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Article

# Heat and Photon Energy Phenomena: Dealing with Matter at the Atomic and Electronic Levels

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## Abstract

Both heat and photon energy are integral parts of scientific research. The study of the photon and the electron does not present up-to-date science in some phenomena. A misconception falls at the basic level. To eliminate the misconception, a discussion presents the electron dynamics in the silicon atom. The electron executes confined interstate dynamics for one forward or reverse cycle. As a result, the resulting shaped force-energy defines a unit photon. That unit photon has a shape similar to a Gaussian distribution with turned ends. A featured photon can interact with the side of a laterally orientated electron (of a semisolid or solid atom) to possibly convert into heat energy. When a featured photon interacts with the tip of a laterally oriented electron, that photon can convert into energy bits. The shapes of energy bits are similar to integral symbols. The reference point for the electron executing confined interstate dynamics is the center of a silicon atom. The north-south tips of the electrons align along the north-south poles. The energy shapes around the force tracing along the trajectory of electron dynamics. To execute confined interstate dynamics, forces of the two poles appear conservatively for turning the electron each time. The outer ring electron of the silicon atom reaches the 'maximum limit point' during the confined interstate dynamics. There is energy of one bit. In the remaining half cycle, that electron also generates energy of one bit. The electron dynamics of the silicon atom generate photons of a wave shape. Atoms of some other elements generate photons other than wave shapes. The execution of the electron dynamics is nearly at the speed of light. In addition to energy science, the study is useful in physical and chemical sciences.

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

## 1. Introduction

A basic understanding of science is still lacking in many phenomena. Technology is achieving its climax. The heat and photon energy have been with the universe since its creation. Catching fires of different materials and burning of various commodities are the usual phenomena under observation. Many studies in the literature discussed light-matter interactions and the phenomenon of surface plasmons. The origin of plasmons has a long history of exploration [1–4].

In the literature, various terminologies such as phonons, excitons, and plasmons discuss the interaction of photons (or light) with matter. A study based on reviews discussed light-matter interactions, considering the properties of polariton modes in two-dimensional materials [5]. In 1931, Frenkel proposed the concept of excitons or electron-hole pairs, as discussed elsewhere [6]. Excitons travel in a particle-like fashion. Excitons can form due to photon absorption by a quantum dot [7], where the phonon is a collective excitation in the periodic arrangement of atoms or molecules.

Tiny clusters are simple chemical compounds with various essential applications in diverse areas [8]. The unique nature of nanocrystals demands the fabrication of new materials with controlled features [9]. The development of nanoparticle technology will provide obvious long-term benefits, as discussed elsewhere [10]. Upon successful assembly of the tiny particles into larger particles, they can be the atoms and molecules of future materials [11]. The dynamics in the development of

nanoparticles provide an advantage for understanding the larger particles, as discussed elsewhere [12].

The surface features of nanoparticles can lead to the development of high-order materials [13]. Tiny-sized clusters have molecular electronic structures and non-face-centered cubic structures, as discussed elsewhere [14]. Geometric and distorted particles deal with different forces to amalgamate in solution [15]. The localized dynamics of the process contribute to the development of the gold [16–19], silver [19], and carbon [20,21] structures. Atomic elongation in arrays of the tiny particle has been discussed elsewhere [22]. By stretching the energy knots, a solid atom deals with elongation [23].

Sir Isaac Newton explained gravity. An area of gravity covers Newtonian physics. Sir Albert Einstein discussed the theory of General Relativity. Bohr proposed that electrons move around the allocated orbits, where they have fixed energy in the ground state. In atoms of different elements, the discussions on the orbits and shells largely remain to describe the electronic structure. Some earlier studies also describe the atomic structure in light of quantum states.

Those studies and other related studies kept the researchers far from the actual structures of atoms belonging to disclosed elements. Moreover, there was less effort in exploring fundamental science. The developed uncertainties toward the fundamentals of science remained unresolved. No alternative discussions progress there. Legitimate physical explanation or corrective analysis also remained missing.

The atomic structure is different from previous ones. A study elsewhere [24] discussed this. A study elsewhere [25] explored the fundamental aspects of structural evolution by considering the conservative forces. The atomic structure of carbon under different states and their binding are also discussed in a separate study [26]. The interaction of a photon with the electron of a suitable semisolid or solid atom is studied here. The conversion of heat energy into photon energy is the core topic of this study.

