind of light energy) from new energy sources as explained before which pull and tug at the buoys (electrons). Weak waves have no effects, but strong ones just might yank a buoy from their mooring and set it adrift. A wave model of light would predict an energy-amplitude relationship and not the energy-frequency relationship. Again, photoelectric experiments describe an electromagnetic ocean where monstrous swells wouldn't tip over a canoe, but tiny ripples would fling you into the air. If that wasn't enough, the photoelectrons seem to pop out from the surface of body too quickly. When light intensities are very low, the rate at which energy is delivered to the surface is downright sluggish. It should take a while for any one particular electron to capture enough of this diffuse energy to free itself. It should, but it doesn't.

The light rays formed by the packets of new photon-likes, excited electrons by flash-like cut-off as 0-1 binary-system of computer, depending on the flexibility of the impact surfaces then created photo-emissions or absorbed energy, then creating variable photo currents with different amplitudes & intensities within close body or close universe (for details see the articles "How-SU-Levels-Are-Imply-for-Life-Consciousness-ABBSR-20" & "PHOTOELECTRIC EFFECTS: HUMAN MIND & SENSE DATUM").

Again, Rutherford model of atoms explains, most of the matter atoms having empty spaces. Photons as well as now photon-like of incoming information energy are always penetrate the multiple layers of atom of the material substances before exciting an electron otherwise experiencing coherent scattering (i.e. Thomson scattering), then rearranging the molecular structures.

Usually, there may be possible to exists an ocean of particle-likes by new energies in wave status after unfolding the 10-dimensional universe including all other previously releasing neutrino-like bosons of the energy sources of SU(12), SU(24),….., etc. which therefore responsible for changing the phases beyond 10-dimensional space-time & influencing for unfolding towards the appearance of most ordinary matter oriented physical universe including charge particles & living things. In our physical universe, practically we found various type of electromagnetic forces with different kind of tiny wave-lengths as "Invisible Rays" [just like as X-rays differ from cathode rays] with visible rays appearing through the "Fluxes of neutrino-likes bosons of the energies of SU(6), SU(12), SU(24),...etc. interacting with photons of U(1)", through the respective framework of "SU(6) × U(1); SU(12) × U(1); SU(24) × U(1)";.....etc. created new kind of light rays with strengthen current of large potentiality including ordinary light. Thus, all particles formed by quarks & gluons after changing 30-number of bosons of SU(6) into 30-number of bosons of SU(5) by exchanging the J-bosons of SU(11) are not sufficient for explanation of everything of this universe.

Experimental Observations of DNA-vibrating Modes

In supporting to the structure formation processes of biological elements for live-body, we need to understand the mechanical and thermo-dynamical properties of DNA. Which have been divided into two domains: the elastic phonon modes i.e. the elastic dynamics of DNA, have been studied using Raman scattering, Brillouin scattering, far-infrared absorption, and sub-millimetre wave absorption spectroscopy in the range of 0.01–10THz and conformational flexibility of DNA has been studied using approaches such as mechanical stretching, fluorescence resonance energy transfer, transient electric birefringence, thermal melting profiles of DNA hairpins and atomic force microscopy. The study of vibrational dynamics of DNA has resulted in various applications such as, detecting mutations by identifying resonant modes associated with localized defect in the DNA polymer. Most of these works have been used double stranded DNA (dsDNA) and given insight into the dsDNA conformational flexibility and vibrational modes, while single stranded DNA (ssDNA) remains less studied, ssDNA occurs as an intermediate molecule in the DNA metabolic processes of repair, replication and transcription, which warrants further study of the associated dynamic properties of ssDNA. It is also the form of genetic information in many viruses.

In continuation to the above experimental study we try to understand the facts of occurrences through the consolidate forms done for the construction of biological properties in our physical matter universe and studying with the natural phenomena for the appearance of lives through the investigation of laboratory experimental observations using vibrational modes of ssDNA at the single molecule level (i.e., studying individual molecules one-at-a-time) and up to the extremely high frequency electromagnetic range (>30 GHz). This was possible by using optical tweezers, which had been an important tool for mechanical, spectroscopic and opto-mechanical studies of nano-particles at single molecule level. Low frequency collective oscillations or resonant modes of DNA and proteins molecules have revealed many of their biological functions along with their dynamic mechanisms such as the intercalation of drugs in DNA. The low frequency vibrational modes correspond to the macroscopic bending, stretching, and torsion motions of the molecule, which leads to the mechanical deformation necessary for the biological processes. The resonant modes of small DNA strands have been identified previously by Raman spectroscopy in the very far infrared region, mostly above 10 THz. The absorption spectroscopy of sub-millimeter electromagnetic waves has been performed on dried DNA films to extract their vibrational resonances. Recently hyper-sound spectroscopy was used to study phonon modes of DNA in the range of 500 GHz and above. But still these studies have been unable to show the lower frequency modes in the few tens of GHz range, in part due to the requirement of sufficiently thick and large diameter films and thus lack conclusive identification of these lower frequency modes. Which are requires for continuing our new conception of present dissertation of quantum states of nascent particles beyond ordinary particle formations and how the bio-molecules appears by trapping nano-particles using new kind of laser designated light rays of multiple foci of beams? Its activation started beyond the standard model of physics. We excite and able to measure the resonant vibration modes of small ssDNA molecules (tens of bases) in the 10-100 GHz

