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Article

Heat and Photon Energy Phenomena: Dealing with Matter at Atomic and Electronic Level

Mubarak Ali

Department of Physics, COMSATS University Islamabad, Islamabad Campus, Park Road, 45550, Pakistan, mubarak74@mail.com

Abstract: Misconception in using the terms photon and electron exists in science. When the electron of the outer ring in the silicon atom executes interstate dynamics for only one cycle, it generates force and energy for the unit photon. Interstate electron dynamics for one forward and reverse cycle generate the overt photon having the least measured length. When the photon of suitable length interacts with the side of the laterally orientated electron of an atom, it converts into heat energy. Under the approximate angle of 90º, when a photon interacts with the tip of a laterally orientated electron, it divides into bits of energy having a shape like integral symbols. In the neutral state silicon atom, the centre acts as the reference point for electrons executing interstate dynamics, and the lateral lengths of the electrons remain along the north-south poles. Under the availability of energy and force, the energy wraps around the force shaping along the tracing trajectory of electron dynamics in a silicon atom. A shaping force due to two poles is from those sides of the electron, not dealing with the force of the remaining two poles. In interstate dynamics, the electron of the outer ring first reaches the maximum limit point, where the energy of one bit is shaped. Electron completes the second half cycle dealing with relevant forces from the maximum limit point, where the energy of one bit is shaped. The shape of the unit photon is like Gaussian distribution having turned ends. When there is an uninterrupted supply of heat energy to the silicon atom, electron dynamics generate the photon having a shape-like wave. Path independent but interstate dependent forces take over the control of an electron. That electron executes dynamics nearly at the speed of light. In confined interstate dynamics, naturally viable conservative forces exert on the position-acquiring electron. A photon can be in the unending length if the electron dynamics remain uninterrupted. Having not made contact with states limiting the forces at work, the changing aspect of the electron recalls the auxiliary moment of inertia at each point of turning. By executing electron dynamics, atoms under neutral states generate photons of different shapes, revealing heat and photon energy phenomena.

Keywords: heat energy; photon energy; fundamental forces; electron dynamics; atomic-scale phenomenon; photon-matter interaction

1. Introduction

Technology is achieving its climax, but a basic understanding of science in numerous phenomena is still required. The creation of earth has benefited from heat and photon energy since its existence. Again, many studies have studied different phenomena such as electrical discharges. Catching fire to different materials and burning various commodities are the usual phenomena under observation.

Many studies have been discussed in the literature studying the light-matter interaction, mainly covered under a phenomenon known as surface plasmons. The origin of plasmons has been explored in some early published reports [1-4]. A plasmon is a quantum of plasma oscillating and representing the collective oscillations of the free electron gas density.

The interaction of light or photons with matter is recognized in various terminologies, such as phonons, excitons and plasmons. A study based on reviews discussed light-

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matter interaction considering the properties of polariton modes in two-dimensional materials [5]. The concept of excitons or electron-hole pairs was first proposed by Frenkel [6]. It deals with an excited state of the atom in a lattice traveling in a particle-like fashion without the net transfer of charge. Excitons can be formed due to photon absorption by a quantum dot [7], where the phonon is a collective excitation in the periodic arrangement of atoms or molecules.

Various studies dealing with different developing processes involve tiny-sized particles. The tiny-sized cluster is a simple chemical compound with various essential applications in diversified areas [8]. The unique nature of nanocrystals solicits the fabrication of new materials having controlled features [9]. The likely development of nanoparticle technology is an obvious long-term benefit [10]. On successfully assembling tiny-metallic colloids in the bigger-sized particles, atoms and molecules would be treated as materials soon [11]. The investigation of the dynamics of individual nanoparticles should be taken as a prime concern prior to going into rational deliberations [12].

A good understanding of the surface features of nanoparticles would lead to the development of high-order materials [13]. Tiny-sized clusters possess molecule-shaped electronic and non-face-centered cubic geometric structures [14]. The chemical properties of gold nanoparticles change with size [15]. Geometric and distorted particles deal with different forces to amalgamate in solution [16]. It has been discussed that localized dynamics of the process are one of the causes that contribute to developing the structure of gold atoms [17-20], silver atoms [20] and carbon atoms [21, 22].

The study of tiny-shaped particles dealing with the elongation of atoms of arrays was also studied [23]. When the stretching of energy knots clamped electrons in an atom is uniform, it is related to the elongation of the atom [24].

Sir Isaac Newton explained gravity, which is called Newtonian Physics. Sir Albert Einstein explained the theory of General Relativity. Bohr proposed that electrons move around the nucleus in allocated orbits, where they have fixed energy in the ground state. The levitational force exerted at the electron level in the gaseous atoms remained beyond the understanding. The study of the bandgap, valence, and conduction bands prevailing in different phenomena. The configuration of the atomic structure remained only associated with the studies of orbits and shells. The concepts of the quantum states also remained part of studying atomic structure.

