Light and the powering of life

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ABSTRACT: In this work we investigate the mechanism by which interactions between the atoms of the sun and photosynthesizing organisms act to produce useable work within the cell. This is explained as a deeply mechanical process by which photoelectrically excited molecules embedded within the organism's specialized membranes rearrange structurally so as to promote physical contact with proximal yet discretized structures and thus promote mechanical conduction of excitation. The contact transmission of motion between these proteins results in localized concentration of electrically active catabolic products. These active species are then dammed and flooded so as to drive a diffusive pump-ratchet system that is responsible for synthesis of the cell's primary power-currency molecules. These molecules store motion internally, wherein the constituent atoms relax into unique and shared-surface configurations and thus serve as portable and stable on-demand power-reservoirs throughout the organism. Later, when the organism requires input motion for longer term storage, these molecules will be dissected by distal machinery and the excess motion will be used to power sugar assembly or other processes. Similar membrane bound mechanical processes can explain metabolism in general by extending these understandings to metabolic processes within the other kingdoms.

Previously we have explained light as a pressure-equalizing transaction mediated along a hypothetical interconnection stretched between any two atoms[1]. In order to understand how the power[Ω] of our sun is harvested by organisms on Earth we will continue our discussion of light relay[2] with a generalized inspection of photo-absorption. Recall that the ability of an atom to absorb or reflect a particular excitation stems from its particular shape, surface elasticity, and neighborhood within its material lattice[1,2]. Often an atom may receive photo-excitation only to re-emit a weaker light with a lower frequency and displaced forward motion. Silver, on the other hand, displays almost perfect efficiency in terms of re-emission of visible light. This is particularly true for those atoms situated within a polished lattice, such as a mirror. Pigments, are molecularly bound groups of atoms, capable of modifying the re-emission spectrum during relay following photonic excitement.

The degree to which a pigment is capable of modifying a particular light during relay is highly dependent upon its shape and dimensions and thus these molecules can be closely likened to antennae. Some pigments such as mercury sulfide, or cadmium sulfide simply screen absorption of photonic excitement, while others participate in a complex series of photoelectric relays that feed back to alter the original input. Such is the case for the bio-pigment, *chlorophyll*, which we will examine in depth momentarily. Pigmented relay, unlike fluorescence[γ] or phosphorescence[Π], can only diminish and relay photoexcitation; it cannot achieve novel frequency light.

When a pigment absorber atom is excited, several modes of dissipative action are available **(Fig 1)**. The particular response of the excited atom depends upon the shape of that atom as well as its immediate coordination to its surroundings. For instance, if the atom is in direct contact with appropriately aligned atoms, it appears able to re-direct incident photonic momentum toward spin motion as *electricity*[3]. In addition to such *photoelectric* dissipation,

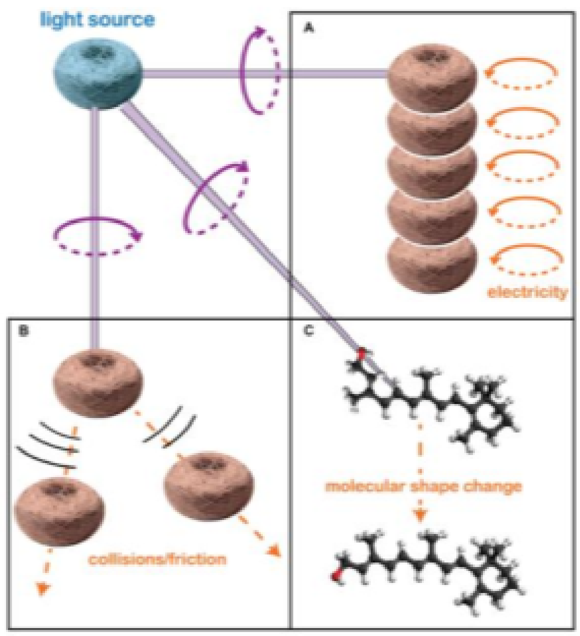

Figure 1| Bio-physical consequences of light absorption. Incident excitation along a photogravitational filament from atoms in a light source (blue) such as the Sun results in distal excitation of stacks of atoms (orange) electrically **(A)** and/or thermally including frictionally, vibrationally and translationally **(B)** and/or molecular shape -change, as shown for the optical pigment retinal **(C)**.

light excitation may be redirected onto unaligned but in-contact atoms through collisions and frictions; a process known as *photothermicity*. A final manner by which photonic excitation can be dissipated is via *molecular shape-change*. Often the change of shape of a molecule allows for subsequent catalysis of inter-atomic bonding by forcing electrically active atomic surfaces into contact. These dissipations may or may not result in re-transmission (reflection, fluorescence, or phosphorescence) of light unto other atoms within the organism.

Life[3], the set of natural objects that moves autonomously against gravity, is essentially powered in all its myriad motions though allocation of this incident radiative excitation from our nearest star. Living objects harness this radiative excitation through specialized pigments using all of the mechanisms presented in **Figure 1**. Shape change of molecules within the stromal membrane **(Fig 1C)**, however, is primary on account of the fact that enzymatic activation allows for the portability and selective transmission of motion when and where necessary to accomplish work within the organism.

To some extent, all atoms and molecules absorb light and so all structures act as variable antennae. The ability of an object to resonate with the incident stimuli appears to follow exclusively from the particular atomic shape of that structure in that certain configurations will allow the stimulus to form standing intra-structural oscillations. DNA, for instance, seems to act as an antenna tuned to a very narrow wavelength range centered about the ultraviolent band (~260nm). In fact, despite long-term UV light leading to DNA damage, the DNA molecule is generally an extraordinary converter of radiation to non-destructive heat **(Fig 1B)**. DNA and melanin both appear to display such internal conversion rates many orders of magnitude faster than any known synthetic molecules[4].

The mechanism by which incident radiation's excitatory motion is comes to be harnessed and stored within an organism using portable battery-like molecules (ATP, NADPH), is well illustrated by the process of photosynthesis, where incident solar radiation is used to produce reactive species that fuel downstream anabolism. While photosynthesis harnesses power for the plant's ends, the process also expels diatomic oxygen that is later tapped by aerobic organisms their own metabolic machinery. Thus, while a minority of single-celled organisms can oxidize their native molecular milieu directly, the vast majority of every-day critters, including ourselves, depend very much on the photosynthetic activity of plants. Many bacteria also perform this feat, but our discussion will focus on plants as archetypical photosynthesizers.

In plant photosynthesis, chlorophyll is the key pigment for light absorption. This molecule is located within specialized organelles called chloroplasts; it predominantly resides within the membrane of the *thylakoid*, a compartment specialized for the spatial segregation of electrically active atoms required for the final step of photosynthesis. The key to chlorophyll's ability to harness solar radiation into useful work comes from the presence of a specialized molecular structure called *chlorin*, which consists a central magnesium coordinated between four radiant nitrile rings **(Fig 2).** The chlorophylls are grouped into reaction-centers that are capable of resonating with one another photonically across their interatomic filaments so as to excite others with unprecedented efficiency (see Supplemental Materials for details). The central

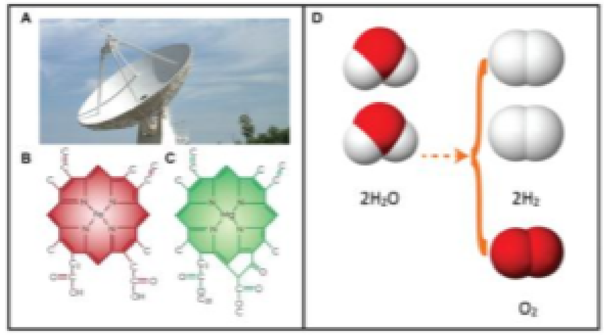

Figure 2| Biopigments act as capacitive antennae, absorbing and resdistributing incident photonic pressures. Incident excitation along a photogravitational filament from a light source results in electric excitation of antennae **(A)**. Cells of plants and some bacteria contain similar antennae called Chlorphyll **(C)**, and this complex together acts to facilitate un-wrenching of hydrogen from oxygen, effectively splitting water througha process called electrolysis **(D)**. Interestingly, the mammalean oxygen carrier, heme **(B)**, is nearly identical in structure to chlorophyl and essentially function oppositionally by binding instead of releasing oxygen. Its function as an antennae has yet to be explored.

magnesium of chlorophyll acts as a sort of capacitor, storing incident excitatory motion from the light source, until it can be applied to bound waters for the process of electrolysis[5].