Regardless of whether a photon is a force-energy, whereas an electron is a matter of the smallest size. In the usage of the electron and the photon, there has always remained confusion. Photons propagate through the metallic wire to study the photonic current. Therefore, there is no current due to the flow of electrons. In other words, there is a photonic current instead of an electric current. A study elsewhere [23] discusses the photonic current and why it is not an electric current. There are many more ambiguities in the literature, which have been with the science for many decades.

The generation of photons under the electron dynamics of suitable element atoms other than silicon atoms also presents a preliminary detail. The phenomena of heat and photon energy at the atomic and electronic levels are the focus of this study. A basic science, which describes those phenomena (of heat and photon energy when dealing with matter at the electronic and atomic levels), is the key aspect of this study.

## 2. Experimental Details

This work does not contain specific experimental details. The ongoing research efforts toward photon-matter interaction, heat and photon energy, fundamental forces, renewable energy, photovoltaics, bandgap, semiconductors, energy science, physics, and materials chemistry can benefit from this study. This study also counters general physics and chemistry.

There are also other types of materials for studying the generation of photon energy. What is a specific difference between different energy generation models? What is the core element that differentiates the two types of solar cells? Addressing these questions can help to meet the energy demand at an affordable price.

This paper clarifies common misconceptions about photon-electron interactions. The study proposes models for photon generation and interaction with matter. The paper investigates how electrons in silicon atoms generate photons through interstate dynamics. What are the forces exerted on the electrons? How do the force and energy work together? What are the possible interactions of a photon with an electron at the basic level? However, there is a need to explore various scientific methods and experimental details.

### 3. Models and Discussion

In the development of distorted nanoparticles or particles, atoms are deformed, as discussed elsewhere [15]. A tiny particle of geometric shape develops from the elongated atoms, as discussed elsewhere [22]. A photonic current (so-called electric current) is not due to the flow of electrons or charged particles [23].

The current is due to the propagation of featured photons as discussed in that study. To transform heat energy into photon energy, electrons should execute their confined interstate dynamics. Therefore, the photonic current should relate to the propagation of featured photons in a suitable medium.

In the transitional behavior of solid atoms, the relation between force and energy at the electron level is directly proportional [24]. The different ground points at which atoms execute the confined interstate electron dynamics have been discussed [25]. Carbon atoms involve energy to form a structure, whereas they engage in force [26]. However, this is not the case with the silicon atoms.

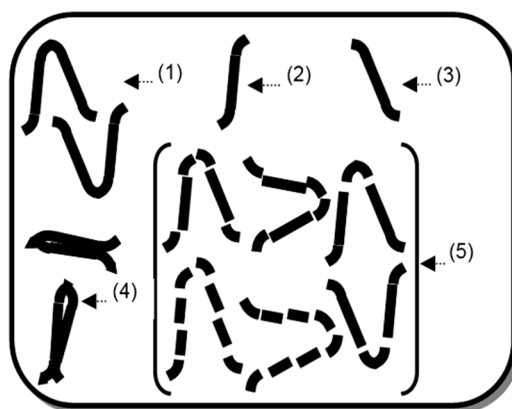
Atoms of the suitable elements can execute electron dynamics. Thus, atoms of different elements can generate photons of varying characteristics. A photon can dissipate the heat element when it interacts with the side of the clamped energy knot electron of a semisolid or solid atom. Photons can interact with electronic tips at suitable angles for reflection.

#### 3.1. Heat Energy Phenomenon

Photons travel through the air medium by dissipating the element of their heat energy, as discussed elsewhere [23]. A longer photon carries more heat energy than a shorter photon. Short- and long-length photons relate to the overt photons. A very long or unending-length photon is also a photon. When a photon breaks into pieces under suitable interactions with the medium, it does not retain nodes and antinodes. The element of force of a broken photon permeates the connected medium.

For a silicon atom, the execution of electron dynamics for one forward or reverse cycle generates the unit photon. Thus, the unit photon has the minimum conserved force and energy. Label (1) in Figure 1 shows the unit photon. It relates to the minimum length of a photon. Therefore, it is a unit photon. This photon has a shape similar to a Gaussian distribution with upwardly turned ends.