A recently published study discussed the atomic structure in different gaseous and solid elements with new insights [25]. However, the conventional studies kept the researchers from thinking about different atomic behaviors. Massive efforts were made to explore technological advances and breakthroughs. The efforts put forth towards exploring fundamental science remained less effective. Nevertheless, fundamental aspects of structure evolutions in suitable atoms were studied in a separate study [26]. Fundamental aspects of binding different state carbon atoms have been discussed [27].

The interaction of the overt photon with an electron of the occupied energy knot is studied here. The conversion of heat energy into photons under electron dynamics of the silicon atom is discussed in the current study. Here, the matter at the atomic level revealing the phenomena of heat and photon energy is being discussed.

2. Experimental Details

This work does not contain specific experimental detail. However, all those studies studying the photon-matter interaction, light-matter interaction, relation between electron and photon, heat energy, photon energy, fundamental forces, renewable energy, photovoltaics, bandgap, semiconductors, energy science, energy application, energy materials, physics and chemistry of materials may refer this study.

3. Results and Discussion

The multiple interactions can deform solid atoms forming the nanoparticles and particles [16]. As discussed elsewhere, the elongated atoms formed the arrays of different tiny

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particles [17-20]. The elongation of atoms in tiny grain carbon films has also been discussed [21, 22]. A uniform elongating behavior of arrays of gold atoms was discussed in a separate study [23]. Splitting electron streams carrying the photons impinge on solid atoms to elongate them or deform them [24].

Photonic current is due to the propagation of featured photons, so it does not relate to the flow of electrons or charged particles [24]. However, electrons of the suitable atoms can transform heat energy into photon energy when executing the confined interstate dynamics. Thus, the photonic current is based on the propagation of featured photons through a suitable medium. The force and energy directly relate to solid atoms, which is not common in the case of gaseous atoms [25]. Three different ground points of atoms with different elements were discussed, where conservative forces were involved in executing the confined interstate electron dynamics [26]. Carbon atoms engage the force rather than involve it in the structural formation [27].

Energy in heat is required for the atoms to generate the photons. Suitable-natured atoms should execute the confined interstate electron dynamics by generating the photons in shape like waves. The generated photons can be transported from the generation point to the consumption end. Such photons can diffract when they interact with the sides of electrons in solid atoms. Such photons can also reflect when they interact with the tips of electrons by forming certain angles. Such photons can also deal with another phenomenon when interacting with the electrons, depending on the incidence angle.

3.1. Heat energy phenomena at the atomic level

By dissipating the heat in the air medium, photons travel in the air medium rather than propagating through the interstate electron gap. A long-length photon called an overt photon carries more energy than a short-length photon. When a photon gets dismantled into pieces under suitable interaction, it should not keep nodes and antinodes. Therefore, the heat energy of the dismantled photon should dissipate, and the field force of the dismantled photon should permeate the connected medium.

The execution of electron dynamics of silicon atom for one forward or reverse-direction cycle generates the unit photon. Thus, the unit photon has the minimum conserved force and energy length. That least-length photon has a shape like Gaussian distribution having upwardly turned ends, as shown in the label (1) of Figure 1. The inverted unit photon having a shape like Gaussian distribution with downwardly turned ends is also shown in the label (1) of Figure 1. At a suitable angle, the interaction of the unit photon with the electron results in dividing two equal parts shapes like integral symbol and opposite integral symbol. Each integral symbol is related to one bit of energy, as shown in labels (2) and (3) of Figure 1. The heat energy is generated when a photon of any length dismantle into pieces.

When a unit photon interacts with the electron of hypothesized solid atom at suitable incidence, despite its division into two pieces, merged energy shaped like a fish can result as labeled by (4) in Figure 1. The merged energy of a unit photon is a bunch of folded energy. When a unit photon interacts with the side of an electron of a hypothesized solid atom, it divides into several pieces. A unit photon can divide into two pieces due to a dedicated interaction with the electron. Each piece can be further divided for pure heat energy. In the divided pieces of the unit photon, the element of force is nearly diminished. Where the unit photons are divided into several pieces, broken pieces are related to heat energy, as labeled by (5) in Figure 1.

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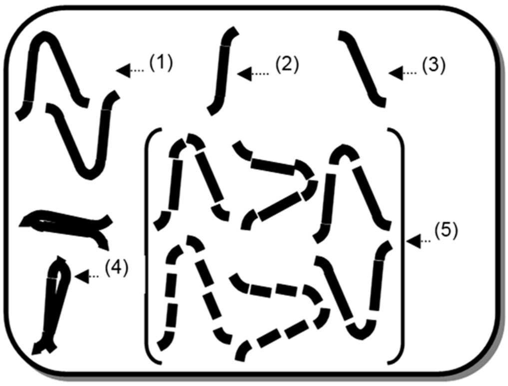

Figure 1. (1) Unit photons shape like Gaussian distribution having turned ends, (2) division of unit photon in shape like integral symbol and (3) division of unit photon in shape like opposite integral symbol, (4) merged energy of unit photons and (5) division of unit photons into the pieces of heat energy.