Interestingly, the chlorin structure responsible for the immensely powerful resonance achieved by the chlorophyll molecule is highly similar to porphyrin, the structure found in heme, our bloodborne oxygen-shuttle. Chlorin and porphyrin differ structurally only in terms of the central metal and bonding of the nitrile rings. While hemoglobin clearly does not participate in photosynthesis,

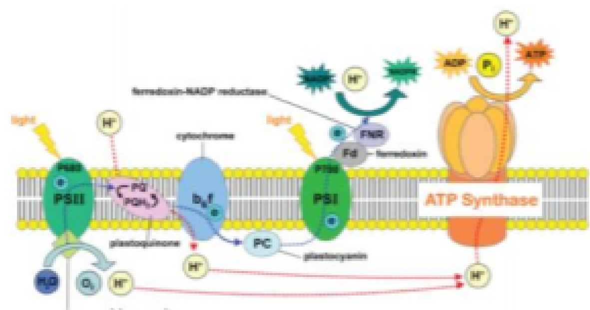

Figure 3| Stroma membrane of the chloroplast and ATP synthesis. Incident excitation along a photogravitational filament from a light source results in electric excitation of chlorophylls embedded within PhotoSystems I and II. Those PS proteins convey the electric excitation via mechanical spin transduction of accessory proteins also embedded in the membrane as well as excitation of soluble molecules such as plasocyanin. Ultimately the incident motive pressure form the light source is transduced into metabolism of NADPH from NADH and ATP from ADP. These two compounds are able to then perform numerous catalytic actions throughout the cell by selectively unleashing the pressures of their phosphate bonds. In this manner, the sequence of events following electric activation of the photosystems closely mirrors the respiratory chain of the preponderance of other organisms: in fact it is often referred to as the "thylakoid electron transport chain".

it does absorb light very effectively. One might speculate that heme participates in the protecting us from radiation damage, although such effects have not been explored in depth.

This electrolytic process surrounding chlorophyll is the only known biological instance concerning the oxidation of water. The unique photoreaction serves not only to physically unscrew hydrogens from water and store them intraluminally for production of a chemi-osmotic gradient in the service of synthesize of ATP synthesis, but also releases a great deal of electrical motion into the local membrane-bound protein machinery. This electrical motion appears to make certain shape changes are available to these membrane proteins per **Fig 1C**, such that electrical contacts are available for the binding and construction of NADPH **(Fig 3).** The flooding of intraluminally concentrated Hydrogen atoms across a special outlet drives torsion of the ATP synthase, which physically clamps phosphates onto adenosine diphosphate (ADP). ATP and NADPH thus contain within the tight frustrations of their bonding the motive pressure originally incident from the light source.

The similarity between the stromal metabolic machinery downstream of chlorophyll-driven oxidation of water in plants and the respiratory machinery of all other organisms cannot be understated. Some have speculated that this machine first appeared on Earth in early organisms that used reducing agents such as hydrogen or hydrogen sulfide instead of water[6]. These ancient metabolic strategies are found in modern bacteria that utilize nitrates, sulfides, molecular hydrogen, and other inorganic substrates for the production of membrane electricity. Later organisms, including animals, may have adapted use of oxygen following appearance of its vast abundance resultant of the early initiation of photosynthesis in cyanobacteria[7-11]. While the source of reducing agent may vary, all organisms ever appear to utilize a remarkably similar series of membrane bound electrical contacts and molecular-shape-change switches **(Fig 1A, C, Fig 3)** for production of a chemi-osmotic gradient and eventual storage of motive pressure within a mobile battery-like molecule such as NADPH or ATP.

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Figure 2D's electrolytic molecule rendering is courtesy of *JSquish* from Wikimedia.

Figure 3's illustration of the chloroplast stroma is adapted from the illustration by Somepics courtesy of Wikimedia.

KEYWORD DEFINITIONS

Object: That which has inward extension.

Exist: Object with location.

Physical: Pertaining to objects that exist.

Pressure: impossibility of two existent objects occupying the same location.

ᴖPower: Work per time.

Work- Ability of one object to pressure another.

♦Life: Set of existent objects capable of autonomous motion against gravity.

ϒFluorescence: specialized, damping form of reflection wherein a particular wavelength of incident light results in re-emission of a longer.

¤Phosphorescence: delayed fluorescent re-emission of photo-excitation from an atom or group of atoms.

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SUPPLEMENTAL MATERIALS

Förster Resonance Energy (FRET) describes the process by which two excited "fluorophore" molecules or atoms excite one another in a manner analogous to near-field radiation, where the radius of interaction is much shorter than the distance of communication between the atoms.

The FRET efficiency depends on many physical parameters that can be grouped as 1) the distance between the donor and the acceptor (typically in the range of 1–10 nm), 2) the spectral overlap of the donor emission spectrum and the acceptor absorption spectrum, and 3) the relative electric orientation (dipole) of the donor emitter with respect to the acceptor. E depends on the donor-to-acceptor separation distance, r, with an inverse 6th-power law:

$$E = \frac{1}{1 + (r/R_0)^6}$$

with representing the median distance of this pair of donor and acceptor, i.e. the distance at which the photon transfer efficiency is 50%.

A physical mechanism for electricity, magnetism, and chemical bonding

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ABSTRACT: The concepts of electricity and magnetism have long been considered two sides of the same conceptual coin. These concepts have been popularized as electric and magnetic "fields," which are defined as regions of interaction rather than as physical objects. However, a rational explanation for these phenomena has by-and-large eluded theorists. Herein, one possible explanation is advanced following from Fiber-Filament atomics where electricity is conceived as *in situ* frictional rotation of atoms aligned in a conductor. Magnetism follows naturally as lateral friction-locking or repulsion of fibrous atomic surfaces. The key to these mechanisms is a fibrous atom, whose shell surfaces are composed of directionally aligned fibers, accounting for descriptions in the literature of "orbitals" with "spin". Spin surfaces enmesh with the complementary surfaces of neighboring atoms either constructively or destructively. Thus, sub-atomic friction between fibrous whirls of atomic surfaces produces atomic repulsion, attraction, or electric conduction. Chemistry is explained as an extension of this frictional locking process. Dielectrics/semi-conductor mechanics are discussed briefly to underscore the importance of lattice alignment in the production of these phenomena.

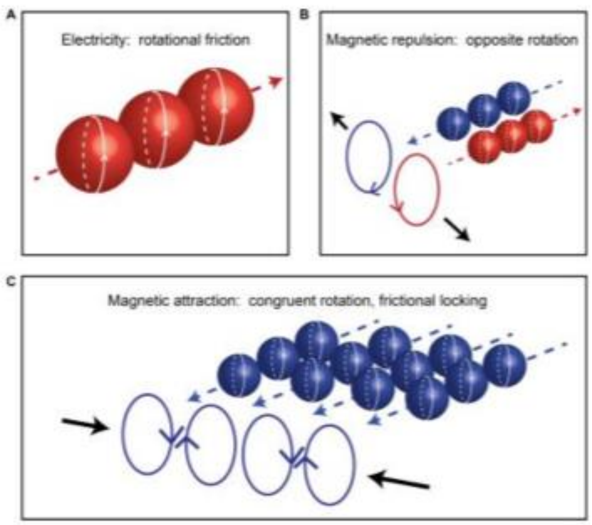

Figure 1| Electricity and magnetism are the result of friction between atoms aligned in a specific lattice. The fibrous surfaces of atoms (simplified as red/blue spheres) enmesh frictionally when aligned in the lattice of certain conductive metals, allowing rotational motion applied at one end to propagate distally as electricity shown in **(A).** Magnetism follows naturally as lateral friction between atomic surface fibers where alignment direction determines whether the composite materials repel one another **(B)** or attract **(C)**.

To understand the physical mechanism of electricity, a physical interaction must be established between the atoms involved. For instance, when one applies a voltage to a circuit, motive force is available at great distance from the motive source (power generator, battery, etc.). While many great minds have discussed the effect of electricity in great quantitative detail, a physical mechanism of conduction was not proposed. Instead, the concept of an "electron" has been reified into a fluid object that is transferred between atoms and somehow results in physical motion at great distance from its source. The mechanism for these fluid-like dynamics of the "electron" has been wholly ignored, in large part because the accounting behind the process has been so widely vetted by technological applications. It is therefore the aim of this paper to not challenge such mathematical descriptions of electric transmission by Maxwell, Tesla, and others[1-10]. Instead, we follow these descriptions toward a possible physical interpretation of these phenomena. Here, electric and magnetic action is proposed the result of friction between atoms aligned in a conductor (**Fig 1**).