range. Using a DNH optical tweezers, we find vibration modes of ssDNA molecule are excited through the interaction of an extremely high frequency (EHF) beating electromagnetic field. The EHF range defined by the class of radiofrequency designation as like our previous consideration of incoming information light rays of the aforesaid new energies and observed that lowering the frequency from the point of molecular spectroscopy of ordinary matter, representing the low frequency long range modes of macromolecules through successive changes. The same technique was recently used to measure the Raman-active vibrations of isolated nano-particles in the 0.1 /cm to 10/cm range. We want to speak that the tuning of resonant mode must change the length of the ssDNA. It was observed in laboratory experiments that DNH tweezers provides a better way to identifying short strands of DNA called oligo-nucleotides compared to present techniques that require dyes and fluorescent markers and therefore can play an important role in genetic testing, forensics and DNA amplification. Because, the DNH tweezers provides label-free, real-time oligo-nucleotides characterisation by their resonant modes in the tens of GHz range, even in aqueous environment and at single molecule level could be shown that trapping of a base ssDNA may be possible by using DNH tweezers. The DNH tweezers is able to unzip a hairpin-DNA and also shows interaction of ssDNA with transcription protein at the single molecule level. The present studies are on the dynamical behaviour of the ssDNA in terms of its collective vibrational modes in the lows of GHz range. The range of low frequency modes could not be observed in real systems due to the viscous effects of the medium. But the high sensitivity of the detected signal in our system to the overall macromolecular motion makes it possible to observe these vibrational modes in a real system with aqueous media, all are at the single molecule level. The significant amplitude of these low frequency vibrational modes and their consequent importance to the overall construction with motion of DNA is a key enabling feature. The resonant vibrational mode corresponding to larger overall motion of the DNA strand in the optical trap is detected by measuring the increase in the intensity fluctuation of the transmission signal through the aperture. This increase is observable as a peak in the root-mean squared (RMS) deviation of the optical transmission through the DNH when the beat frequency matches the vibrational resonance of the ssDNA. That is, we can measure an increase in the noise amplitude of ssDNA motion due to resonant heating in the closed space. The overall motion of the DNA due to the low frequency vibrational modes is closely related to global dynamic properties such as bending and stretching rigidity of the DNA molecule and it is possible naturally only due to the hidden background interaction forces of SU(6) when unfolding ordinary matter particles after the symmetry breaking of GUT of SU(5).

The experimental set up shown by scientists Abhay Kotnala, Skylar Wheaton and Reuven Gordon, were using a simple double nanohole (DNH) tweezers with inverted microscope geometry and the laser focused on the DNH. The laser transmission through the DNH aperture is collected by a condenser lens and measured as a voltage using an avalanche photodiode (APD). The small gap between the two cusps of DNH has high local field intensity, which enables the trapping of small particles in the range of a few nano-meters. Using statistical techniques on the trapped transmission signal, they studied the binding kinetics of protein-small molecule interaction and estimated their dissociation constant using the DNH tweezers, for exciting the vibrational modes of the molecule in addition to the trapping by using a slightly modified tweezers setup. The single laser is replaced by two trapping lasers then shifted in wavelength by tens of gigahertz and coupled using a 50/50 coupler to produce a single laser beam with amplitude modulation through interference beating. Then beating is achieved by slightly detuned lasers. The beating frequencies were measured using on optical spectrum analyzer and found to be stable within 0.4 GHz. Then ssDNA is trapped, they collect the transmission signal for different beat frequencies and use it to calculate the spectrum of the RMS deviation of the transmission signal. Using this setup, a wide range of beat frequencies between 10 GHz to 0.3THz with resolution of 0.4 GHz is possible, but for the experimental limit of range to 10 GHz-60 GHz, which is the range for interest of the ssDNA modes of their studied. This was done by keeping the wavelength of one laser constant and sweeping wavelength of the other laser by temperature tuning. Then find peak in the resulting spectrum corresponds to the resonant beat frequency. The experiment can be further extended to >10 THz by replacing one of the lasers with a widely-tuneable external cavity laser, which could be exploited to study dynamics in the terahertz region.

The observation from the above experimental results finds, that the intensity fluctuations of the transmission signal is due to the trapped ssDNA for two different regions of the spectrum and to the Gaussian distribution for beat frequencies corresponding to 13-15 GHz (non-resonant frequencies) and 38.5-40.5 GHz (resonant frequency). The first part corresponds to the non-resonant frequency range where the width of the Gaussian distribution corresponds to the small RMS. The second part corresponds to the resonant frequency range where the larger RMS width of the Gaussian distribution corresponds to maximum or the peak RMS values. The Gaussian fit of the transmission signal at resonant frequency shows a 46.6% increase in the width of the Gaussian signal corresponding to resonant heating (as compared to off-resonant excitation). This is seen as a peak in the RMS deviation of the fluctuating transmission signal at the resonant beat frequency. The ssDNA is coupled to the electromagnetic field due to the charge distribution on the DNA strand. The resulting electrostriction force excites the low frequency vibrational modes in the ssDNA molecule. This appears as collective motions of the DNA strand resulting in an accordion–like motion or stretching of the ssDNA. The electrostriction force is modulated by the change in the beat frequencies produced by the two trapping laser beams. At the beat frequency corresponding to the natural frequency of the ssDNA, the DNH tweezers excites the resonant vibrational mode of the ssDNA to heat it up. As a consequence, the Brownian motion of the ssDNA increases hence increases the intensity fluctuations of the transmitted signal through the aperture. The increase in RMS fluctuations occurs when the beat frequency matches the vibrational frequency of a Raman-active acoustic vibration, as they confirmed it by comparison with Lamb's theory. Recently shows by the nor-

malized RMS variation in the transmitted intensity through the DNH as a function of the beat frequency between the lasers for a 20-base ssDNA. The peak RMS is found to be 39.8 GHz. The same peak was observed with variation within 1 GHz around the mean value for different scans done for multiple trapping events. The vibrational resonance modes are expected to be broad due to strong damping by the aqueous surrounding medium. The point of interest is thus, the beat frequency corresponding to the peak in the RMS deviation within the frequency range of interest. Higher frequency harmonics are also observed for larger frequency range sweeps.