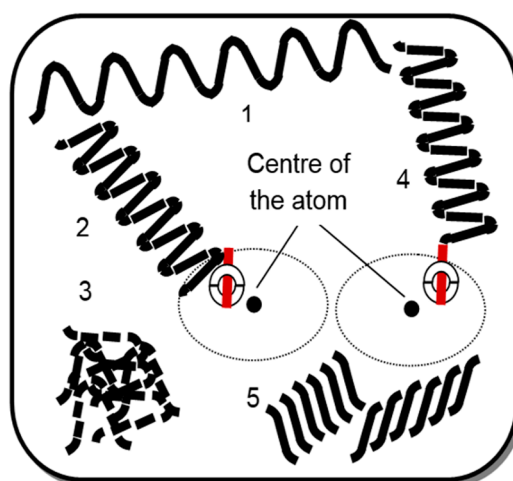
Label (1) in Figure 1 also shows an inverted unit photon having a shape similar to a Gaussian distribution with downwardly turned ends. When a unit photon interacts with an electron at a suitable angle, it can divide into two equal parts. Each integral symbol relates to one bit of energy, as shown in labels (2) and (3) of Figure 1.



**Figure 1.** (1) Unit photons having a shape like a Gaussian distribution with turned ends. Division of a unit photon in the shape of an (2) integral symbol and (3) opposite integral symbol, (4) merged energy of unit photons and (5) broken pieces of unit photons.

When a unit photon interacts with the electron of a hypothesized semisolid or solid atom at a suitable incidence, the 'unit photon' converts into a folded energy or into a fish shape. Label (4) in Figure 1 shows this. The folded energy of a unit photon is a bunch of merged energy. A 'unit photon' can convert into many pieces when interacting with the side of the electron of the hypothesized semisolid or solid atom. The broken pieces of the 'unit photons' are related to heat, as labeled by (5) in Figure 1. It is possible to validate these models from the experimental data.

If the electron of a suitable atom remains executing confined interstate dynamics and without any interruption, it can generate a photon of infinite or unending length. Label (1) in Figure 2 shows a wave-shaped photon. This overt photon results from the three forward and reverse cycles of the electron executing confined interstate dynamics in a silicon atom. Depending on the potential energy and orientation force, the interaction of photons with an embedded electron can vary. The momentum of traveling or propagating photons can alter the nature of interactions with electrons.



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

Photons of different characteristics can also alter the nature of interactions with an electron. In a specific interaction with an electron, photons can merge into the heat bed. The heat energy can then convert into photon energy. A suitable electron of the silicon atom or another suitable element atom can execute confined interstate dynamics. The different options for photon-matter interactions can open a new field of research.

When a photon interacts with the side of the electron (of the hypothesized semisolid or solid atom) at a suitable incidence, it can fold under the impact of absorption. The label (2) in Figure 2 indicates this incidence. That photon can convert into many pieces of heat. Label (3) in Figure 2 shows many pieces. They are now related only to heat.

By constructing an approximation angle of  $90^\circ$ , the photon can interact with the tip of the laterally orientated electron. The electron belongs to the hypothesized semisolid or solid atom. It can convert into bits of energy. Label (4) in Figure 2 shows this incident. Label (5) in Figure 2 shows many energy bits shaped like integral symbols. From the experimental data, the validation of the models of Figures 1 and 2 is feasible.

### 3.2. Photon Energy Phenomenon

In semisolid atoms, electrons keep their centers at the middle of the clamping energy knots. A study elsewhere [24] discussed the atomic structure of the semisolid elements. In executing confined interstate dynamics, the outer ring electrons of a silicon atom should deal with the conservative forces. Heat energy initiates the interstate electron dynamics for conversion into photon energy. In interstate dynamics, a suitable electron of the silicon atom considers the two poles for each turning point.