Under Fiber-Filament theory[11], the atom is proposed to be an object composed of enchained fibers, with surfaces in place of the reifications commonly referred to as "electrons" or "orbitals". These fibrous surfaces are in constant and eternal motion, winding with a particular orientation, much like a ball of yarn. The standing academic concept of "particle spin" is claimed to have no physical correspondence[12]. However, here we interpret spin as the winding orientation of the fibers at the atomic surface (see **Fig 2**). This spin is almost always measured photoelectrically, which we interpret as meaning that a particular filament's winding orientation is measured[13]. This measurement gives rise to the other quantum numbers, which detail the location of that measurement on the atomic

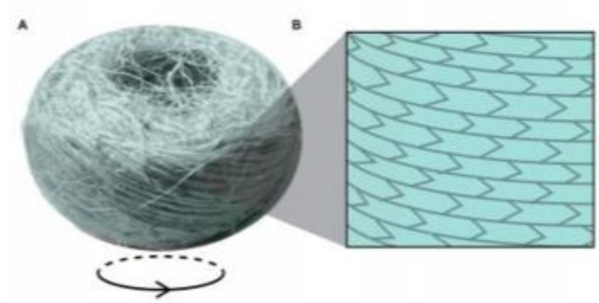

Figure 2| Physical interpretation of spin as orientation of fiber-winding on atomic surface Atoms and the photogravitational filament that connects them are assumed to be composed of interlocking fibers **(A)**. The orientation of fibers **(B)** allows for friction-like enmeshment between atoms, in order for one to spin the next in line for a conductor or laterally, in the case of magnetism.

surface. Spin is thus decided at the moment of the species spallative formation.

A given atomic surface can spin one way or the opposite, with no other possibilities. Consider that a sphere may have a north and south pole but not one without the other. This is confusingly referred to in the quantum number as spin +1/2 or -1/2. It is more useful to refer to these orientations as clockwise (CW) or counter-clockwise (CCW) spin. Incoming and outgoing photogravitational filaments converge on the atomic surface and conserve this directionality under fiber-filament theory[11]. This allows us to understand "quantum entanglement"[14], where measurement of spin orientation by electromagnetic radiation on one side of the atom will necessarily lead to the opposite-handed measurement for the same filament on the opposite side of the atom. This immediate "spooky action at a distance" results simply from measuring the same filament viewed from opposing perspectives! In general, particular spin surface orientations allow atomic fibers to interact and enmesh constructively or destructively producing all phenomena of electromagnetism and chemistry.

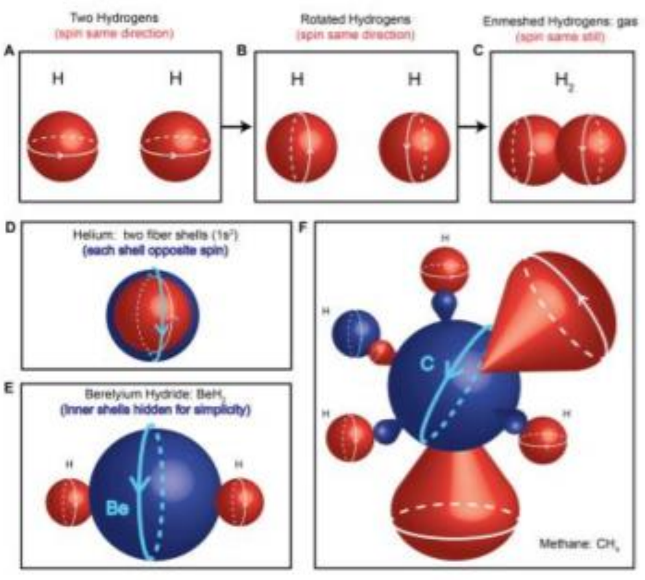

Figure 3| Chemical bonding results from enmeshment of fibrous surfaces with opposing orientation (spin). The fibrous surfaces of atoms (simplified spheres) enmesh frictionally when aligned in opposition (red versus blue). Basic elements like Hydrogen **(A)** can freely rotate **(B)**, oppose and enmesh with self-simlar species to form diatomic gases **(C).** When elements are subject to sufficient pressures, they may spallate fiberous material and lose a surface, whereby the unveiled surface has opposing spin **(D).** More complex chemicals can readily be produced from interactions between opposing spin surfaces, where Hydrogen, free to rotate into either CW or CCW spin orientation, can play the wild card binding to either surface, as can be seen with Berylium Hydride **(E)** and Methane **(F)**.

Chemical bonding is a very simple phenomenon to explain using fiber-filament theory. In the case of basic diatomic gas formation, we see a unified spin-orientation of the outer atomic shell surface. Initially mono-atomic species are free to rotate and so can oppose each other freely and entangle physically with fibers frictionally locking from a similar partner atom **(Fig 3A-C)**. For larger species, which may under certain pressures decay into simpler elements, we see that when material is lost from the outer shell an opposing surface remains **(Fig 3D)**. This seems to indicate that fibrous shells are woven in opposing spin orientation, which perhaps provides frictional locking between the surfaces and adds stability to those atoms. More complex chemical arrangements can follow such that opposing spin results in frictionally locking bonds. Interestingly, Hydrogen can play a sort of wild-card in chemistry since it is free to rotate into either CW or CCW positions in a given context, allowing it to enmesh and bind with either surface orientation on a given element **(Fig 3 E, F)**.

Dielectric materials are a prime example of how lattice arrangement within a material can affect the atoms ability to conduct spin motion **(Fig 4)**. In a dielectric material, there is a blend of conductive, columnar aligned, atoms and regions of unaligned "drawbridge"-like atoms. These "drawbridge" regions are free to rotate once sufficient spin motion is present in the material. The key concept here is that some effort is spent realigning semi-conductive elements within the dielectric, such that they may participate in the current. Because of their lattice arrangements and bonding angles, once the input power is removed, the semi-conductive atoms will de-align and cease to participate in the current.

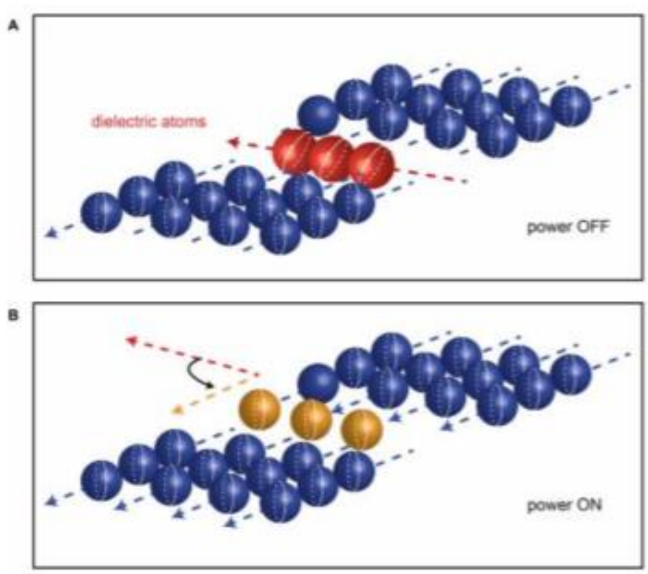

Figure 4| Dielectric materials underscore the importance of lattice arrangment in the electricity. Pre-aligned atoms (conductive) are interspersed with alignable atoms **(A)**. When sufficient power is supplied to the material from one end, spin propagation allows for semi-conductive atoms to be realigned and participate in the current **(B)**.

It is clear that a physical interpretation of atomic behavior has been historically neglected, in favor of detailed numeric descriptions of measurement. This is particularly true with regards to electricity and magnetism, which have been presented here quite simply as the result of friction between species. Chemical bonding is proposed to follow naturally from this mechanism as a consequence of enduring surface enmeshment, while dielectrics show how transient realignment of atoms mixed within a material can allow for threshold gated current control. A future paper will address both the specific nature of the fibers that comprise the atom as well as the details of ionization, where atomic shells are greatly expanded and thus allow for transmission of electricity across great distances.

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KEYWORD DEFINITIONS

Object: That which has shape.

Shape: An effectively closed surface which forms a boundary to immediate surroundings.

Exist: Object with location and outward extension.

Physical: Pertaining to objects that exist.