They also studied the influence of the size of ssDNA on the resonant vibrational frequency by repeating the above measurements for different lengths of ssDNA ranging from 20 to 40 bases. A decrease in the resonant vibrational frequency with the increase in the length of DNA strand and was found to be in good agreement with the resonant frequency calculation by using the 1-D lattice vibration theory. Thus, the DNH tweezers could characterize very short DNA strands based on their different resonant frequency with resolution down to few bases. A recent work where used terahertz cavity to excite the self-resonant modes of small DNA strands, which showed different resonant frequencies for 50 and 100bp DNA strands. The method of works in the terahertz frequency domain and is not a single molecule method as compared to the present technique. Since the experiments were done for dsDNA, which has different mechanical characteristics than ssDNA. Compared to that work, their method provides better resolution of few base pairs to distinguish between different oligo-nucleotides length sequence.

Calculation of the resonant modes of ssDNA by using simple one-dimensional lattice vibration theory, the ssDNA is considered as a linear chain of atoms with the atomic groups replaced by average mass 'M' of the DNA sequence connected by effective springs with spring constant κ. Since the sequences were roughly equally distributed among the bases, so using an average is reasonable. The solution of the classical equation of motion for the ssDNA using this model gives the resonant vibrational frequency as (within the harmonic approximation)

$$\omega r \approx \prod / Nb \sqrt{(\kappa / M)}$$

Where Nb is the number of bases in the ssDNA, κ is the spring constant or stretch modulus. The freely jointed chain model of the ssDNA molecule used to determine the stretching elastic constant of the ssDNA has been studied extensively, using this stretching elastic constant value for calculation of resonant frequency. The spring constant of the ssDNA is given as $\kappa = 123.5$ kBT/nm², kB is the Boltzmann constant, generally accepted value of the stretch modulus of the sugar phosphate backbone of ssDNA molecule irrespective of the base sequence in the given approximation.

From the above experimental observations, using double nanohole (DNH) optical tweezers with two trapping lasers beating to excite the vibrational modes of single-stranded DNA (ssDNA) fragments in the extremely high frequency range we found then resonant vibration frequency of a base ssDNA to be 40 GHz. It was observed that the change in the resonant frequency for different lengths of the DNA strand is in good agreement with one dimensional lattice vibration theory. Thus, the DNH tweezers system could distinguish between different lengths of DNA strand with resolution down to a few bases. By varying the base sequence and length, it is therefore possible to adjust the resonance frequency vibration spectrum. These techniques may show the potentiality for using in sequencing applications if we improve the resolution of the present system, we can detect any changes in resonant frequencies for a single base within a given sequence.

The Interpretations of Influences by Exotic Matters or Colloidal Fluids

The experiences of laboratorial observational studies shown the influences of the fluid flow for increasing the laser power are very much reasonable to compare with the study of above discussions for appearance of nano-particles then naturally trapping nano-particles etc. the influences are very much countable from the exotic matter fluid stages to ordinary mater particle formation of the universe through colloidal stages of fluid flows for the generations of different laser designated power beams by photons including photon-likes fluxes of energies, which are the causes for creation & smoothness of everything of our physical universe. In view point of above laboratorial observational studies, we found the ability to trap optically a 20 nm polystyrene particle in reality from a stationary micro fluidic environment and how then hold it against flow. Increased laser power is required to hold nano-particles then obviously increased the flow rate with an empirical linear dependence of 1 ml/(min3mW). This is promising for the delivery of additional nano-particles to interact with a trapped nano-particle; such as, to study protein-protein interactions, and for the ability to move the trapped particle in solution from one location to another. The ability of optical trapping to immobilize and manipulate nano-particles has opened up new possibilities for manipulation at the nano-meter scale. Considering, this trapping system used in the characterization and placement of colloidal quantum dots from the colloidal stages of universe, therefore we interested for study the nano-scale biological interactions; those involving protein-protein interactions, antigen–antibody binding, and the manipulation of individual virus particles.

Some biological nano-particles have been trapped by conventional methods such as the tobacco mosaic virus and bacteria, but these are usually highly elongated, and therefore more polarizable than simple spheres of the same volume. Optical tweezers have also been used to trap dielectric nano-spheres, carbon nano-tubes, semiconductor nano-wires, DNA strains, and metal nano-particles. Also, excellent reviews on the fundamentals of plasmonic trapping are available. One approach for trapping of these small nano-particles with conventional optical tweezers is tethering a micrometer-sized bead to them. Tethering, however, introduces sterics issues that hinder studying of processes such as protein-protein interaction and processes which require binding to a surface.

To achieve the large trap stiffness and highly localized field intensities, many have used nano-photonic and plasmonic optical traps. These traps, however, are still perturbative in the sense that the traditional gradient force calculation can be used to quantify the trapping, and therefore, they require either large local intensities to trap small objects, or highly polarizable particles.

Trapping with apertures in metal films has been used to overcome the problem of required high intensities. In 2009, trapping 50 nm polystyrene particles with 1 mW of power was demonstrated using an aperture in a metal film. It was confirmed by comprehensive numerical calculations that this aperture trapping method does not follow the traditional third power scaling with particle size. The particle to be trapped strongly modifies the local electromagnetic environment and thereby facilitates the trapping – for this reason, the approach was referred to as self-induced back-action (SIBA) optical trapping. Shaped apertures can lead to further improved trapping performance of even smaller particles. For example, used a double-hole aperture to trap 12 nm particle, a rectangular aperture has been used to trap particles as small as 22 nm, with a propensity for trapping of multiple particles simultaneously. Later, used the double-hole aperture to trap and unfold single proteins, which is a promising step for studying the interactions of biological particles at the single particle level (e.g., protein binding).