The photon length depends on the executed number of cycles by the electron under confined interstate dynamics. If the changing interstate aspect of an electron is executing uninterruptedly, then photon generation is also with unending length. A wave-shaped photon is labeled by (1) in Figure 2. That overt photon was generated by the three forward and reverse direction cycles of the electron of the silicon atom.

When a photon interacts with the side of the electron occupied by the energy knot in hypothesized solid atom under suitable incidence, it is folded by the impact of absorption. It is shown in the label (2) of Figure 2. That photon got converted into many pieces of heat energy, as shown in the label (3) of Figure 2. A filled force from the pieces of heat energy is almost diminished. Different pieces of the photon are now related to only heat energy.

By constructing the approximate angle of 90°, the photon interacts with the tip of the laterally orientated electron of the hypothesized solid atom, dividing it into bits of energy. It is shown in the label (4) of Figure 2. That overt photon got converted into the integral symbols dividing at the points of nodes and antinodes. It is shown in the label (5) of Figure 2, where a single photon was converted into several bits of energy having a shape like integral symbols. A bit energy is partially related to the heat energy and partially related to the photon energy as the element of field force is still there.

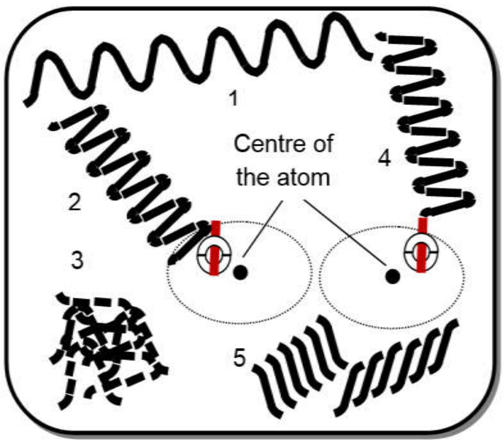

Figure 2. (1) overt photon, (2) interaction of an overt photon with the side of laterally orientated electron of hypothesized solid atom, (3) pieces of heat energy, (4) interaction of an overt photon with the tip of laterally orientated electron of hypothesized solid atom and (5) bits of energy.

A bit of energy can further be divided into pieces of heat energy. It can be deduced that an overt photon is a combination of several unit photons, where division under miscellaneous interactions converted it into pieces of heat energy. However, an overt photon of the least measured length is formed by joining the pair of the unit photon. Thus, an overt photon is based on a minimum of two nodes and two antinodes. So, a unit photon is a subset of the overt photon.

3.2. Photon energy phenomena at the atomic level

In semisolid atoms, electrons deal with the zone of impartial force at 0° orientation along the north-south poles [25]. When the outer ring electrons of semisolid atoms keep orientation 0° along the normal lines drawn from the centers, they can deal with the impartial force along the north-south poles. In a silicon atom, electrons of the outer ring keep half-lengths above the middle of occupied energy knots and half-lengths below the middle of occupied energy knots. In this way, electrons deal with force along the opposite tips at equal levels. Electrons also deal with equal force along the east and west poles. Hence, electrons of the outer ring deal with neutral force. Thus, the supply of heat energy can trigger the confined interstate electron dynamics converting into the photon energy when the forces of all four poles remain conserved.

The forces exerted on the relevant poles of the electron introduce a moment of inertia, which is in an auxiliary manner at each point of turning that electron. When the suitable electron is lifted from the occupied state without touching it, the energy of one bit is utilized along the tracing trajectory of the electron in the first half-cycle. The heat energy wraps around the force shaping along the tracing trajectory of the electron. Electron deals with the forces of relevant poles in a conserved manner. The force is shaped from the sides of the electron, not facing the exertion of the remaining two forces. The energy of one bit is also utilized along the tracing trajectory of the electron in the second half-cycle. In a silicon atom, electrons of the zeroth ring and the first ring do not execute dynamics to entertain the exertion of forces. Only the electrons of the outer ring execute interstate dynamics.

In Figure 3 (a), a top left-sided electron of a silicon atom executes interstate dynamics. Under confined interstate dynamics of that electron, the conversion of heat energy into unit photon energy is shown in Figure 3 (b). At the maximum limit point of the lifted electron, the energy of one bit is utilized along the traced trajectory. The energy of the one bit is utilized to cover the force shaping along the tracing trajectory of the electron in the first half cycle. The trajectory forming by the electron for the first half cycle is up to the maximum limit point, as shown in Figure 3 (b). The turning of electron deals with the auxiliary moment of inertia. In the second half cycle, another energy of one bit is utilized along the tracing trajectory of an electron to cover the shaping force. The trajectory formed by the electron in the second half cycle is up to the last point of the cycle, where the turning of the electron again deals with the auxiliary moment of inertia. Thus, a unit photon is due to the force and energy generated from one complete forward direction cycle of interstate electron dynamics. That electron recalls the moment of inertia at each point of turning, which is in an auxiliary manner. A complete forward direction cycle of confined interstate dynamics of the electron is shown in Figure 3 (b).