Rational: Explanation following from non-circular, consistent, objective assumptions that does not commit the fallacy of reification.

Pressure- impossibility of two existent objects occupying the same location.

Lattice: The patterned orientation and localization of atoms within a homogenous material.

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Mechanisms for atomic transit and ionization suggest possible sub-atomic fiber and photogravitational filament architecture

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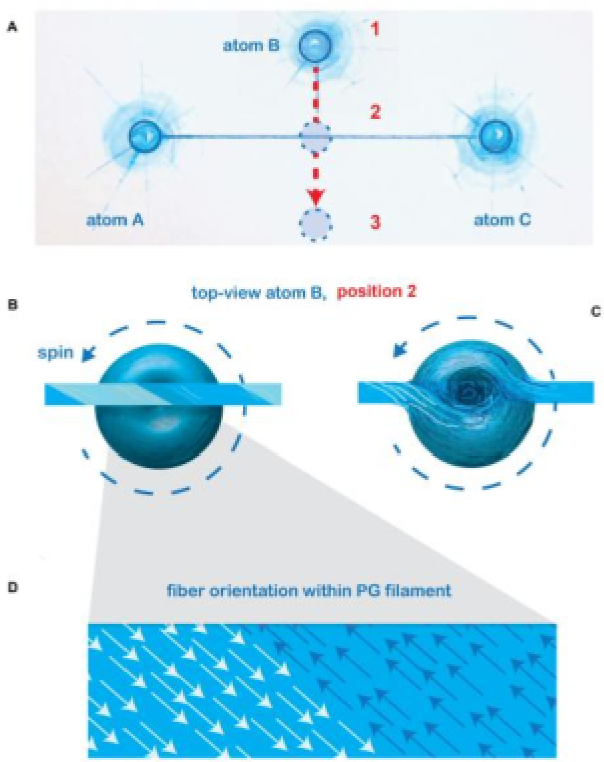
ABSTRACT: Our use of the Fiber-Filament hypothesis of inter-atomic connection, the photogravitational (PG) filament, has up to present allowed for the development of physical mechanisms for poorly understood phenomena such as electricity, magnetism, light, and gravity. In this manuscript, the possible shapes of the sub-atomic fiber and composite photogravitational filament are proposed based on the following requirements: that the fibers have orientation dependent strength, such that the composite filament between atoms can separate at the atomic surface and allow for interceding atomic transit, and that the fibers have the subsequent ability to recombine in order to restore direct connectivity between interrupted atomic relays. Additionally, the fiber must allow for an atom to expand and fill the extraordinary volumes necessary for surface-surface transmission of electricity across great distances as is apparent during ionization in low-pressure electric arcing. Here, a catch-spring structure is proposed for the fiber.

To understand the possible shapes of the sub-atomic fiber it is first necessary to consider the requirements based on the apparent behavior of the atom, with respect to its role in natural phenomena; in particular light and electricity.



Previously we have proposed that light is the result of torsional motion along an elastic filament between two atoms[1]. In this work, the atom and the photogravitational (PG) filament are assumed to be comprised of the same fundamental objects, fibers. The proposed mechanism for electricity and magnetism under the Fiber-Filament hypothesis has led to the model that fibers are wound concentrically about the atom, thereby lending a physical interpretation of "atomic spin" as atomic fiber orientation[2]. Here, we consider that in order for the fibrous atoms to move about and change position, they should need to be constantly transecting a vast network of PG filaments. A proposed mechanism for this transit is shown in **Fig 1**.

Interestingly, the transition mechanism by which PG filaments merge with the surface of atoms mandates that fibers from each side of the transected filament be oriented in opposition in order to comply with the apparent surface orientation of atomic fiber (atomic spin). What this means, and what spin implies in this context, is that for an atomic surface with a homogenous winding of fiber[2], there will be two sides of the atomic globe, each with opposing fiber orientation. The intersecting filament must always conform to these fiber stream orientations. Perhaps the simplest way for fiber of the filament to merge with spooled fiber of the atom, from any intersecting angle, is via immediate interaction with two opposite streams of fiber in each filament. In **Fig 1B** such an atomic transit is imagined during a polar approach of the filament, however the same principle can be applied at any intersection angle. Also, because shorter wavelength is the result of greater torsional compression upon the filament[1], we expect more of these alternating bands per unit length of filament during high frequency light transmission.

Figure 1| Transection of photogravitational filaments during atomic transit. **(A)** Atomic transit is represented at three positions, with all atoms assumed in plane with one another. At position 2, the filament merges with the transiting fibrous atom, with filamentary fibers joining the natural spin path of the atomic fiber as shown in **(B)** and **(C)**, with the plane rotated such that the atoms are viewed from above here. The mechanics of this merger implies that the photogravitational filament must display alternating bands of opposing orientation fiber as simplified by arrows in **(D)**. Atoms are assumed to be connected to all others within their photogravitational system, either directly or indirectly, however only the filament between A and C is shown for simplicity.

Furthermore, from this mechanism, some architectural requirements of the fiber are revealed: the fiber must afford to some specific elasticity and rupture dynamics to its composite streams. Other clues about the shape of the fiber may be gleaned from certain behaviors of the atom, including electricity and in particular, ionization.

Most of the matter in existence occurs in the ionized state[3]. During ionization, inert atoms are said to be excited to participate in electricity. A common case of electrical ionization is found in low-pressure neon lamps: a voltage is applied to an inert gas, which is then able to conduct current. The conduction of this current results in the emission of light[4,5]. In the photogravitational theory, light has previously been explained as filamentary torsion[1]. However, the classical mechanism for ionization has been generalized as the liberation of atomic "electrons". This is a reification of electrical accounting and fails to provide physical mechanism[2]. This manner of viewing the process in terms of quantitative accounting has served engineers well throughout the centuries but has failed to provide a mechanistic explanation for the physical reality of observed phenomena[3]. Because it is impossible that a zero-dimensional "electron" can transmit force, alternatives have been proposed[2,6].

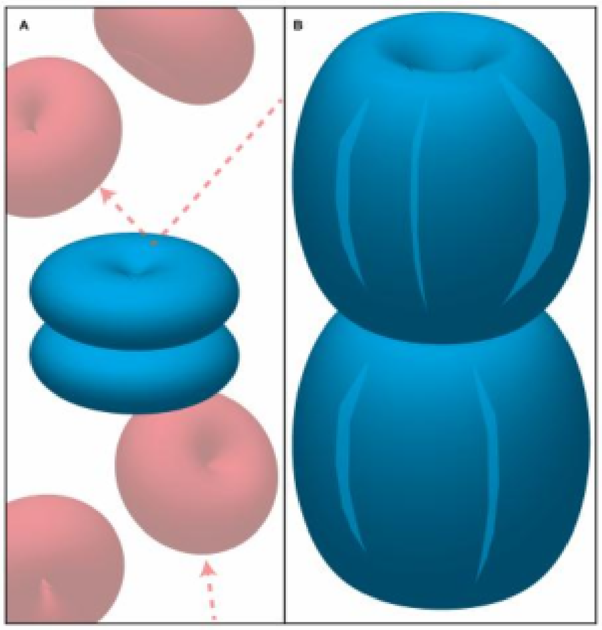


Figure 2| Ionization interpreted as expansion of the depressurized atomic surface allows for transmission of electricity across great distances. Often free atoms appear in pressurized environments on Earth or in other Astrons and certainly condense during the process of material solidification and liquification. Such pressures result from collisions with other atoms and restrict the size of the atomic surface as shown in **(A)**. When an atom is relieved of this pressure, as in interstellar regions or under artificial (though always imperfect) vacuum conditions, the atomic surface of unbound atoms may expand dramatically **(B)**. Based on the sparsity of such matter available throughout the cosmos, which is still able to conduct surface-to-surface electrical action, it is suggested emperically that atoms can expand to 10^{22} times their pressured volume.

Generally, alternative explanations have treated electricity as a product of surface-to-surface friction-like transmission of rotational motion between adjacent atomic bodies[2]. Because ionization is simply electrical action at a distance, the mechanism of should be very similar to a typical conduction schema.