Conclusion

The conclusion is very clear from the above discussion that there are two region of explanation such as the theory of SUT of SU(11)[⊃ SU(6) × SU(5) × U(1)], explained the whole material system of physical universe including the appearances of lives, other is popularly known as GUT theorem of SU(5) [⊃ SU(3) × SU(2) × U(1)], which explained mostly the pure matter element formations of this universe. Thus for explanation of everything we need to consider the symmetry breaking of super unified theorem of SU(11), where created nascent particle-likes from colloidal fluids before the appearance of ordinary matter particles including new kind of light rays.

There created natural "Holography Optical Tweezers" uses laser-designated energy waves of new kind of light rays trapping nano-colloidal-particles for the creation of animates & inanimate, only possible in a particular situation of the physical universe. It was shown in the laboratory experiments that artificial HOTs using laser light trapping nano-particles of bio-molecules. A kind of laser-like beam was created by photon-based light rays with photon-likes after the interactions with neutrinos of new energies SU(6) can widely useable for future medical treatments. This new kind of laser-like beams can possible to produce artificially in laboratory by the special attention of upgrading the instrumentation setup of experiments, specially it opens a new path for future medical treatments of human & lives. It will be unfolding a new regime of medical science revolution. We compare it like the invention of X-Rays from the experimental set-up of cathode rays, which are very much essential for our everyday life.

These new kind of laser or radio wave designated light rays appears with high intensities short wave lengths energy waves etc. appears in a particular situation of the space-time, then interacting with magnetic monopole of U(1) within the ocean of electrons creating various electromagnetic forces. The new kind of light rays are actually exerted by the new energy sources that appears with different gradient forces due to various inclination of rays from hollow black-hole or multiple hollow nano-holes of different apertures which then behaving like holography optical tweezers for trapping multiple nano-particles, found then natural materials with living substances in this physical world. It is possible to create the same situation artificially in laboratory through experimental set-up of holography optical tweezers using laser light and then repeatedly changing experimental setup we found different laser-designated beam of light rays or designated radio-waves. Treatments in medical science using this kind of new light rays will open a "Pandora's box" for the next generation.

Very recently, CERN of Geneva at LHC announced boldly that they were discovered more than 90 new particle-likes other than fundamental particles of block building like protons, neutrons, electrons etc. These particles only visible in the laboratory experiments and remains hidden in the background of ordinary particle interaction of block building, although scientist declared that those are formed by "charm quarks" etc. We now assuming there must be exists some new kind of aforesaid intermediate fundamental particle-likes, as auxiliary matter particles remains before the formation of ordinary matter particles. In our present dissertation we try to establishing the existences of many more new particle-likes to be in SUT model of SU(11).

I, believe that scientists in future will observe more & more new desire particle-likes in laboratory experiment by advancing with technology, which will confirm the present dissertation, then find these are actually the backgrounds of all basic elementary particle formation including of bio molecules such as DNA, Protein molecules etc.

References

1. Narayan Kumar Bhadra .(2021). Photoelectric Effects: Human Mind & Sense Datum. IOSR Journal of Applied Physics (IOSR-JAP, 13(3), 59-73.
2. Narayan Kumar Bhadra .(2020). How "SU" Levels Are Imply For Life & Consciousness. Advances in Bioengineering and Biomedical Science Research, 3(2), 58.
3. Narayan Kumar Bhadra .(2014). The Origin of Consciousnessin the Universe. IOSR Journal of Mathematics, 10(5), 53-68.
4. Narayan Kumar Bhadra .(2013). The Complex Quantum andClassical Pseudo-Tachyonic Universe. IOSR Journal of Mathematics, 8(3), 15-32.
5. Bhadra, N. K. (2013). The Complex Quantum-State of Black-Hole and Thermo-statistics. IOSR Journal of Mathematics, 8, 1-19.
6. Bhadra, N. K. (2012). The complex model of the quantum universe. IOSR Journal of Mathematics, 4(1), 20-33.
7. Narayan Kumar Bhadra .(2017). The Complex Quantum-Stateof Consciousness. IOSR Journal of Applied Phys-