When the interstate electron dynamics of the neutral-state silicon atom complete six cycles –three in the forward direction and three in the reverse direction. It shapes the energy of twelve bits forming the shape like a wave. The energy of six bits has shapes in opposite integral symbols, and the energy of the remaining six bits has shaped in straight integral symbols, shown in Figure 3 (c). The electron does not touch the energy knot in the forward or reverse direction cycle. Hence, under uninterrupted forward and reverse cycles, the execution of confined interstate electron dynamics generates the force and energy in the form of an overt photon.

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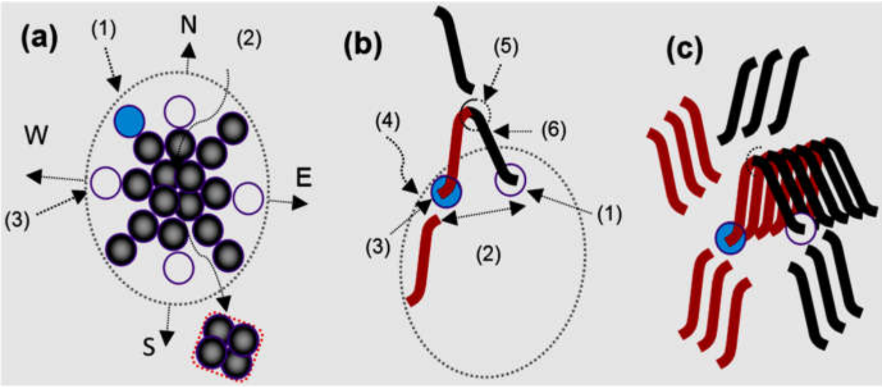

Figure 3. (a) Neutral-state silicon atom: (1) targeted electron; (2) zeroth ring; (3) unfilled energy knot. (b) Electron dynamics of silicon atom in the forward direction cycle: (1) unfilled state; (2) interstate electron gap; (3) filled state; (4) one-bit energy wrapping around the shaping force along the trajectory of an electron in first half cycle; (5) maximum limit point; (6) one-bit energy is wrapping around the shaping force along the trajectory of an electron in the second half cycle. (c) Three forward direction cycles and three reverse direction cycles of interstate electron dynamics utilizing the energy of twelve bits to generate the overt photon having a length equal to the lengths of unit photons in six.

The turning positions of the electron under the auxiliary moment of inertia are responsible for forcing the energy of a photon from one point to another. The exerted forces on the electron remain path-independent. However, the exerted forces remain confined within the interstate gap of the electron executing dynamics. Figure 3 (b) validates that the electron executing confined interstate dynamics does not possess any other way to regain the state.

The overall shape of formulated energy along the traced trajectory of electron dynamics for the first half cycle is like a straight integral symbol (⨍). The shape of formulated energy along the traced trajectory of electron dynamics for the second half cycle is like the opposite integral symbol (ʅ). For the first-half forward and the second-half forward cycles of electron dynamics, two shapes of integral symbols connect at the center of the maximum limit point resulting in the overall shape of force and energy shaped like Gaussian distribution in the turned ends, shown in Figure 4.

The relationship between force and energy in each step of the forward direction cycle of the electron has been plotted in Figure 4 (a). The different steps are labeled from 1 to 6. In the reverse direction cycle of the electron, the relationship between force and energy is shown in Figure 4 (b). The different steps are also labeled from 1 to 6. In Figure 4, the maximum limit point is denoted by 7.

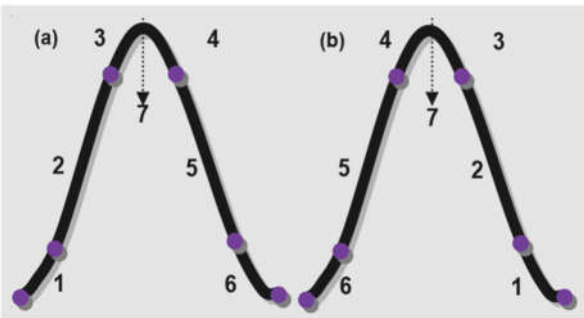

Figure 4. Sections of the unit photon generated by interstate electron dynamics of silicon atom (a) in forwarding direction cycle and (b) in reverse direction cycle; (7) maximum limit point where left and right half cycles of electron dynamics get connected.

Motion to rest and rest to motion state of the electron at the center of a maximum limit point are due to the disappearance of the exerted force. From that point, that electron turns towards the nearby unfilled state to occupy it due to the appearance of the exerted force. Therefore, by recalling the moment of inertia in an auxiliary manner, that electron deals with the following exerting forces. Forces of two poles act together but from the opposite sides, which causes that electron to turn. Thus, the coupling of force and energy is shaped in the first half cycle electron dynamics and the second half cycle electron dynamics. The recalled moment of inertia also remained legible during less turning of the electron. The electron's trajectory in its less turned path forms a shape like a slash, as shown in Figure 4 (a) and (b).

