

Physical Model of a Real Photon with Substructure and Mass

by

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Abstract

A physical model is proposed of a real photon with substructure and mass. It is based on a MC Physics theory that a photon is a first order/ level elemental particle made of two opposite electro-static charge-types of the lowest known electro-static charge strength mono-charges (MCs) that are travelling at the vectored *average* speed of light, c , and are rotating in a (polarization) plane that includes the linear velocity vector. A mono-charge is a charged particle that possesses an singular electro-static charge type (positive + or negative -) and a specific electro-static charge strength or potential. Photonic MCs have the lowest charge strength evidenced. Charge strength causes charge force between charges per Coulomb's Law, $F=C_1*C_2/R^2$ for static charges and $F=C_1*C_2/R$ for relativistic moving charges, due to space compression. Charge also causes inertia, seen as 'mass'. As a photon travels, the joined MCs are held together by attractive electro-static charge force as they rotate at its given frequency (and resultant wavelength). In its rotation plane at velocity, the relativistic impacted mono-charges alternate in dominant strength and emanate alternating charge fields (with co-incident induced magnetic fields, together EMF) that are propagated from relativistic compacted space. The model also satisfies the other measured properties and characteristics of photons- possessing momentum and kinetic energy, possessing an overall neutral charge, affected by gravity, scattering effects and the existence of a polarization plane.

Keywords: light, photon, EMF, electro-magnetic, sub-atomic particles, speed of light, relativity, atomic substructure, mono-charge, electro-static charge force

History of Sub-Atomic Particle Sub-Structures

Efforts to develop an atomic sub-structure date back to 1974 with a paper by Pati and Salam [8], followed by a 1977 paper by Terazawa, Chikashige and Akama [9], 1979 papers by Ne'eman [10], Harari [11], Shupe [12], a 1981 paper by Fritzsche and Mandelbaum [13], a 1992 book by D'Souza and Kalman [1], a paper by Kalman [7] and works by de Souza [5][6][14]. In his 1989 Nobel Prize acceptance lecture, Hans Dehmelt described another fundamental elementary particle, the "cosmon" [15]. In many of those earlier particle physics sub-structure theories, quarks and leptons were suggested to be made up of preons, or "point-like" particles [1]. The word "preon" was coined by Jogesh Pati and Abdus Salam in 1974. Other names for sub-structure entities include prequarks, subquarks, maons [3], alphons, quinks, rishons, tweedles, helons, haplons, Y-particles [4], and primons [5]. However, preon is the leading name for these theories in the physics community [2].

Many of the preon-type theories attempted to follow the simplification precepts of the Periodic Table and the Standard Model. Preon-type theories may require that quarks and electrons should have a finite size [2], and nothing below those particles was formulated. Preon model interest peaked in the 1980s and then declined as the Standard Model theory became more successful in describing the known physics. The preon model has attracted comparatively little interest to date among the particle physics community [2].

The Standard Model hold that photons are massless (as in 'rest mass') bosons that carry the electro-magnetic force, have neutral charge, spin of 1, parity of -1, c-parity of -1, and co-exist as both a wave and particle [16]. Some current theories, e.g. Quantum Field Theory and String Theories, hold that photons are only energy fluctuations that have no discernable location and can be statistically simultaneously present in multiple physical locations, i.e. not a real physical entity. Many hold that photons never have any mass, even while travelling, although photons have measured momentum and, therefore by extension, kinetic energy. The author believes that the 'no mass' requirement comes from the relativistic inflection point being assumed to be exactly the speed of light, c , since that conveniently matches the speed of the smallest entity known [16].

No previous sub-atomic model was found that has theorized a sub-structure for photon particles.

Mono-Charge Basics

A mono-charge is a singular charged particle that possesses an electro-static charge type (positive + or negative -) and a specific electro-static charge strength or potential that are both conserved in the normal universe, i.e. a new proposed *Charge Conservation Law*. In the normal universe forces, mono-charges do not merge to form one particle, but retain their identity even while joining very strong opposite-charged MCs to form elemental or composite (combined) particles. MC Physics also theorizes that charge strength provides an entity's inertia in space, and therefore its 'mass', and all relativistic relationships. Therefore, it is proposed that a charge is a real physical entity in space and time and cannot be in simultaneous multiple locations, except as represented statistically (due to limitations in our measurement and understanding). It also means that MCs must come from somewhere physical, go somewhere as a physical entity and then reside somewhere physical.