ics 9, 57-93.
8. Bhadra, N. K. (2019). Revised Standard Model of Physics and Origin of Biology. IOSR Journal of Applied Physics, 2, 12-40.
9. Narayan Kumar Bhadra .(2019). A Human is a Miniature ofUniverse. IOSR Journal of Biotechnology and Biochemistry 5, 56-73.
10. Narayan Kumar Bhadra .(2012). The complex model of theuniverse. IOSR Journal of Mathematics 2, 41-45.
11. Bhadra, N. K., & Di Sia, P. (2019). Mind and consciousness as created by electromagnetic force. International Journal of Applied and Advanced Scientific Research (IJAASR), 4(1), 1-6.
12. Di Sia, P., & Bhadra, N. K. (2020). Origin of consciousness and contemporary physics. World Scientific News, 140, 127-138.
13. Di Sia, P., & Bhadra, N. K. (2020). Origin of living matter by a new model of consciousness. World Scientific News, 143, 67-78.
14. Di Sia, P., & Bhadra, N. K. (2020). Everything in a part: about the creation of universe and consciousness. Ergonomics Int J, 4, 000228.
15. Kotnala, A., Wheaton, S., & Gordon, R. (2015). Playing the notes of DNA with light: extremely high frequency nanomechanical oscillations. Nanoscale, 7(6), 2295-2300.
16. van der Horst, A., & Forde, N. R. (2008). Calibration of dynamic holographic optical tweezers for force measurements on biomaterials. Optics express, 16(25), 20987-21003.
17. Ravindranath, A. L., Shariatdoust, M. S., Mathew, S., & Gordon, R. (2019). Colloidal lithography double-nanohole optical trapping of nanoparticles and proteins. Optics express, 27(11), 16184-16194.
18. Zehtabi-Oskuie, A., Bergeron, J. G., & Gordon, R. (2012). Flow-dependent double-nanohole optical trapping of 20 nm polystyrene nanospheres. Scientific reports, 2(1), 1-4.
19. Gross, P., Laurens, N., Oddershede, L. B., Bockelmann, U., Peterman, E. J., & Wuite, G. J. (2011). Quantifying how DNA stretches, melts and changes twist under tension. Nature Physics, 7(9), 731-736.
20. Zhao, Y., Chen, D., Yue, H., French, J. B., Rufo, J., Benkovic, S. J., & Huang, T. J. (2013). Lab-on-a-chip technologies for single-molecule studies. Lab on a Chip, 13(12), 2183-2198.
21. Williams, M. C., & Rouzina, I. (2002). Force spectroscopy of single DNA and RNA molecules. Current opinion in structural biology, 12(3), 330-336.
22. Deniz, A. A., Laurence, T. A., Dahan, M., & Chemla, D. S. (2001). Ratiometric single-molecule studies of freely diffusing biomolecules. Annual review of physical chemistry, 52, 233.
23. Mills, J. B., Vacano, E., & Hagerman, P. J. (1999). Flexibility of single-stranded DNA: use of gapped duplex helices to determine the persistence lengths of poly (dT) and poly (dA). Journal of molecular biology, 285(1), 245-257.
24. Kuznetsov, S. V., Shen, Y., Benight, A. S., & Ansari, A. (2001). A semiflexible polymer model applied to loop formation in DNA hairpins. Biophysical Journal, 81(5), 2864-2875.
25. Rivetti, C., Walker, C., & Bustamante, C. (1998). Polymer chain statistics and conformational analysis of DNA molecules with bends or sections of different flexibility. Journal of molecular biology, 280(1), 41-59.
26. Urabe, H., Tominaga, Y., & Kubota, K. (1983). Experimental evidence of collective vibrations in DNA double helix (Raman spectroscopy). The Journal of Chemical Physics, 78(10), 5937-5939.
27. Krisch, M., Mermet, A., Grimm, H., Forsyth, V. T., & Rupprecht, A. (2006). Phonon dispersion of oriented DNA by inelastic x-ray scattering. Physical Review E, 73(6), 061909.
28. Lindsay, S. M., & Powell, J. (1983). Structure and Dynamics: Nucleic Acids and Proteins. ClementiE. & SarmaR. H., Eds., Adenine Press, New York, 241-260.
29. Schroll, W. K., Prabhu, V. V., Prohofsky, E. W., & Van Zandt, L. L. (1989). Phonon interpretation of inelastic neutron scattering in DNA crystals. Biopolymers: Original Research on Biomolecules, 28(7), 1189-1193.
30. Woolard, D. L., Globus, T. R., Gelmont, B. L., Bykhovskaia, M., Samuels, A. C., Cookmeyer, D., ... & Loerop, W. R. (2002). Submillimeter-wave phonon modes in DNA macromolecules. Physical Review E, 65(5), 051903.
31. Blinov, V. N., & Golo, V. L. (2011). Acoustic spectroscopy of DNA in the gigahertz range. Physical Review E, 83(2), 021904.
32. Woolard, D. L., Koscica, T., Rhodes, D. L., Cui, H. L., Pastore, R. A., Jensen, J. O., ... & Nuss, M. C. (1997, July). Millimeter Wave-induced Vibrational Modes in DNA as a Possible Alternative to Animal Tests to Probe for Carcinogenic Mutations. In Journal of Applied Toxicology: An International Forum Devoted to Research and Methods Emphasizing Direct Clinical, Industrial and Environmental Applications (Vol. 17, No. 4, pp. 243-246). Chichester: John Wiley & Sons, Ltd..
33. Maragò, O. M., Jones, P. H., Gucciardi, P. G., Volpe, G., & Ferrari, A. C. (2013). Optical trapping and manipulation of nanostructures. Nature nanotechnology, 8(11), 807-819.
34. K. Chou, Trends Biochem. Sci., 1989, 14, 212.
35. Kuo-Chen, C. H. O. U. (1984). THE BIOLOGICAL FUNCTIONS OF LOW-FREQUENCY VIBRATIONS (PHONONS) 4. RESONANCE EFFECTS AND ALLOSTERIC TRANSITION. Biophysical Chemistry, 20, 61-71.
36. Thomas Jr, G. J. (1999). Raman spectroscopy of protein and nucleic acid assemblies. Annual review of biophysics and biomolecular structure, 28(1), 1-27.
37. Barhoumi, A., Zhang, D., Tam, F., & Halas, N. J. (2008). Surface-enhanced Raman spectroscopy of DNA. Journal of the American Chemical Society, 130(16), 5523-5529.
38. Powell, J. W., Edwards, G. S., Genzel, L., Kremer, F., Wittlin, A., Kubasek, W., & Peticolas, W. (1987). Investigation of far-infrared vibrational modes in polynucleotides. Physical Review A, 35(9), 3929.
39. Wittlin, A., Genzel, L., Kremer, F., Häseler, S., Poglitsch, A., & Rupprecht, A. (1986). Far-infrared spectroscopy on oriented films of dry and hydrated DNA. Physical Review A, 34(1), 493.
40. Ashkin, A., Dziedzic, J. M., & Yamane, T. (1987). Optical trapping and manipulation of single cells using infrared la-