In Figure 5, electrons of four quadrants trace the trajectories of confined interstate dynamics in both forward and reverse direction cycles. In Figure 5 (a), an electron leaves the state from the rear or tail and enters the nearby state from the front side or head while executing forward interstate dynamics. That electron leaves the state from the rear or tail and enters the nearby state from the front side or head while executing reverse interstate dynamics. The electron is shown in Figure 5 (b) oppositely executes dynamics to keep the equilibrium state of the atom. In Figure 5 (c), an electron leaves the state from the front side or head and enters the nearby state from the rear side or tail while executing forward interstate dynamics, so it leaves the state from the front side or head and enters the nearby state from the rear side or tail while executing reverse interstate dynamics. Under the equilibrium state of an atom, the electron is shown in Figure 5 (d) oppositely executes dynamics.

The electrons are shown in Figure 5 (a) and (b) execute their rise and fall while in confined interstate dynamics. The electrons are shown in Figure 5 (c) and (d) execute their fall and rise in confined interstate dynamics. The electrons can also execute the dynamics in reverse order. Therefore, the electrons in Figures 5 (a) and (b) can also execute their fall and rise while in confined interstate dynamics. The electrons in Figure 5 (c) and (d) can also execute their rise and fall in confined interstate dynamics. Forward and reverse cycles of electron dynamics in all four quadrants of the silicon atom are symbolically shown in Figure 5 (a-d). The pair of forces exerted on the electron at each turning point is also labeled in Figure 5 (a-d).

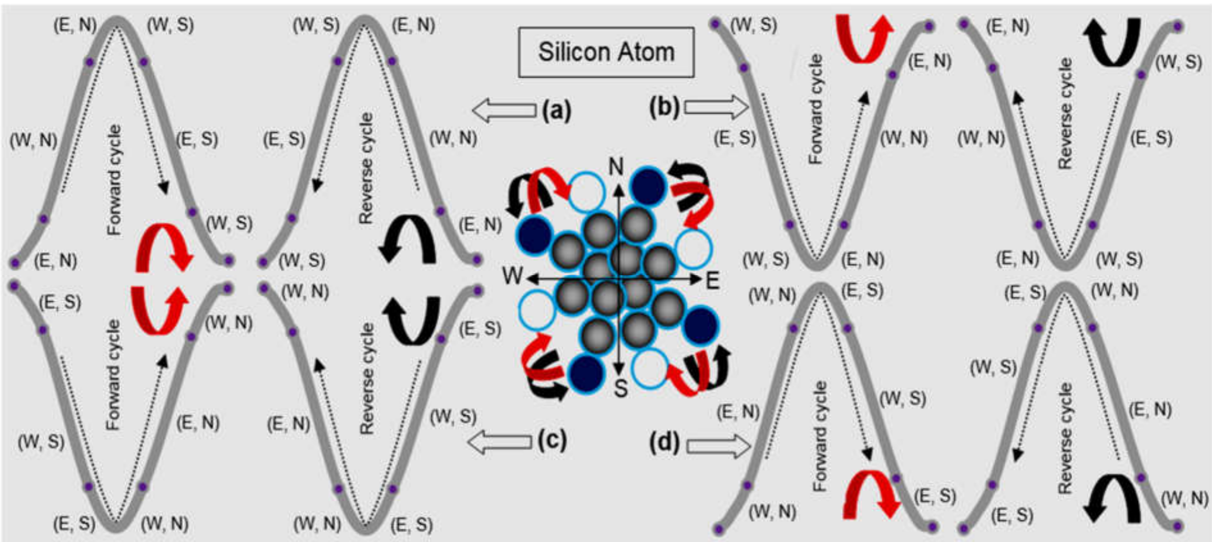

Figure 5. Blue colored electrons of quadrants (a), (b), (c) and (d) deal with the east (E), west (W), north (N) and south (S) forces along the relevant poles while executing confined interstate dynamics in forward (red-colored round arrows) and reverse (black colored round arrows) direction cycles.

A photon propagates through the interstate electron gap dealing with force and energy in a wave-like fashion. It is the case of the silicon atom discussed above. However, depending on the interstate electron gap of atoms, they can also generate photons having shapes other than the wave-like shape. In the atoms of those elements where three conservative forces exert, interstate electron dynamics transform heat energy into the photon energy having a shape like connected integral symbols. In the atoms of those elements where two conservative forces exert, interstate electron dynamics transform heat energy into the photon energy having a shape like connected tick symbols. Heat energy converts into the photon energy, having a shape like a connected '*L*' alphabets in atoms when two conservative forces are exerted so that the electron under dynamics attempts to cross the pole of its atom. Photons shapes like connected integral symbols, tick symbols and *L*-like symbols are shown in Figure 6 (a-c), respectively. In Figure 6 (d), a generating photon shows both force and energy.