Ionization is unique, however, in terms of conducting electricity since it appears to require very, very, very few atoms per unit volume. For instance, currents are apparent throughout the interstellar regions with as little as 1 atom per cubic 10 centimeters[7]. Consider this in contrast a copper conducting wire of 8.49×10^{23} atoms per 10 cubic centimeters (see Supplemental Materials for calculations). Mediation of physical phenomena requires objects as actors and so surface-to-surface contact must occur between atoms to provide for the conduction of electricity even under such sparse conditions and pressures. Thus, we interpret ionization as expanded atomic surfaces capable of conducting electricity across vast distances **(Fig 2)**. In fact, the first continuous electric arc of ionized conductive material was described by Vasily V. Petrov as a "special fluid with electrical properties[3]." And for good reason! A fluid is merely an assembly of tightly packed yet heterogeneously oriented objects; both in the case of single atoms and composite molecules. Ionized gas is different only in so much as the colossal quantitative difference in pressures upon the elements involved. Under the near-vacuum conditions of deep space, surface collision pressures for ionized atoms are unimaginably low and the atomic size is no longer restricted as it would be under gravitation and other containment conditions.

The necessity of physical contact between atoms for electrical conduction coupled to their extremely low native density means that the atomic surface is unimaginably elastic and/or rarefied during the ionization apparent throughout the cosmos[9]. This apparently elastic atomic surface suggests that the sub-atomic fibers are quite capable of being stretched and/or detaching from one another in order to accommodate the necessary surface requirements. Because the atomic transit problem implies a solution whereby sub-atomic fibers in the PG filament detach at the atomic surface, one possibility emerges whereby great gaps become exposed in the atomic surface as spooled fibers detach from one another **(Fig 2B)**. These gaps would satisfy the surface thinning requirement during low density arcing while allowing for contact between atoms electrically. This is not to discount the possibility of fibril stretching, and a detailed accounting of the elasticity dynamics may inform one as to the proportion of cause with regards to these two possibilities. To that end, the initial manuscript considered in its appendices the elastic properties of the PG filament in terms of Planck's constant, h. In brief, the dynamics of light indicate a compressive limit on the filament and thus a conceivable rupture point[1].

PG filament transection during atomic transit implies fibers may have the ability to separate from one another to enchain with fibers of a congruent orientation at the atomic surface. This requirement can allow one to hypothesize possible architecture of the filament **(Fig 1)**. The hypothesis is strengthened by the elastic behavior of the atomic surface during ionization **(Fig2)**, which reveals the necessity of an elastic atomic surface and surface thinning, possibly due to the appearance of surface gaps. To satisfy these requirements of the natural atomic phenomena of light and electricity, here proposed and illustrated is a Velcro-like catch-spring configuration for the sub-atomic fiber **(Fig 3)**. It is noted that this is merely one possible shape and countless others that might also satisfy these requirements are available to the imagination. The catch-spring hook-and-loop model is advanced here due to its simplicity in addressing the needs of the apparent phenomena of light, atomic transit across filaments, and electrical ionization. This fiber shape allows for orientation specific enchaining, elasticity, and rupture in each of those contexts.

A future manuscript will examine the specifics of light relays along fibrous photogravitational filaments in terms of apparent behavior lacking rational explanations including reflection, refraction, and polarization. Additionally, we will begin to investigate and report on possible explanations for sub-atomic phenomena such as the proton using the Fiber-Filament hypothesis.

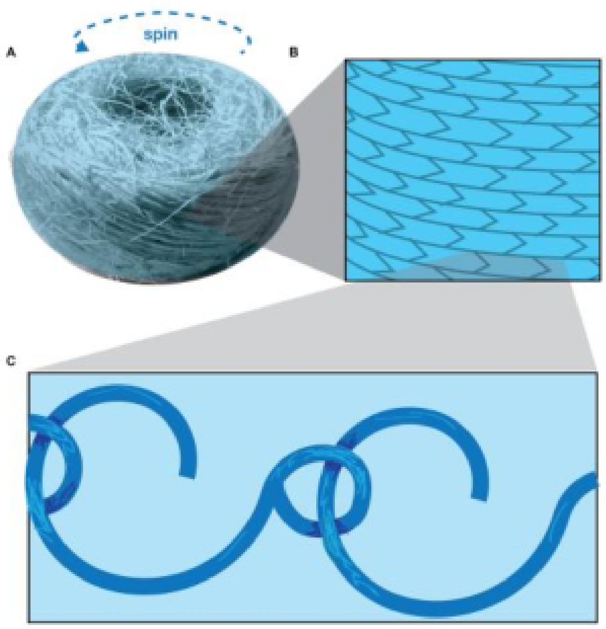


Figure 3| Possible shape of sub-atomic fiber. Atomic spin is interpreted physically as winding orientation of fibers **(A, B).** Because filamentary fiber-streams must separate and rejoin other fibers at the atomic surface during transit, a hook-and-loop, catch-spring type configuration is proposed as one possible architecture **(C).**

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KEYWORD DEFINITIONS

Object: That which has shape.

Shape: An effectively closed surface which forms a boundary to immediate surroundings.

Exist: Object with location and outward extension.

Physical: Pertaining to objects that exist.

Rational: Explanation following from non-circular, consistent, objective assumptions that does not commit the fallacy of reification.

Pressure- impossibility of two existent objects occupying the same location.

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SUPPLEMENTAL MATERIALS

The density of copper is 8.96 g/cm^3 (8960 kg/m^3) at room temperature. The molar mass is 63.546 g/mol (molar mass). Thus, there are 0.141 mol of copper per cm^3. Each mol contains 6.022×10^{23} atoms of copper so we have a total of 8.49×10^{22} atoms per cm^3 in a typical copper conducting wire.

This quantity may be contrasted with the density of ionized material in space, capable of conducting interstellar currents, which by conservative estimates requires 0.1 atoms per cm^3. Under the assumption that electricity requires contact between atoms, this reduction in density constitutes is a relative expansion of atomic size by a factor of more than 10^{23}.

Micky Callahan*

ABSTRACT: Whereas a mechanism for pull cannot be rationalized without direct connection between objects, a fibrous filament is assumed responsible for the phenomenon of atomic pull collectively referred to as gravitation between large composite objects. The assumption of a physical interatomic filament also provides a convenient rational mechanism for transmission of light between bodies, where light is a torsional action along the filament and tighter winding of the rigid helix explains higher "energy" light. The well characterized nature of this filamentary torsion (light) gives insight into the specific structure of the filament. The fibrous composition of the atom and its filaments is introduced to be expanded upon in a separate manuscript.

To understand the physical process of pull a physical connection must be established between any two objects. For instance, when one observes a train in the distance, one notes a series of discrete cars moving in formation across the landscape (Fig 1A). It is not apparent that the train cars are coupled mechanically with obscured linkages. Nonetheless, one readily assumes that a physical connection is indeed present because it is apparent that the train is an unconscious composite object moving as a singular body. It follows that this is the case for all physical objects in composition. There is simply no rational mechanism available for coupling pull between objects without a physical linkage.

A B

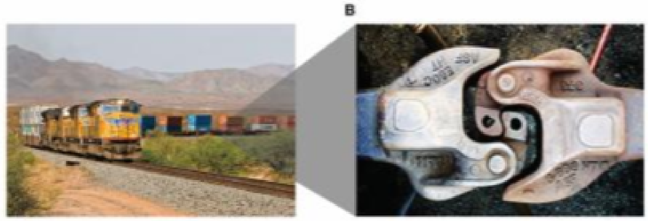

Figure 1| Hidden couplings accompany mechanical pull within composite systems. For a train we assume a mechanical couple exists even if it cannot be directly observed. Clearly the train moves cohesively **(A)** and pull must be transmitted mechanically **(B)**. This logic must be extended to all physical objects in systems of composition where internal pull strains occur.

It is effectively uncontestable that we should expect physical extensions to accomplish pull in the case of the train cars. The concept of gravity describes such pull between large, composite objects in systems such as the solar system, or bodies falling on Earth[1]. Certainly, powerful numerical descriptions of gravitation, first suggested by Bullialdus, have been provided by Newton and others. However, descriptions of trajectory are *not* explanations! While many have fallaciously accepted the reification of space and time[2,3] as cause for gravitational phenomena, no rational theory has been provided to date.

The reason our venerable predecessors abandoned the possibility of understanding invisible pull at these scales is simple: they could not conceive of the fact that the implicated and necessary linkages can exist despite being unavailable to direct measurement. However, much like the train-couplings when viewed from a distance, the interconnection responsible for gravity is merely untouchable using traditional methods. This is because the tools of the observer are composite objects comprised of atoms, much like the train of cars (**Fig 1**). However, because pull cannot be rationalized without direct connections, their existence can be readily assumed. To that end, there are clues about the shape of this unobservable connecting structure embedded in its other key role in the nature: transmission of light.