ser beams. Nature, 330(6150), 769-771.
41. Curto, A. G., Volpe, G., Taminiau, T. H., Kreuzer, M. P., Quidant, R., & van Hulst, N. F. (2010). Unidirectional emission of a quantum dot coupled to a nanoantenna. Science, 329(5994), 930-933.
42. Pattantyus-Abraham, A. G., Qiao, H., Shan, J., Abel, K. A., Wang, T. S., van Veggel, F. C., & Young, J. F. (2009). Site-selective optical coupling of PbSe nanocrystals to Si-based photonic crystal microcavities. Nano Letters, 9(8), 2849-2854.
43. Jeffrey N. Anker, W. Paige Hall, Olga Lyandres, Nilam C. Shah, Jing Zhao, et al. (2008). Biosensing with plasmonic nanosensors. Nat Mater 7, 442-453.
44. Ferreira, J., Santos, M. J., Rahman, M. M., Brolo, A. G., Gordon, R., Sinton, D., & Girotto, E. M. (2009). Attomolar protein detection using in-hole surface plasmon resonance. Journal of the American Chemical Society, 131(2), 436-437.
45. Romanuik, S. F., Grist, S. M., Gray, B. L., Hohertz, D., Kavanagh, K. L., Gulzar, N., ... & Gordon, R. (2010, November). Sensing of antibodies secreted by microfluidically trapped cells via extraordinary optical transmission through nanohole arrays. In SENSORS, 2010 IEEE (pp. 2105-2108). IEEE.
46. Seisenberger, G., Ried, M. U., Endress, T., Buning, H., Hallek, M., & Brauchle, C. (2001). Real-time single-molecule imaging of the infection pathway of an adeno-associated virus. Science, 294(5548), 1929-1932.
47. Ashkin, A., Dziedzic, J. M., Bjorkholm, J. E., & Chu, S. (1986). Observation of a single-beam gradient force optical trap for dielectric particles. Optics letters, 11(5), 288-290.
48. Ashkin, A., & Dziedzic, J. M. (1987). Optical trapping and manipulation of viruses and bacteria. Science, 235(4795), 1517-1520.
49. Dholakia, K., Reece, P., & Gu, M. (2008). Optical micromanipulation. Chemical Society Reviews, 37(1), 42-55.
50. Kwak, E. S., Onuta, T. D., Amarie, D., Potyrailo, R., Stein, B., Jacobson, S. C., ... & Dragnea, B. (2004). Optical trapping with integrated near-field apertures. The Journal of Physical Chemistry B, 108(36), 13607-13612.
51. Marago, O. M., Jones, P. H., Bonaccorso, F., Scardaci, V., Gucciardi, P. G., Rozhin, A. G., & Ferrari, A. C. (2008). Femtonewton force sensing with optically trapped nanotubes. Nano letters, 8(10), 3211-3216.
52. Reece, P. J., Toe, W. J., Wang, F., Paiman, S., Gao, Q., Tan, H. H., & Jagadish, C. (2011). Characterization of semiconductor nanowires using optical tweezers. Nano letters, 11(6), 2375-2381.
53. Yang, A. H., Moore, S. D., Schmidt, B. S., Klug, M., Lipson, M., & Erickson, D. (2009). Optical manipulation of nanoparticles and biomolecules in sub-wavelength slot waveguides. Nature, 457(7225), 71-75.
54. Pelton, M., Liu, M., Kim, H. Y., Smith, G., Guyot-Sionnest, P., & Scherer, N. F. (2006). Optical trapping and alignment of single gold nanorods by using plasmon resonances. Optics letters, 31(13), 2075-2077.
55. Selhuber-Unkel, C., Zins, I., Schubert, O., Sonnichsen, C., & Oddershede, L. B. (2008). Quantitative optical trapping of single gold nanorods. Nano letters, 8(9), 2998-3003.
56. Juan, M. L., Righini, M., & Quidant, R. (2011). Plasmon nano-optical tweezers. Nature photonics, 5(6), 349-356.
57. Erickson, D., Serey, X., Chen, Y. F., & Mandal, S. (2011). Nanomanipulation using near field photonics. Lab on a Chip, 11(6), 995-1009.
58. Miao, X., Wilson, B. K., Pun, S. H., & Lin, L. Y. (2008). Optical manipulation of micron/submicron sized particles and biomolecules through plasmonics. Optics Express, 16(18), 13517-13525.
59. Kim, J. (2012). Joining plasmonics with microfluidics: from convenience to inevitability. Lab on a Chip, 12(19), 3611-3623.
60. Wang, M. D., Yin, H., Landick, R., Gelles, J., & Block, S. M. (1997). Stretching DNA with optical tweezers. Biophysical journal, 72(3), 1335-1346.
61. Abbondanzieri, E. A., Greenleaf, W. J., Shaevitz, J. W., Landick, R., & Block, S. M. (2005). Direct observation of base-pair stepping by RNA polymerase. Nature, 438(7067), 460-465.
62. Finer, J. T., Simmons, R. M., & Spudich, J. A. (1994). Single myosin molecule mechanics: piconewton forces and nanometre steps. Nature, 368(6467), 113-119.
63. Chen, C., Juan, M. L., Li, Y., Maes, G., Borghs, G., Van Dorpe, P., & Quidant, R. (2012). Enhanced optical trapping and arrangement of nano-objects in a plasmonic nanocavity. Nano letters, 12(1), 125-132.
64. Ashok, P. C., & Dholakia, K. (2012). Optical trapping for analytical biotechnology. Current opinion in biotechnology, 23(1), 16-21.
65. Huang, L., & Martin, O. J. (2008). Reversal of the optical force in a plasmonic trap. Optics letters, 33(24), 3001-3003.
66. Nieto-Vesperinas, M., Chaumet, P. C., & Rahmani, A. (2004). Near-field photonic forces. Philosophical Transactions of the Royal Society of London. Series A: Mathematical, Physical and Engineering Sciences, 362(1817), 719-737.
67. Okamoto, K., & Kawata, S. (1999). Radiation force exerted on subwavelength particles near a nanoaperture. Physical review letters, 83(22), 4534.
68. Novotny, L., Bian, R. X., & Xie, X. S. (1997). Theory of nanometric optical tweezers. Physical Review Letters, 79(4), 645.
69. Yang, A. H., Moore, S. D., Schmidt, B. S., Klug, M., Lipson, M., & Erickson, D. (2009). Optical manipulation of nanoparticles and biomolecules in sub-wavelength slot waveguides. Nature, 457(7225), 71-75.
70. Righini, M., Ghenuche, P., Cherukulappurath, S., Myroshnychenko, V., García de Abajo, F. J., & Quidant, R. (2009). Nano-optical trapping of Rayleigh particles and Escherichia coli bacteria with resonant optical antennas. Nano letters, 9(10), 3387-3391.
71. Ohlinger, A., Nedev, S., Lutich, A. A., & Feldmann, J. (2011). Optothermal escape of plasmonically coupled silver nanoparticles from a three-dimensional optical trap. Nano letters, 11(4), 1770-1774.
72. Donner, J. S., Baffou, G., McCloskey, D., & Quidant, R. (2011). Plasmon-assisted optofluidics. Acs nano, 5(7), 5457-5462.