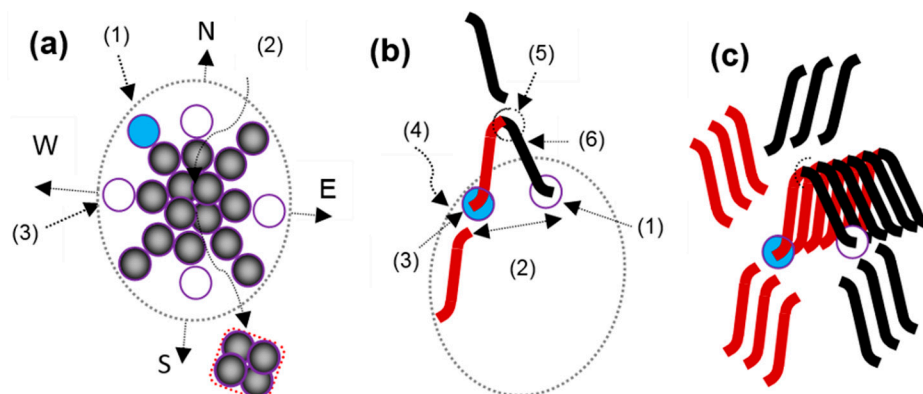
The forces exerted on the relevant poles of the electron introduce a moment of inertia. This inertia exists in an auxiliary manner. It is at each turning point of the electron. In the first half-cycle of the electron dynamics of the silicon atom, the energy of one bit is engaged along the tracing trajectory. In the second half-cycle of the electron dynamics, the energy of one bit is again engaged along the tracing trajectory.

Electrons (of the zeroth and first rings) of the silicon atom are not in a position to execute the dynamics. The suitable electrons of the outer ring execute confined interstate dynamics. The forces of the four poles are there. However, two forces turn an electron. Energy covers the force from the remaining two poles to not influence.

Label (1) in Figure 3 (a) indicates an electron of a different color. There is also a representation of the complete electronic structure of a silicon atom. It will execute the confined interstate dynamics as a model study. A force can trace along the trajectory of an electronic tip. It will also engage the energy to trace along the trajectory of an electronic tip.

Figure 3 (b) shows the conversion of heat energy into photon energy. It is in the forward cycle of electron dynamics. At the maximum limit point, the energy of one bit is there along the traced trajectory. Thus, one bit of energy shapes around the tracing force in the first half cycle. In the first half cycle, the trajectory tracing along the tip of an electron reaches the 'maximum limit point'. Figure 3 (b) shows this. In the second half cycle, the energy of one bit again engages along the tracing trajectory. The energy is also shaping along the electronic tip.

In the second half cycle, the tracing trajectory is from the 'maximum limit point'. The electron again addresses the auxiliary moment of inertia. Therefore, a unit photon is the 'force-energy' of a complete forward direction cycle. A forward direction cycle is due to confined interstate electron dynamics. An electron under confined interstate dynamics recalls the moment of inertia at each turning point, which occurs in an auxiliary manner. Figure 3 (b) shows a complete forward cycle of the confined interstate dynamics of the electron. 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 forces on the electron under confined interstate dynamics remain independent of the path. The electron regains the state by terminating the confined interstate dynamics.



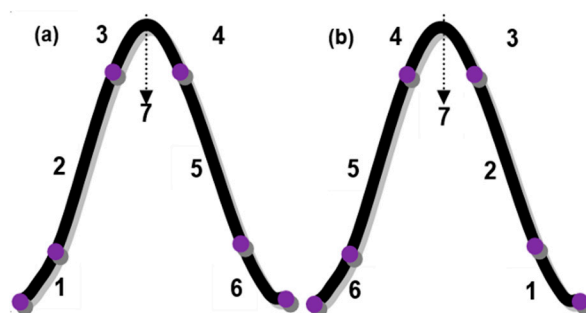
**Figure 3.** (a) Neutral-state silicon atom: (1) targeted electron; (2) zeroth ring; (3) unfilled energy knot. (b) Electron dynamics in the forward cycle: (1) unfilled state; (2) interstate electron gap; (3) filled state; (4) one-bit energy shaping around the force tracing along the trajectory of an electron in the first half cycle; (5) maximum limit point; (6) one-bit energy shaping around the force tracing along the trajectory of an electron in the second half

cycle. (c) Three forward cycles and three reverse cycles of interstate electron dynamics engaging the energy of twelve bits to generate an overt photon with a length equal to the length of unit photons in six.