The physical mechanism of light has indeed puzzled scholars since time immemorial. Early investigations by Huygens, Young, Fresnel, Kirchhoff, and others revealed that light displays both wavelike properties and yet occurs as discrete events, later referred to as photons[4,5]. Instead of rationalizing how a discrete physical event could propagate in a wavelike fashion, theoreticians, with varying degrees of reluctance, accepted this dualism as an exception to nature: light is somehow a waving particle. Dualistic explanations violate the law of non-contradiction, however, and so reflect a misunderstanding of natural mechanics.

It is well documented that light propagates at a constant speed through a vacuum and that this speed is proportional to the frequency multiplied by the wavelength, $c=f\lambda$. This basic relationship holds for soundwaves or any other mechanical wave propagating though a medium. The speed of propagation is directly dependent upon the stiffness of the media. That propagation of sound is a wave-like motion described by the above relation is not under dispute, and so light must also behave as a wave in some rigid medium, or $c=f\lambda$ would not be apparent. Herein, light is proposed as torsion along an interatomic photogravitational filament (**Fig 2A**), following from and in alternative to Mr. Gaede's initial "rope" hypothesis of atomic extensions in 2008[6].

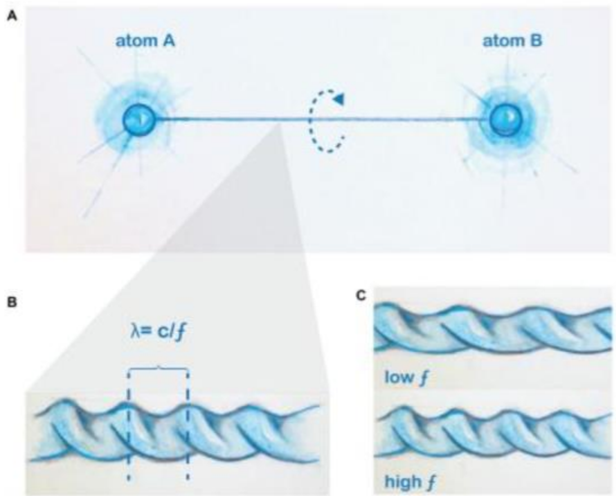

Figure 2| The photogravitational filament hosts torsion waves of light. Atoms ceaselessly expand and contract during quantum jumps to provide torque to the filament **(A)** at various frequencies (f), resulting in wavelengths (λ) of twist upon filament **(B, C)**. Both atoms and filaments are assumed composite structures of a fundamentally fibrous nature. Atoms move along the filaments thus acting as sliding-pulleys. Atoms A and B are similarly engaged with all atoms in their photogravitational system (not shown for clarity).

The speed of a wave in a medium depends on the rigidity of that medium[7] and we should expect much the same for the photogravitational filaments. Thus, the relationship between light energy and frequency, $E \sim f$, can be understood as an elastic responsiveness of an increasingly tightly wound helical filaments. Thus, it is quite likely that the filaments function similarly to cylindrical torsion springs[8], with a tighter-winding corresponding to higher frequency light, higher "energy" light. Like the cylindrical torsion spring, more torque applied to the photogravitational filament leads to more windings per length (**Fig 2B,C**) and thus greater stored potential (see Supplemental Discussion pertaining to elastic modulus of the filament and Planck's constant, h). Atoms are assumed to act as classical sliding-pulleys such that torsion propagates along the filaments irrespective of their corresponding atom's locations. In this manner, observer-independence of the speed of light, c, can finally be rationalized.

Composites of atoms produce the effect of gravitation between one another, which decreases as a function of the separation distance squared, $F = G \cdot m_1 m_2 / d^2$. Another way to look at it, is that pull increases as objects approach. Newton first described this relationship, but did not attempt an explanation for its cause. With filaments stretched between sliding atoms at equalized tension, the mechanism becomes apparent: The Newtonian force scaling of acceleration within gravitational systems describes atoms acting as classical sliding pulleys (**Fig 3**).

When two sliding pulleys are attached to an object, the angle of pull spreads as the object nears the horizontal meridian between those pulleys (see Supplemental Materials Equation 1.0). The greater the angle, the more pull each atom experiences. Near the horizontal meridian between atom-pulleys, the force multiplication is dramatically amplified such that it follows a square law with respect to approach distance. At great distances from the pulleys, however, the angle is effectively oblique to the object and a linear regime dominates such that each pulley takes only half the pull (**Fig 3B**). Pulley force multiplication during gravity is instantly transmitted into atomic momentum and thus motion and acceleration, since the atoms are free to slide along their filaments. This is why the acceleration due to the force of gravity appears less on Mt. Everest than at the Dead Sea[9].

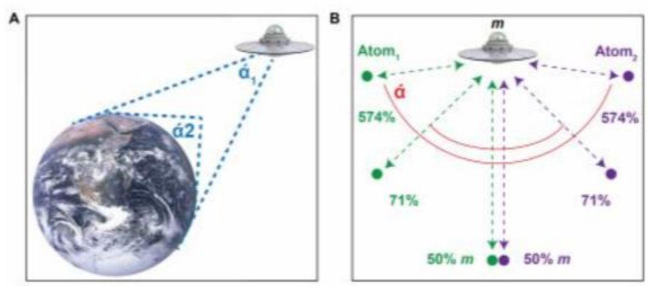

Figure 3| The force of gravity as a function of distance/spreading angle between photogravitational filaments, α. A composite object of mass m approaches the Earth and the angle α between photogravitational filaments connecting the objects spreads as shown in **(A)**. The quantity of filaments remains constant while forces experienced by each sliding-pulley atom as a result of mass m are multiplied as the spreading angle increases **(B)**. The force multiplication of the pulley system results in the Newtonian relationship for gravity where force increases as a square of the approach distance (see Supplemental Equation 1.0).

Clearly, the photogravitational filaments must be composite objects capable of transecting one another and atomic surfaces. This leads to the hypothesis that the photogravitational filaments act in a similar manner to self-healing polymers[10] and are comprised of analogous monomeric fibers. A future manuscript will address possible structures of the fibers themselves, which may at this point be approximated as homogenous catch-springs of a fixed conformation and stiffness.

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Image for fig 1A without permission from http://dogcaught.com/2006/07/ and 1B from http://trains4africa.co.za. Fig 3's Earth came from Wikipedia and the spaceship from https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTaFeW4Yoi2I6psfXFgTZVKKJJB02OIYXkSjJUcmTfhIgF8wjl

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Object: That which has inward extension.

Shape: An effectively closed surface which forms a boundary to immediate surroundings.

Rational: Explanation following from non-circular, consistent, objective assumptions that does not commit the fallacy of reification.

Pull: Outward application of pressure upon an object (opposite of push).

Pressure- impossibility of two existent objects occupying the same location.

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SUPPLEMENTAL MATERIALS

Regarding the elasticity of the photogravitational filament and Planck's constant, *h*:

If torque is applied to the photogravitational filament at constant radius and the angle of torsion, θ in radians then torque, τ, can be expressed as

$$\tau = k\theta$$

where *k* is the torsion coefficient, equal to the change in torque required to twist the spring through an angle of 1 radian. Thus, *k*, is a type of Hookean modulus: a spring constant reflecting the elastic properties of the filamentary material. Here, we model the frequency of light as a full twist (2π rad) upon the filament, such that torque per frequency can be written,

$$\tau_f = 2\pi k \cdot f$$

The torsional "energy" required to apply said torque to a torsional spring can be written as:

$$E_\tau = \tau\theta$$

and substituting for τ_f and the full 2π twist on the filament yields

$$E_\tau = 4\pi^2 k \cdot f$$

The photon potential of light, *E*, can be related in terms of Planck's constant, *h*, as follows

$$E = hf$$

We can therefore describe this "energy" of light, *E*, as the torsional spring potential for a full twist on the filament such that

$$E_\tau = hf$$

where

$$h = 4\pi^2 k$$

Planck's constant, *h*, is then understood as encompassing a torsional coefficient for the filament, *k*, which details the elastic properties of the filament in accordance with the fibers that comprise it.