73. Righini, M., Zelenina, A. S., Girard, C., & Quidant, R. (2007). Parallel and selective trapping in a patterned plasmonic landscape. Nature Physics, 3(7), 477-480.
74. Righini, M., Volpe, G., Girard, C., Petrov, D., & Quidant, R. (2008). Surface plasmon optical tweezers: tunable optical manipulation in the femtonewton range. Physical review letters, 100(18), 186804.
75. Yang, A. H., Lerdsuchatawanich, T., & Erickson, D. (2009). Forces and transport velocities for a particle in a slot waveguide. Nano letters, 9(3), 1182-1188.
76. Hu, J., Lin, S., Kimerling, L. C., & Crozier, K. (2010). Optical trapping of dielectric nanoparticles in resonant cavities. Physical Review A, 82(5), 053819.
77. Barth, M., & Benson, O. (2006). Manipulation of dielectric particles using photonic crystal cavities. Applied physics letters, 89(25), 253114.
78. Juan, M. L., Gordon, R., Pang, Y., Eftekhari, F., & Quidant, R. (2009). Self-induced back-action optical trapping of dielectric nanoparticles. Nature Physics, 5(12), 915-919.
79. Pang, Y., & Gordon, R. (2011). Optical trapping of 12 nm dielectric spheres using double-nanoholes in a gold film. Nano letters, 11(9), 3763-3767.
80. Pang, Y., & Gordon, R. (2012). Optical trapping of a single protein. Nano letters, 12(1), 402-406.
81. Neumann, L., Pang, Y., Houyou, A., Juan, M. L., Gordon, R., & Van Hulst, N. F. (2011). Extraordinary optical transmission brightens near-field fiber probe. Nano letters, 11(2), 355-360.
82. Weber-Bargioni, A., Schwartzberg, A., Cornaglia, M., Ismach, A., Urban, J. J., Pang, Y., ... & Schuck, P. J. (2011). Hyperspectral nanoscale imaging on dielectric substrates with coaxial optical antenna scan probes. Nano letters, 11(3), 1201-1207.
83. Bruus, H. (2004). Theoretical microfluidics; Lecture notes. Denmark, MIC Department of Micro and Nanotechnology, Technical University of Denmark.
84. Ashkin, A., Dziedzic, J. M., Bjorkholm, J. E., & Chu, S. (1986). Observation of a single-beam gradient force optical trap for dielectric particles. Optics letters, 11(5), 288-290.
85. Moffitt, J. R., Chemla, Y. R., Smith, S. B., & Bustamante, C. (2008). Recent advances in optical tweezers. Annual review of biochemistry, 77(1), 205-228.
86. Greenleaf, W. J., Woodside, M. T., & Block, S. M. (2007). High-resolution, single-molecule measurements of biomolecular motion. Annual review of biophysics and biomolecular structure, 36, 171.
87. Bustamante, C., Chemla, Y. R., Forde, N. R., & Izhaky, D. (2004). Mechanical processes in biochemistry. Annual review of biochemistry, 73(1), 705-748.
88. Lenormand, G., Hénon, S., Richert, A., Siméon, J., & Gallet, F. (2001). Direct measurement of the area expansion and shear moduli of the human red blood cell membrane skeleton. Biophysical journal, 81(1), 43-56.
89. Visscher, K., Brakenhoff, G. J., & Krol, J. J. (1993). Micromanipulation by "multiple" optical traps created by a single fast scanning trap integrated with the bilateral confocal scanning laser microscope. Cytometry: The Journal of the International Society for Analytical Cytology, 14(2), 105-114.
90. Vossen, D. L., van der Horst, A., Dogterom, M., & van Blaaderen, A. (2004). Optical tweezers and confocal microscopy for simultaneous three-dimensional manipulation and imaging in concentrated colloidal dispersions. Review of Scientific Instruments, 75(9), 2960-2970.
91. Deng, Y., Bechhoefer, J., & Forde, N. R. (2007). Brownian motion in a modulated optical trap. Journal of Optics A: Pure and Applied Optics, 9(8), S256.
92. Dufresne, E. R., & Grier, D. G. (1998). Optical tweezer arrays and optical substrates created with diffractive optics. Review of scientific instruments, 69(5), 1974-1977.
93. Reicherter, M., Haist, T., Wagemann, E. U., & Tiziani, H. J. (1999). Optical particle trapping with computer-generated holograms written on a liquid-crystal display. Optics letters, 24(9), 608-610.
94. Lesem, L. B., Hirsch, P. M., & Jordan, J. A. (1969). The kinoform: a new wavefront reconstruction device. IBM Journal of Research and Development, 13(2), 150-155.
95. Liesener, J., Reicherter, M., Haist, T., & Tiziani, H. J. (2000). Multi-functional optical tweezers using computer-generated holograms. Optics Communications, 185(1-3), 77-82.
96. Curtis, J. E., Koss, B. A., & Grier, D. G. (2002). Dynamic holographic optical tweezers. Optics communications, 207(1-6), 169-175.
97. Wulff, K. D., Cole, D. G., Clark, R. L., DiLeonardo, R., Leach, J., Cooper, J., ... & Padgett, M. J. (2006). Aberration correction in holographic optical tweezers. Optics Express, 14(9), 4169-4174.
98. Spalding, G. C., Courtial, J., & Di Leonardo, R. (2008). Holographic optical tweezers (pp. 139-157). Academic Press.
99. Grier, D. G. (2003). A revolution in optical manipulation. nature, 424(6950), 810-816.
100. Dholakia, K., Macdonald, M., & Spalding, G. (2002). Optical tweezers: the next generation. Physics world, 15(10), 31.
101. Neuman, K. C., & Block, S. M. (2004). Optical trapping. Review of scientific instruments, 75(9), 2787-2809.
102. Belloni, F., Monneret, S., Monduc, F., & Scordia, M. (2008). Multiple holographic optical tweezers parallel calibration with optical potential well characterization. Optics Express, 16(12), 9011-9020.
103. Sinclair, G., Jordan, P., Leach, J., Padgett, M. J., & Cooper, J. (2004). Defining the trapping limits of holographical optical tweezers. journal of modern optics, 51(3), 409-414.
104. Di Leonardo, R., Ianni, F., & Ruocco, G. (2007). Computer generation of optimal holograms for optical trap arrays. Optics Express, 15(4), 1913-1922.
105. Haellstig, E. J., Sjoeqvist, L., & Lindgren, M. (2003). Intensity variations using a quantized spatial light modulator for nonmechanical beam steering. Optical Engineering, 42(3), 613-619.
106. Tan, K. L., Warr, S. T., Manolis, I. G., Wilkinson, T. D., Redmond, M. M., Crossland, W. A., ... & Robertson, B. (2001). Dynamic holography for optical interconnections. II. Routing holograms with predictable location and intensity of each diffraction order. JOSA A, 18(1), 205-215.
107. Burnham, D. R., & McGloin, D. (2006). Holographic op-