When the interstate electron dynamics of the silicon atom complete six cycles, three forward and three reverse direction cycles, the energy of the twelve bits forms a wave shape. The electron does not touch the energy knot in the forward or reverse cycle. When there are three forward and reverse direction cycles, the electron dynamics shape the 'force-energy' in a short-length photon or in an overt photon. Figure 3 (c) shows this. The shape of energy tracing along the trajectory is like an integral symbol ( $\int$ ). In the second half cycle, the shape of energy is different. The shape of energy tracing along the trajectory is like the opposite integral symbol ( $\int$ ). Figure 3 (c) shows the energy bits of both shapes.

Two shapes of integral symbols connect at the center of the maximum limit point. The 'force-energy' of the first half and the second half of the forward (or reverse) cycles of electron dynamics connect at the maximum limit point. These factors give rise to an overall shape of force and energy, such as a Gaussian distribution with turned ends. Figure 4 shows this shape with different sections.

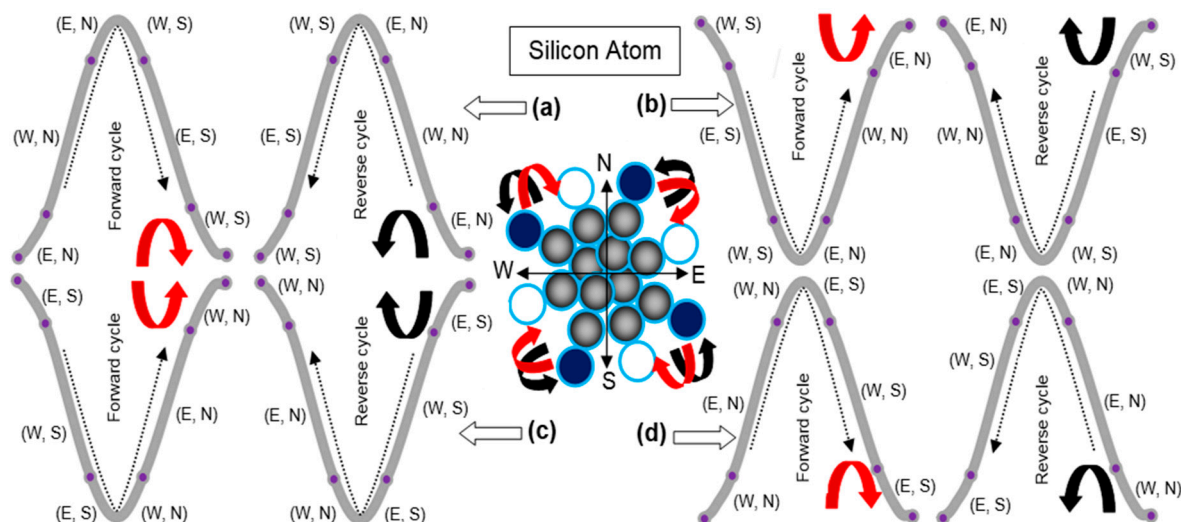
Figure 4 (a) plots the relationship between the force and energy in the forward cycle of the electron. Labels (1) to (6) denote the different steps in Figure 4 (a). Figure 4 (b) shows the reverse cycle of the electron and the relationship between force and energy. Labels (1) to (6) in Figure 4 (b) also show the different steps of the electron dynamics in one forward direction cycle (or in one reverse direction cycle). Label (7) in Figure 4 denotes the maximum limit point. From that point, the electron turns toward the nearby unfilled state to occupy it. It is due to the appearance of another pair of forces.



**Figure 4.** Sections of the unit photon generated under the electron dynamics of the silicon atom in (a) forward and (b) reverse cycles; (7) connected left and right half-cycles at the maximum limit point.

Two forces of different poles act on the electron in each step of the dynamics. The exertion of forces is simultaneous. The action of forces is from opposite sides of the electron. In a complete forward or reverse cycle of the interstate dynamics, an electron turns six times. Figure 5 (a-d) shows the forward and reverse cycles of electron dynamics in all quadrants of the silicon atom symbolically. Figure 5 (a-d) also shows the forces exerted on the electron at each turning point. Electrons in four quadrants trace the trajectories of confined inter-state dynamics in both forward and reverse cycles.