Regarding force multiplication due to pulling angle for sliding pulleys:

The force applied to each of two atoms as the result of approaching object of mass, *m*, can be written as a function of the angle of spread, α, between the two atoms with respect to *m* as follows:

$$F = \frac{1}{2}m/(\cos\frac{\alpha}{2}) \qquad \text{(Equation 1.0)}$$

Thus, when the atoms are at a great distance from *m* and α is effectively 0°, the pull force on mass *m* is split equally between the two atoms. As the mass approaches the atoms, α increases and so does the force of gravity due to those atoms as an approximate square of the distance between *m* and their horizontal meridian ($\alpha = 180°$). This is reflected in Newton's equation where the force of gravity between these atoms (M) and the approaching object of mass *m* is written:

$$F = GmM/d^2$$

where *G* is a constant that reflects the average oppositional pull between any two atoms. The gravitational constant *G* is thus a mass-scaling constant understood as ~½ of the rest mass of a Hydrogen atom multiplied by the speed of light squared. The quantity 'mass' scales approximately how many atoms are involved in the Machian gravitational system.

Light and Gravity

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Light and gravity.

artofrationalscience

The mechanics of light and relay of photons via reflection, refraction, and diffraction.

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ABSTRACT: Light is explained as a complex phenomenon that involves the equalization of torsional pressure between surfaces of at least two atoms. Previously, it has been proposed that this pressure equalization is mediated by a fibrous extension stretched between atoms, the hypothesized photogravitational filament. The Fiber hypothesis of atomics leads to a possible *physical* interpretation of the apparent events constituting light and the photon. This physical interpretation is detailed herein, with special attention paid to the peculiar behavior of light propagation: reflection, refraction, and diffraction. The illustrated mechanisms do not contradict contemporary mathematical descriptions of light, the photon, and atomics, but rather serve to help visualize these well-described events as occurring exclusively among physical objects that do or may, at least, possibly be said to exist.

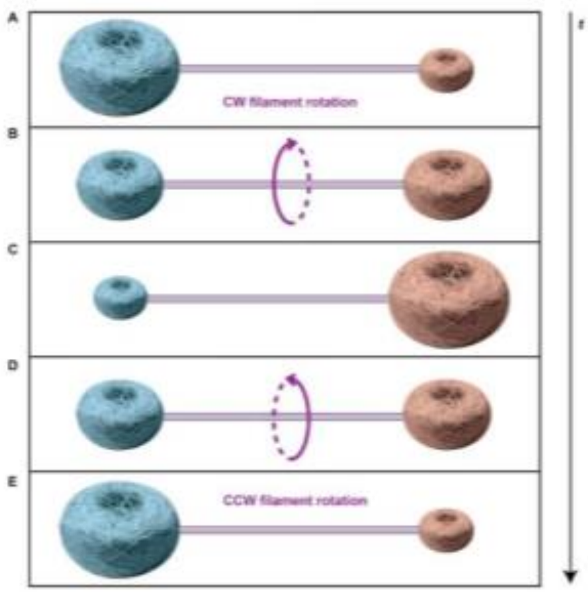

Figure 1| Darkness is in-phase atomic expansion and contraction (breath). Temporal sequence is shown in **(A-D)** where atoms expand and contract ceaselessly and share fibrous surface-material such that between pairs of atoms one's outer surface is expanded whilst the partner's is contracted. When a pair of atoms is expanding and contracting at the same rate, the atoms can be said to be in phase. At timeframe **(C)**, the direction of filamentary rotation is depicted to shift from CW to CCW. In-phase atomic breathing does not produce the appearance of light.

Light is perhaps the most misunderstood class of basic physical phenomena. Many scholars have troubled themselves to the grave, having failed to uncover a consistent mechanism capable of producing the range of contradictory behaviors apparent to even the most pedestrian experimentalists. Some progress was made when Newton, Hooke, Grimaldi, Huygens, Fresnel and others systematically dissected the most confusing aspect of light, diffraction, and revealed wavelike action: the apparent reflection of shadows cast by sharp edges into direct light and vice versa that produces a recognizable interference pattern[1-3]. Despite their systematic analysis of diffraction, no physical mechanism was proposed. To this day, the modern academy has essentially given up hope of providing physical remediation of light-on-light interference, insisting that the matter cannot be rationalized. Light is said to result from the bullet-like shots of mysteriously wave-like particles, the wave-particle duality[4,5]. Dualisms indicate an irrational explanation, and this one likely stems from reification of events (photons) into discrete bullet-like objects. An alternative rational explanation would be to consider that light is a transaction that occurs between two or more atoms, and is mediated by a physical extension stretched between them[6]. We have introduced this hypothetical structure previously as the photogravitational filament[7].

The previously hypothesized photogravitational filament is a stiff, yet elastic extension that connects, directly or indirectly, all atoms in a given system[7,8]. In the photogravitational model, light can be considered as a complex process involving pressure-equalization between the surfaces of participating atoms, transmitted along interconnecting fibers. One rational explanation for the wave-particle duality is that the photon is a physical perturbation of the photogravitational filament between participating atoms. If this is the case, that the underlying structure of atomic interconnection mediates light, then it is in place before the switch is flipped and photons become apparent. Light results from torsional action upon the photogravitational filament by those atoms at either end.

Let us consider the possible details of those events. One atom is presumed to torque upon the filament, which then transmits this force to a partner atom. However, the apparent phenomenon of interference (to be expanded upon later) necessitates that such input pressures upon the filament bear out the possibility of being contradicted from an opposing perspective under certain conditions. To this effect, our theory of light begins in the dark with homeostatic pairs of atoms expanding and contracting in perfect phase with one another such that when one is pulling the filamentary material into its body, a partner atom is pushing material outward into the filament in perfect complementarity **(Fig 1)**. This equilibrium expansion and contraction continually twists the filament back and forth. Let us call this behavior in-phase atomic breath.

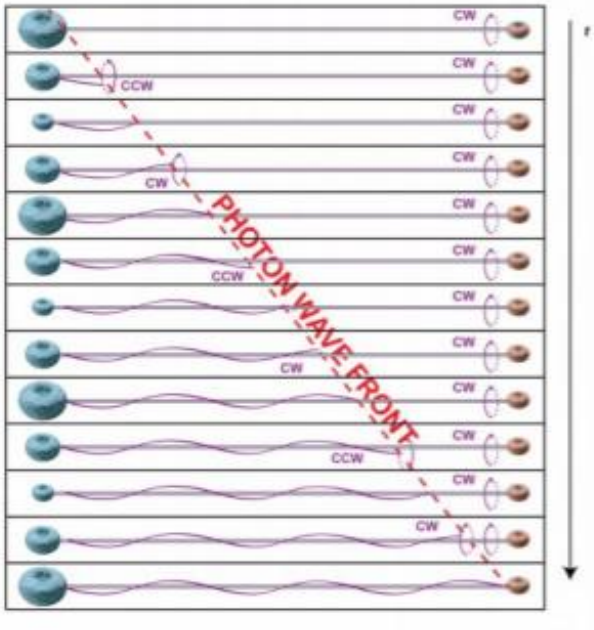

Figure 2| The photon event results from equilization of atomic surface pressures and is mediated by torsional pressure upon the photogravitational filament during out-of-phase atomic breath. When a filamentary-pair of atoms is breathing out-of-phase, the faster atom will induce the slower to a more excited state. To this end, additional torque is gradually loaded onto the filament and this pressure front, the photon, will appear to advance toward the slower atom. As torque pressure along the filament accumulates at the surface of the slower atom, the breath speeds between the two will begin to equalize. Eventually the two atoms' breath will reach equilibrium and darkness will be restored.

Now, consider illumination: the photon event itself **(Fig 2)**. When the light switch is flipped, atoms in the source are induced to breathe at a faster rate. Because the filament is somewhat elastic, there is a delay in transmission of these additional forces unto the partner atom at the other end of the filament. We know, for instance that light farther from a source has a lower frequency[9]. This can be interpreted as travel of additional winding of the filament following classical torsion-spring mechanics. The delay in transmission of excitement from atom to the next is called the speed of light, and is informed by the material properties of the photogravitational filament and its constituent fibers. Eventually, the partner atom will become fully subject to the torsional excitement provided by the source atom, and the photon event concludes with the establishment of a filament of a higher wavelength and frequency and equalized atomic breath rates for the atoms involved[7]. This will slow down the excited atom to some extent as well and that relaxation event is referred to as an electron transition in classical quantum electrodynamics[10]. Once equilibrium is reached between surface pressures of the atoms, the atoms are in perfectly locked breath-phase and darkness resumes. More likely, the excitement will be transferred into the surrounding photogravitational system, and those atoms will also relax photonically in succession.