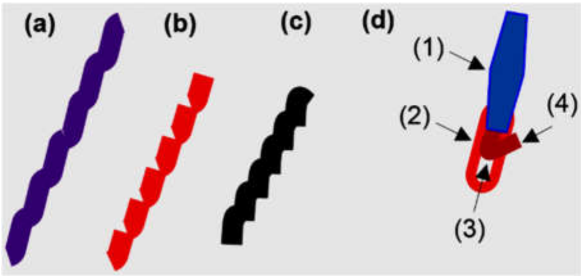

Figure 6. Overt photon of connected (a) integral symbols, (b) tick symbols, (c) L-like symbols and (d) shaping force and energy along the trajectory; (1) electron dynamics, (2) wrapped energy, (3) shaped force, (4) force in the removed region of energy.

Where there is no specific interaction of a photon with the electron, it divides into pieces of heat energy. The heat energy of a divided photon dissipates in the structure of atoms. The resulting heat energy can be utilized to wrap around the force shaping along the tracing trajectory by executing electron dynamics of the atom or atoms. The conversion of energy from one form to another depends on structural characteristics.

3.3. General discussion

Each silicon cell connected in the series adds up to the generating number of photons under a suitable fabrication procedure in the solar panel. The heat dissipation at the rear side surface of the solar cell is controlled by using silver paste or through other means. In the laminated panels of solar cells, the generating photons are collected at appropriate points. As observed in solar panels, solar cells can generate the maximum power when the setting is under the proper inclination. The cycles of confined interstate electron dynamics of silicon atoms remain uninterrupted for a more extended period, where titling the solar panel at a suitable angle concerning the base results in varying efficiency. Depositing silicon atoms for a few layers can generate high power.

When the photons of X-rays interact with amorphous material by constructing suitable angles, the energy of photons mainly converts into the energy of heat. In some cases, photons having characteristics of photonic current are utilized to split the inert gas atoms [24]. Electrons possess different masses under different energy and force when their atoms undertake different transition states [25]. Atoms of suitable elements evolve structures under the exertions of conservative forces on the electrons [26]. A carbon atom converts into another state, where involved energy at the electron level engages the partially conserved force [27].

When the featured photons interacted with the tips of laterally orientated electrons of elongated atoms, the reverted element of force prints the pattern [28]. The set modalities of photons depend on the origin of generation establishing the role set by the manufacturer. A structural design is crucial to target the specific application, and many studies are now targeted to explore the structure [29-38]. A structural shape is due to the controlled behavior of force and energy [18], which is a different case from the structure of semisolid atoms [21, 39].

The development of particles under predictor packing is also studied, where photons shaped like waves get converted into the tuned pulses [40]. Measuring the temperature of such materials is an integral part of the research, and some studies have also shed light on it [41-43]. A study explained the role of van der Waals interactions in the isolated atoms by considering the induced dipoles [44], which can be attained when charge density fluctuations are in wave fashion [45]. When the atoms execute electron dynamics to evolve structure, the generated binding energy binds the atoms [26].

4. Conclusion

Heat energy wraps around the force shaping along the tracing trajectory of the electron dynamics. In executing confined interstate dynamics, the force is being shaped from the sides of the electron, not experiencing the forces of the remaining two poles. When the silicon atom executes interstate dynamics for one electron of the outer ring, a unit photon having a shape like Gaussian distribution with turned ends is generated in one forward or reverse direction cycle. A long-length photon can be generated under the uninterrupted supply of heat energy.

On executing the interstate electron dynamics, a silicon atom transforms the heat energy into the photon energy. A unit photon is based on the energy of two bits only, whereas a long-length photon can be based on several bits' energy. A photon of the least measured length is formed by joining a pair of unit photons. When a photon interacts with the north-sided tip of the laterally orientated electron by constructing the approximate angle of 90°, it gets divided into bits of energy. Bits of energy can further divide into pieces of heat energy.

The exerted forces on the electron change the aspects by restricting it in the interstate gap. The energy wraps around the force shaping along the tracing trajectory of electrons executing interstate dynamics. The force shaping along the trajectory of an electron and wrapping energy remains preserved. In the atoms, the charisma of conserved forces enables the charisma of conserved energy.

In a silicon atom, the auxiliary moment of inertia is recalled at each point of turning the electron of the outer ring. The outer ring means the outermost ring. A reference point of the electrons executing dynamics is the center of an atom.

The exerted forces on the electron remain conserved within the interstate electron gap of an atom. Before crossing the maximum limit point, the electron is examined by the opposite forces to pull it downward. First, the electron of the outer ring gets lifted laterally. To turn it back, it gets relief from the effect of upward force. So, to turn downward, opposite forces are exerted on the electron. Path-independent conservative forces exerted on the electron acquiring its lateral and adjacent positions are within the natural viability. The electron executes interstate dynamics at the speed of light.