An electron leaves the state from the rear side or tail side. It enters the nearby state from the front side or head side while executing forward interstate dynamics. Figure 5 (a) shows this. This electron will leave the state from the rear side or tail side. It will enter the nearby state from the front side or head side while executing reverse interstate dynamics. In this case, the tail becomes the head, and the head becomes the tail. The tracing trajectory of the electron dynamics in Figure 5 (a) is from the front side. The electron dynamics in Figure 5 (b) trace the trajectory from the back of the atom. In this way, an atom maintains the equilibrium state.



**Figure 5.** Electrons in four quadrants denoted by (a), (b), (c), and (d) correspond to the east (E), west (W), north (N), and south (S) forces, respectively, along the relevant poles while executing confined interstate dynamics in forward (red-colored round arrows) and reverse (black-colored round arrows) cycles.

An electron leaves the state from the front side or head side. Figure 5 (c) shows this. It enters the nearby state from the rear side or tail side while executing forward interstate dynamics. In the reverse interstate dynamics, this electron will leave the state from the front side or head side. It enters the nearby state from the rear side or tail side. The electron dynamics in Figure 5 (d) trace the trajectory from the front of the atom. In this way, an atom maintains the equilibrium state.

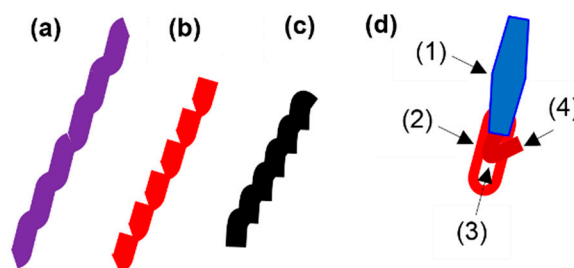
The electrons 'a' and 'd' in Figure 5 can trace the trajectory from the front side. The electrons 'b' and 'c' in Figure 5 can trace the trajectory from the back side. The electrons can also execute the dynamics in reverse order. Electrons 'a' and 'b' in Figure 5 can also execute dynamics from the front side. The electrons 'c' and 'd' can execute dynamics from the rear side. In these electron dynamics, an atom can also secure the equilibrium state. However, the forces involved at each turning point of an electron are required to maintain its confined interstate dynamics.

In the atoms of those elements, where conservative forces are only from three poles, electron dynamics transform heat energy into photon energy. The shape of the resulting photon is like the connected integral symbols. However, an electron deals with the forces of only two poles at a time to execute interstate dynamics. It is necessary to determine which element atoms convert heat energy into integral symbol-connected photon energy.

In the atoms of those elements, where conservative forces are only from two poles, electron dynamics transform heat energy into photon energy. The shape of the resulting photon is like the connected tick symbols. It is necessary to determine which element atoms are suitable for converting heat energy into tick symbol-connected photon energy.

In the atoms of those elements, where conservative forces are from three poles, the electron dynamics also transform heat energy into photon energy. In this case, the electron reverts without touching the nearby unfilled state. The shape of the resulting photon is like the connected letters L. It is necessary to determine which element atoms are suitable for such a photon. However, an electron deals with the forces of only two poles at a time.

Different photons in Figure 6 (a-c) show the shape of connected integral symbols, tick symbols, and letters L, respectively. A photon in Figure 6 (d) shows elements of both force and energy. Atoms of suitable elements can generate photons with different characteristics. Generating photons of a different nature can open new areas of research. There is also a need to study the photons in semi-behavioral materials.



**Figure 6.** Overt photons of connected (a) integral symbols, (b) tick symbols, (c) letters L, and (d) shaping force and energy along the trajectory; (1) electron dynamics, (2) shaping energy, (3) shaping force, (4) the removed, red-colored energy region showing the force in white color.

### 3.3. General Discussion

The number of photons resulting from silicon cells connected in series, constructing a solar panel, increases. As observed in a solar panel, there is a maximum generation of power from the atoms of the solar cells. It is the case of having the proper inclination setting. The cycles of confined interstate electron dynamics of silicon atoms remain uninterrupted for an extended period, where tilting the solar panel at a suitable angle relative to the base results in varying efficiency.