Thus, we must consider the propagation of photonic events throughout and beyond ensembles of atoms: the wide-ranging phenomena of lensing. Lensing includes reflection, refraction, and diffraction; the details of these are determined both by the individual atomic properties as well as the composite properties of the bulk material. Reflection is the simplest and most foundational of these phenomena. During reflection, photon transactions occur between a light source and a lens. The forward momentum of filamentary excitation is readily relayed forward in all directions beyond the reflecting line as is shown in **Figure 3**. At the surface of a polished material, whose atoms are structurally resonant enough to transmit all input received (such as Silver[1]), the majority of these relays will travel the path of least resistance through the sparse air toward the projected mirror image.

If the atoms of a material receiving incident photons are arranged in a particularly coordinated fashion, input momentum may also be relayed directly through the atomic assembly of the lens itself. If not, the material may be considered opaque and will merely produce a shadow. Each atom in the path of such a relay chain will absorb some of the photonic momentum in the form of sub-atomic motion, the sub-atomic analogue to heat. The appearance of an atom in the path of the relay may slow the forward motion of photons significantly, thus producing both a frequency drop along inter-atomic photogravitational filaments as well as a slight downward deflection (loss of forward momentum). This is the phenomenon of refraction and was first described quantitatively by Ibn Sahl over 500 years ago, later named Snell's Law in the West. Refraction is thus known to be a product of how the speed and frequency of the incident photons becomes diminished by the particular atomic shock-absorption character of a material.

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[1]x Silver may resonate because it's a particularly elastic structure construct, but also because of its meta-structure within the lattice. Notice, that polishing surfaces (smoothing out the lattice) results in greater reflectivity.

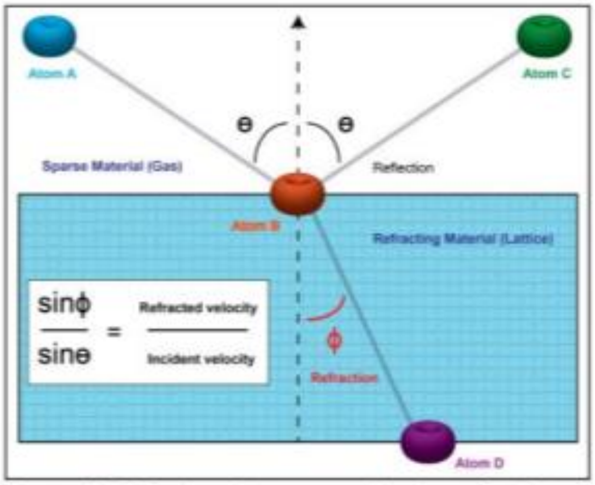

Figure 3| Reflection is conserved relay of photonic momentum while refraction results from damping of forward velocity by intervening atomic shock-absorbtion. Atom A begins to breathe faster than Atom B and induces it to excitement torsionally along the depicted photogravitational filament (see Fig 2). Atom B then relays that indident momentum to atoms in front of the reflecting line such as Atom C or D. Atoms below the surface of a refracting (lensing) material, such as Atom D are so dense that forward photon relay is impeded in proportion to their refracting angle with respect to the incident angle.

Diffraction is a very unique case of light relay that has caused much confusion throughout the ages. This may be due to the necessity of understanding the inter-atomic breath-phase relationships described earlier **(Fig 1)**. During diffraction, a narrow edge, or rounded edge (thus presenting only slivered rows of atoms toward the light source), is known to produce a discrete series of shadows within the field of direct illumination. An experiment demonstrating this effect is shown in **Fig 4A**. What we find is that while the light source is able to directly excite atoms C and D, there is some interference with Atom C as a result of a reflection off of Atom B within the edge of the diffracting object (in this case, the housing of a dis-lensed laser pointer) that prevents re-emission of a photon from atom C and appears to us as a dark fringe band. The mechanics of this interference are delineated in **Fig 4B.** What is apparent is that there is no possibility of both AC and ABC being in phase with one another. In fact, it is apparent that AC and ABC will necessarily be a complete cycle out of phase with one another. That is to say that if A instructs B to expand, then B instructs C to contract. Meanwhile, A must be instructing C to expand. This contradiction of input is the physical interpretation of quantum interference. For the bright fringe involving atom D and its neighbors **(Fig 4C)**, we simply have not satisfied the line-of-sight for a reflected photon along the filament BD. Because the diffracting surface is rounded or in many cases atomically thin with respect to its exposure to the incident light source, minute geometrical changes result in scattered reflections commensurate with these geometries outward into the direct light field. What results is a series of out of phase photonic convergences and no atomic excitation for atom C or others at the dark fringes.

Overall, light may be thought of as a transaction that ensures torsional surface pressure equalization between atoms, as mediated by inter-atomic photogravitational filaments. Atoms are ceaselessly expanding and contracting in what is known as the "quantum jump", herein referred to as atomic breathing. When breath is perfectly in phase between two atoms there is no light apparent. Only when the breath rate of one atom is altered does the photon result, as a method of restoring surface pressure equalization. Photons may be relayed via the path of least resistance as in reflection, or directed into a material with various effects of dampening the signal as in the case of refraction. Diffraction is the result of conflicting expansion and contraction signals, relationships which are in place before any light source is induced to excite the particular network of atoms.

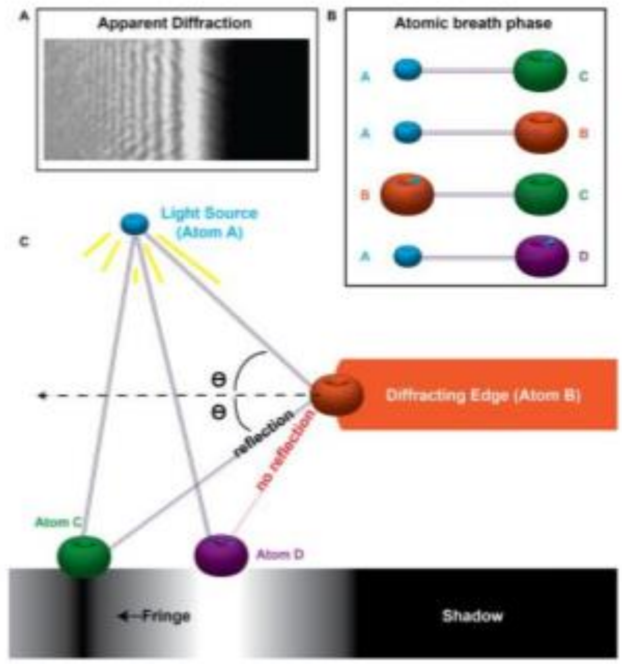

Figure 4| Diffraction occurs at reflection boundaries and results from the inability of atomic pairs to participate in photonic events when their breath is 180° out-of-phase and they receive simultaneus and identical stimuli from a source. A typical diffraction pattern is shown from an experiment in **(A).** Before the light source is engaged and photonically induces excitement throughout the connectome, 180° contraditory phase relationships are occurring within the system as shown in **(B)** where atomic pairs AC, AB, and AD are in phase while BC is necissarily 180° opposite. When the source is engaged, the otherwise reflected signal from source to BC cannot behave photonically due to the interferring instructions: for instance, if Atom B is induced to contract from A in this moment, it will then instruct C to expand, however C is also receiving direct instructions from A to contract. This conflict of impetus precludes the possibility of a photon occurring because surface pressured are gridlocked. Bright fringe atoms to the left of the shadow, BD, are simply not receiving reflections from the diffraction edge and thus only indicate direct stimulation from the source, Atom A. Such bright finges appear and diminish beyond the shadow where surface topology at the diffracting edge, including convexity and roughness, scatter reflections from B geometrically following classical ray-spreading principles.

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KEYWORD DEFINITIONS

Object: That which has shape.

Shape: An effectively closed surface which forms a boundary to immediate surroundings.

Exist: Object with location and outward extension.

Physical: Pertaining to objects that exist.

Rational: Explanation following from non-circular, consistent, objective assumptions that does not commit the fallacy of reification.

Pressure- impossibility of two existent objects occupying the same location.

Photon- the temporal sequence of events whereby one atom is excited to higher expansion and contraction (breath) speed and induces a partner atom to equivalent breath speed via torsional action across the adjoining photogravitational filament. This sequence extends from the former to the latter and summarily rearranges the shape of the filament accordingly with a slightly greater longitudinal compression and torsional spring potential, whereby $E \sim f$.

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