A photon has a solid analogy to the electron as the electron forms a bandgap for propagating the photon. A propagating photon transfers the force and energy. When a photon interacts with the side of the electron of a solid atom, it diffracts, dividing into pieces. The heat energy of the dismantled photon can dissipate, and the field force of the dismantled photon can permeate. The electron streams impinge on a solid atom to modify it [24]. The photon energy is not the one impinging on a solid atom.

Different atoms generate photons of different shapes depending on the built-in interstate gap of electron dynamics. Photons also have a shape other than the wave, depending on the interstate gap of electron dynamics in atoms. The mechanism of photon generation validates the atomic structure discussed elsewhere [25].

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Data Availability Statement: The work is related to the fundamental nature of science.

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References

[1] D. Bohm, D. Pines, A Collective Description of Electron Interactions. I. Magnetic Interactions, *Phys. Rev.* **82**, (1951) 625-634.

[2] D. Pines, D. Bohm, A Collective Description of Electron Interactions: II. Collective *vs* Individual Particle Aspects of the Interactions, *Phys. Rev.* **85**, (1952) 338-353.
[3] R. H. Ritchie, Plasma Losses by Fast Electrons in Thin Films, *Phys. Rev.* **106**, (1957) 874-881.
[4] D. Bohm, D. Pines, A Collective Description of Electron Interactions: III. Coulomb Interactions in a Degenerate Electron Gas, *Phys. Rev.* **92**, (1957) 609-625.
[5] T. Low, *et al.*, Polaritons in layered two-dimensional materials, *Nat. Mater.* **16**, (2017) 182-194.
[6] J. Frenkel, On the Transformation of Light into Heat in Solid. I, *Phys. Rev.* **37**, (1931) 17-44.
[7] O. D. D. Couto Jr. et al., Charge control in InP/(Ga,In)P single quantum dots embedded in Schottky diodes, *Phys. Rev.* B **84**, (2011) 125301-7.
[8] M. Brust, M. Walker, D. Bethell, D. J. Schiffrin, R. Whyman, Synthesis of Thiol-derivatised Gold Nanoparticles in a Two-phase Liquid-Liquid System, *J. Chem. Soc., Chem. Commun.* (1994), 801-802.
[9] R. L. Whetten, J. T. Khoury, M. M. Alvarez, S. Murthy, I. Vezmar, Z. L. Wang, P. W. Stephens, C. L. Cleveland, W. D. Luedtke, U. Landman, Nanocrystal Gold Molecules, *Adv. Mater.* **8**, (1996) 428-433.
[10] M. Brust, C. J. Kiely, Some recent advances in nanostructure preparation from gold and silver particles: a short topical review, *Colloids and Surfaces A: Physicochem. Eng. Aspects* **202**, (2002) 175-186.
[11] S. C. Glotzer, M. J. Solomon, Anisotropy of building blocks and their assembly into complex structures, *Nature Mater.* **6**, (2007) 557-562.
[12] S. Link, M. A. El-Sayed, Shape and size dependence of radiative, nonradiative and photothermal properties of gold nanocrystals, *Int. Rev. Phys. Chem.* **19**, (2000) 409- 453.
[13] C. P. Shaw, D. G. Fernig, R. Lévy, Gold nanoparticles as advanced building blocks for nanoscale self-assembled systems, *J. Mater. Chem.* **21**, (2011) 12181-12187.
[14] Y. Negishi, T. Nakazaki, S. Malola, S. Takano, Y. Niihori, W. Kurashige, S. Yamazoe, T. Tsukuda, H. Häkkinen, A Critical Size for Emergence of Nonbulk Electronic and Geometric Structures in Dodecanethiolate-Protected Au Clusters, *J. Am. Chem. Soc.* **137**, (2015) 1206-1212.
[15] A. Moscatelli. Gold nanoparticles: Metallic up to a point, *Nature Nanotechnol.* (2015), DOI:10.1038/nnano.2015.16.
[16] M. Ali, I–Nan Lin, Forces driving amalgamation of nanoparticles and particles in solution, *Forces in Mech.* **7**, (2022) 100076.
[17] M. Ali, I–N. Lin, Development of Gold Tiny Particles and Particles in Different Sizes at Varying Precursor Concentration, *Adv. Nat. Sci: Nanosci. Nanotechnol.* **11**, (2020) 015006 (13pp).
[18] M. Ali, I–N. Lin, Controlling morphology-structure of gold tiny particles, nanoparticles and particles at different pulse rates and pulse polarity, *Adv. Nat. Sci: Nanosci. Nanotechnol.* **10**, (2019) 025015 (14pp).
[19] M. Ali, I–N. Lin, Formation of tiny particles and their extended shapes: origin of physics and chemistry of materials, *Appl. Nanosci.* **9**, (2019) 1367-1382.
[20] M. Ali, I–N. Lin, C.–J. Yeh, Tapping Opportunity of Tiny-Shaped Particles and Role of Precursor in Developing Shaped Particles, NANO 13, (2018) 1850073.
[21] M. Ali, I–N. Lin, Phase transitions and critical phenomena of tiny grains carbon films synthesized in microwave-based vapor deposition system, *Surf. Interface Anal.* **51**, (2019) 389-399.
[22] M. Ali, M. Ürgen, Switching dynamics of morphology-structure in chemically deposited carbon films -A new insight, *Carbon* **122**, (2017) 653-663.
[23] M. Ali, Tiny-Shaped Particles Developing a Mono Layer Shape Dealing with Localized Gravity and Levity at the Solution Surface, (2022). http://arxiv.org/abs/1609.08047v29
[24] M. Ali, Atoms of None of the Elements Ionize While Atoms of Inert Behavior Split by Photonic Current, (2022). http://arxiv.org/abs/1611.05392v28
[25] M. Ali, Atoms in Gaseous and Solid States and their Energy and Force Relationships under Transitional Behaviors, (2022). https://doi.org/10.21203/rs.3.rs-88120/v4
[26] M. Ali, Structure Evolutions in Atoms of the Elements Executing Confined Interstate Electron Dynamics, (2022). http://arxiv.org/abs/1611.01255v28
[27] M. Ali, Atomic Structure and Binding of Carbon Atoms, (2021). https://www.preprints.org/manuscript/201801.0036/v11
[28] M. Ali, I–N. Lin, Gold Nanostructures and Microstructures with Tunable Aspect Ratios for High-Speed Uni- and Multidirectional Photonic Applications, *ACS Appl. Nano Mater.* **3**, (2020) 9410-9424.
[29] J. Zhao, L. Yang, Structure Evolutions and Metallic Transitions in In_2Se_3 Under High Pressure, *J. Phys. Chem. C* **118**, (2014) 5445-5452.
[30] V. N. Manoharan, Colloidal matter: Packing, geometry, and entropy, *Science* **349**, (2015) 1253751.
[31] J. Park, *et al.*, 3D structure of individual nanocrystals in solution by electron microscopy, *Science* **349**, (2015) 290-295.
[32] D. Jacobsson, *et al.*, Interface dynamics and crystal phase switching in GaAs nanowires, *Nature* **531**, (2016) 317-322.
[33] T. Tuma, A. Pantazi, M. L. Gallo, E. Eleftheriou, Stochastic phase-change neurons, *Nature Nanotech.* **11**, (2016) 693-699.
[34] J. Rensberg, *et al.*, Active Optical Metasurfaces Based on Defect-Engineered Phase-Transition Materials, *Nano Lett.* **16**, (2016) 1050-1055.
[35] Y. Suzuki, G. Cardone, D. Restrepo, P. D. Zavatteri, T. S. Baker, F. A. Tezcan, Self-assembly of coherently dynamic, auxetic, two-dimensional protein crystals, *Nature* **533**, (2016) 369-373.
[36] C. H. J. Evers, J. A. Luiken, P. G. Bolhuis, W. K. Kegel, Self-assembly of microcapsules via colloidal bond hybridization and anisotropy, *Nature* **534**, (2016) 364-368.