Depositing silicon atoms for a few layers can also generate high power. In each atom of the layer, conservative forces in the interstate dynamics control the turning of the electron. At each point of a turning electron, there is an auxiliary moment of inertia. A photon of infinite or unending length can result if the electron dynamics are without any hurdle.

It may not be viable for one or three electrons of the outer ring to execute interstate dynamics. A minor influence of the atomic state can lead to stopping confined interstate electron dynamics and the disappearance of the conservative force. The dynamics for one or three electrons can influence the atomic neutrality. However, additional work is required to obtain a complete picture.

When the featured photons interact with the tips of laterally orientated electrons of elongated atoms, the reverted element of force prints the pattern. A separate study discusses this elsewhere [27]. To introduce specific applications, a structural design is crucial, as discussed elsewhere [28–37]. A shaped structure is due to the controlled behavior of force and energy, as discussed elsewhere [17].

If there is no specific interaction with an electron, a photon divides into pieces. These pieces relate to the heat energy. The heat of a divided photon dissipates in the structure of atoms. The conversion of energy from one form to another depends on structural characteristics.

The ‘energy-force’ of the atoms in depositing carbon films varies, as discussed elsewhere [20,38]. The developing particles under predictor packing are studied, where the featured photons convert into tuned pulses [39]. Measuring the temperature of such materials is an integral part of related research, and some studies have also shed light on this topic [40–42]. A study elsewhere [43] explains the role of van der Waals interactions in isolated atoms by considering the induced dipoles. Dispersion forces (or van der Waals interactions) are due to the charge density fluctuations, as discussed elsewhere [44]. This charge density forms a wave.

The topic of this study is in its early stages. Therefore, there is a need to investigate a further theoretical basis. There is also a need to study the experimental validation. The real-world applicability of the discussed models in this study is also required. How would the discussed findings in this study translate into practical applications? It is needed to investigate further. This paper primarily focuses on silicon atoms. Therefore, the discussed principles should also require validation for other relevant materials. The discussed models require further authentication. There is also a need to clarify further how this work advances the existing literature on the topic.

## 4. Conclusions

A unit photon contains the energy of two bits. A long photon has several energy bits. Two-unit photons jointly construct the photon of the shortest wavelength. When an overt photon interacts with the north-sided tip (of a laterally orientated) electron at an approximately 90° angle, it can divide into bits of energy. The interaction of a suitable photon with the side of a solid (or semisolid) electron can convert it into energy pieces.

When an outer ring electron of a silicon atom executes confined interstate dynamics, two forces are present to turn it each time. However, those forces introduce an auxiliary moment of inertia. In a silicon atom, energy shapes around the force, thus tracing an electronic trajectory. In each electron dynamics, the shaping of energy is from the opposite sides of the forces that turn the electron. For one forward (or reverse) cycle, the dynamics of an electron generate a unit photon. The unit photon is in the shape of a Gaussian distribution with turned ends.

The forces exerted on the electron change its aspects. The dynamics restrict the electron within the interstate gap. Shaping force-energy along the tracing trajectory of the electron is conserved. The auxiliary moment of inertia is at each point of the turning electron. A suitable electron of the silicon atom executes its dynamics. The reference point is the center of the silicon atom. In the first stage, the electron lifts laterally.

The conservative forces for the electron dynamics are within the interstate electron dynamics. Before crossing the maximum limit point, the electron is examined by the opposite forces pulling it. To complete the second half-cycle, there is a relief from the effect of the forces for the first half-cycle of the electron. Therefore, the forces of the opposite poles will exert on the electron to complete the second half-cycle.

Path-independent conservative forces exist for the electron. Therefore, the electron acquires lateral and adjacent positions. Those forces are within natural viability. An electron executes interstate dynamics nearly at the speed of light. Electrons of suitable atoms build a bandgap. The photons propagate between electronic gaps to define the photonic band gap. In the propagation of photons, the 'force energy' is carried from one end to the other.

Suitable element atoms generate photons of different shapes depending on the built-in interstate gap of electron dynamics. Therefore, suitable element atoms can generate photons other than a waveform depending on their built-in interstate electron gap. Such investigations open up new horizons in energy science and materials science.

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