tical trapping of aerosol droplets. Optics express, 14(9), 4175-4181.
108. Carter, B. C., Shubeita, G. T., & Gross, S. P. (2005). Tracking single particles: a user-friendly quantitative evaluation. Physical biology, 2(1), 60.
109. Visscher, K., Gross, S. P., & Block, S. M. (1996). Construction of multiple-beam optical traps with nanometer-resolution position sensing. IEEE journal of selected topics in quantum electronics, 2(4), 1066-1076.
110. Berg-Sørensen, K., & Flyvbjerg, H. (2004). Power spectrum analysis for optical tweezers. Review of Scientific Instruments, 75(3), 594-612.
111. Polin, M., Ladavac, K., Lee, S. H., Roichman, Y., & Grier, D. G. (2005). Optimized holographic optical traps. Optics Express, 13(15), 5831-5845.
112. Keen, S., Leach, J., Gibson, G., & Padgett, M. J. (2007). Comparison of a high-speed camera and a quadrant detector for measuring displacements in optical tweezers. Journal of Optics A: Pure and Applied Optics, 9(8), S264.
113. Allersma, M. W., Gittes, F., deCastro, M. J., Stewart, R. J., & Schmidt, C. F. (1998). Two-dimensional tracking of ncd motility by back focal plane interferometry. Biophysical journal, 74(2), 1074-1085.
114. Osten, S., Krüger, S., & Hermerschmidt, A. (2008). New HDTV (1920× 1080) phase-only SLM–Poster Paper. In Adaptive Optics for Industry and Medicine (pp. 124-129).
115. Klug, U., Boyle, M., Friederich, F., Kling, R., & Ostendorf, A. (2008, February). Laser beam shaping for micromaterial processing using a liquid crystal display. In Micromachining and Microfabrication Process Technology XIII (Vol. 6882, pp. 30-37). SPIE.
116. Serati, S., & Harriman, J. (2006, September). Spatial light modulator considerations for beam control in optical manipulation applications. In Optical Trapping and Optical Micromanipulation III (Vol. 6326, pp. 729-739). SPIE.
117. Curtis, J. E., Schmitz, C. H., & Spatz, J. P. (2005). Symmetry dependence of holograms for optical trapping. Optics letters, 30(16), 2086-2088.
118. Schmitz, C. H., Spatz, J. P., & Curtis, J. E. (2005). High-precision steering of multiple holographic optical traps. Optics Express, 13(21), 8678-8685.
119. Eriksson, E., Keen, S., Leach, J., Goksör, M., & Padgett, M. J. (2007). The effect of external forces on discrete motion within holographic optical tweezers. Optics Express, 15(26), 18268-18274.
120. Valentine, M. T., Guydosh, N. R., Gutiérrez-Medina, B., Fehr, A. N., Andreasson, J. O., & Block, S. M. (2008). Precision steering of an optical trap by electro-optic deflection. Optics letters, 33(6), 599-601.
121. Pralle, A., Prummer, M., Florin, E. L., Stelzer, E. H. K., & Hörber, J. K. H. (1999). Three-dimensional high-resolution particle tracking for optical tweezers by forward scattered light. Microscopy research and technique, 44(5), 378-386.
122. Lee, S. H., Roichman, Y., Yi, G. R., Kim, S. H., Yang, S. M., Van Blaaderen, A., ... & Grier, D. G. (2007). Characterizing and tracking single colloidal particles with video holographic microscopy. Optics express, 15(26), 18275-18282.