[37] I. R. Epstein, B. Xu, Reaction–diffusion processes at the nano- and microscales, *Nature Nanotech.* **11**, (2016) 312-319.
[38] A. Azizi, Spontaneous Formation of Atomically Thin Stripes in Transition Metal Dichalcogenide Monolayers, *Nano Lett.* **16**, (2016) 6982-6987.
[39] M. Ürgen, Morphology and Structure of Carbon Films Deposited at Varying Chamber Pressure, (2022). https://arxiv.org/abs/1802.00730v20
[40] M. Ali, I–N. Lin, C.–J. Yeh, Predictor Packing in Developing Unprecedented Shaped Colloidal Particles, NANO 13, (2018) 1850109 (15 pages).
[41] M. Mecklenburg, W. A. Hubbard, E. R. White, R. Dhall, S. B. Cronin, S. Aloni, B. C. Regan, Nanoscale temperature mapping in operating microelectronic devices, *Science* **347**, (2015) 629-632.
[42] L. Ye, D. Hou, X. Zheng, Y. Yan, M. D. Ventra, Local temperatures of strongly-correlated quantum dots out of equilibrium, *Phys. Rev. B* **91**, (2015) 205106-8.
[43] F. Menges, P. Mensch, H. Schmid, H. Riel, A. Stemmer, B. Gotsmann, Temperature mapping of operating nanoscale devices by scanning probe thermometry, *Nat. Commun.* **7**, (2016) 10874.
[44] S. Kawai, A. S. Foster, T. Björkman, S. Nowakowska, J. Björk, F. F. Canova, L. H. Gade, T. A. Jung, E. Meyer, Van der Waals interactions and the limits of isolated atom models at interfaces, *Nat. Commun.* **7**, (2016) 11559.
[45] A. Ambrosetti, N. Ferri, R. A. DiStasio Jr., A. Tkatchenko, Wavelike charge density fluctuations and van der Waals interactions at the nanoscale, *Science* **351**, (2016) 1171-1176.