MC Theory also proposes that all charges (binary joined and mono-charges) follow Coulomb's Charge Force Law of $F=C_1*C_2/ R^2$ for both attract force (between opposite charges) and repel force (between same charges), even if affected by relativistic spatial compression (i.e. space going from 3 to 2 dimensions). Note that like-charged MCs are repelled to never directly form elementary particles.

MC Physics also expands the natural law that all moving charges (even mono-charges) in space generate (induced) magnetic fields in proportion to their charge strength and velocity. This

implies that relativistic velocities can impart relatively strong magnetic fields from compressed space.

MC Physics theorizes that a photon is a first order/ level elemental particle that is made up of (at least) 2 opposite charge-type mono-charges (MCs). Both photonic MCs have the lowest charge strength evidenced and, for the purpose of this Model, their strengths are exactly equal and are always conserved.

Photonic Mono-Charge Model

Per the MC Physics theory, a photon is only formed, i.e. its MCs joined together, when its lowest strength mono-charges are emitted from the gluons of a source atom and joined together by attraction charge force. It is then accelerated and rotated by surrounding electric and magnetic field forces. In that process the source atom loses the kinetic energy ($KE = \frac{1}{2} * M * c^2 = C * c^2$) put into the new photon.

The photon travels *at the average speed of light, c*, in its vectored path while its rotating MCs are being affected by gravity, charge and magnetic forces and relativity until it encounters another atom. During travel the photonic MCs rotate in their polarized plane, which contains the vector of the photon's travel, causing alternating relativistic effects (on velocity and charge/ inertia/mass) on the MCs. This is because, as they rotate, each photonic MC inversely alternates from *greater than c to less than c*, due to their direction of travel causing additional induced relativistic effects. This is why the relativistic inflection point must be greater than c.

It should be noted here that binary star systems that are held together by gravity are common in the universe. The expansion of that concept to a binary system held by known electro-static forces is, therefore, no great step.

It is deduced from binary system force propagation dilution relationships that static (or low charge velocities) generated and propagated forces follow a $1/R^2$ (normal geometric 3 dimensional spherical surface dilution) relationship, while at relativistic charge velocities its force propagation follow a stronger $1/R$ (relativistic compressed space, 2 dimensional circular circumference) dilution relationship. The circular dilution of force appears as a cylindrical event, due to charge movement.

The photon particle ceases to exist when its then dominant photonic mono-charge is attracted to and is then absorbed by an opposite-charged atomic MC. That atom then gains both the full KE of the travelling photon and the photon's now lower non-relativistic MC masses.

If a photon encounters an atomic MC with a like-like electric charge exposed to it, a repel charge force will occur and the photon will be deflected. This is the source of scattering effects and the results from double slit experiments, both discussed in a later paper.

From this information it should be noted that the KE of a travelling photon is based on its relativistic total mass at its average linear velocity and at its rotational velocities (giving it frequency), therefore possessing both linear and rotational energies.

This physical model of a photon can reasonably cause all measured properties and characteristics of photons: affected by gravity, having momentum and therefore kinetic energy, emitting electro-magnetic forces while travelling, an overall neutral charge, scattering (Compton, etc..), double slit experiment, and more. It also expands the natural laws of normal binary charged systems to now cover all charges. The MC Physics Photonic model therefore proposes and requires that:

1. Fully joined photons travel at the **average** velocity of 'the speed of light', c .
2. Existence of mono-charges, singular electro-static charges with a type (+ or -) and with a given electro-static charge strength or potential.
3. Mono-charges are true and real 3 dimensional particles (not point-like or dimensionless entities) with a strong interfacial surface that does not merge under enormous force ($F=C_1*C_2/R^2$) at near-zero distance apart. A Conservation of Charge natural law may be proposed.
4. Charge strength provides inertia, which is seen as 'mass', for all matter. This should be considered part of that natural law.
5. Electro-static mono-charges emanate single charge force fields that follow the same natural laws as for binary systems.
6. Mono-pole magnetic field/ forces **are induced** by mono-charges moving through space and follow the same natural laws as for binary systems, ie. magnetic force is a function of the charge's type (induced pole), strength, velocity and distance.
7. Photonic MCs rotate in a rotational (polarization) plane that includes the linear velocity vector. The polarization plane can be rotated and shifted by external forces.
8. Relativistic inflection point V_t must be greater than c . This may also apply to the mass-energy conversion equation.
9. As the full photon travels at the relativistic average linear velocity of c , its rotating mono-charges are further modified by relativity:
 - rotational forward direction - adding velocity to the mono-charge- relativistic increasing charge strength, inertia (mass) and causing decreased forward velocity;
 - rotational reverse direction - decreasing forward velocity of the mono-charge- relativistic lowering charge strength and inertia (mass) and causing increased reverse velocity.
10. Both electro-static charge and (induced) magnetic fields that are generated from moving mono-charges and are propagated through relativistic compressed geometric space (3D to 2D) at/from the source MC.

One simplified version of the Photonic model, at one fixed position in its rotation, is shown in Figure 1, below. Figure 2 shows the rotating photon structure at several positions during one full rotation of its frequency (and, with velocity, one full wavelength). In these figures it should be noted that:

- a) Circle sizes are in relation to charge strength/ mass/ inertia and not a physical dimension/ radius.
- b) Rotation direction of the mono-charges in the photon is assumed clockwise in the polarization plane. Linear velocity of the photon at c is from the left to the right along the Y-axis.
- c) Circular rotation with constant distance is assumed for simplification, but not expected in reality due to vastly changing forces, velocities and inertia/mass.
- d) Photonic Model is shown at fixed distance positions ($0/8$ to $8/8$) in its full wavelength (coming from its rotational frequency) in $1/8^{\text{th}}$ fractional steps of one full rotation (ie. one wavelength at velocity). Photon rotation is continuous, not stepped.
- e) Drawings are shown in 2 dimensions, but is in reality, a 3 dimensional entity due to its 3D particle nature and possible x- axis forces occurring during rotation. The 2D plane shown is the plane of rotation, aka its polarization plane.
- f) Relativistic effects occur on both mono-charges at all times, but stronger on the forward moving mono-charge and lower on the reverse direction rotating mono-charge. Therefore, alternating dominance of each charge type.
- g) Highest inertia/ mass occurs on only one side of the photon particle, thus the center of mass and travel/ particle path is just inside that higher inertia/ mass side, not rotational center.
- h) Overall neutral charge of the photon is understood, but its instant or dominant charge varies by rotational position during one rotation.

Figure 1: Photon Structure and Mono-Charges' Relativistic Charge Strength / Inertia / Mass at one Rotational Position While Travelling.

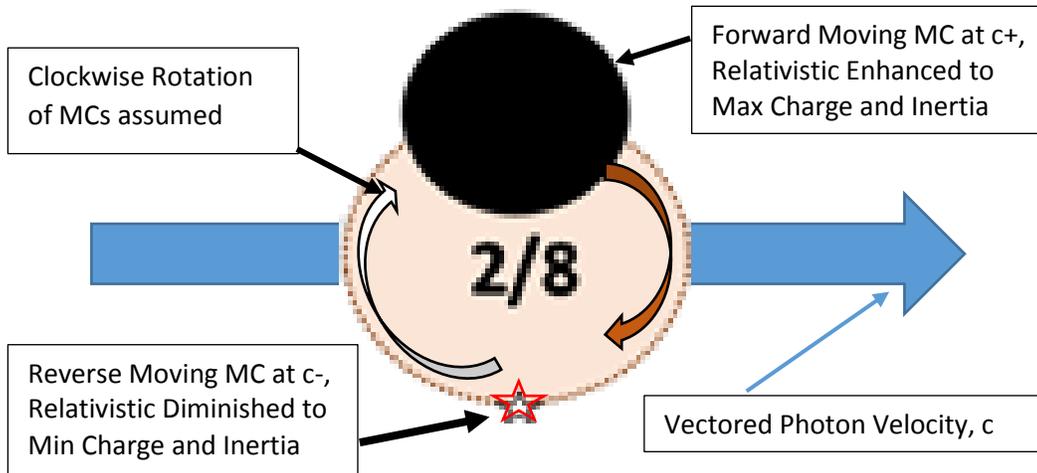
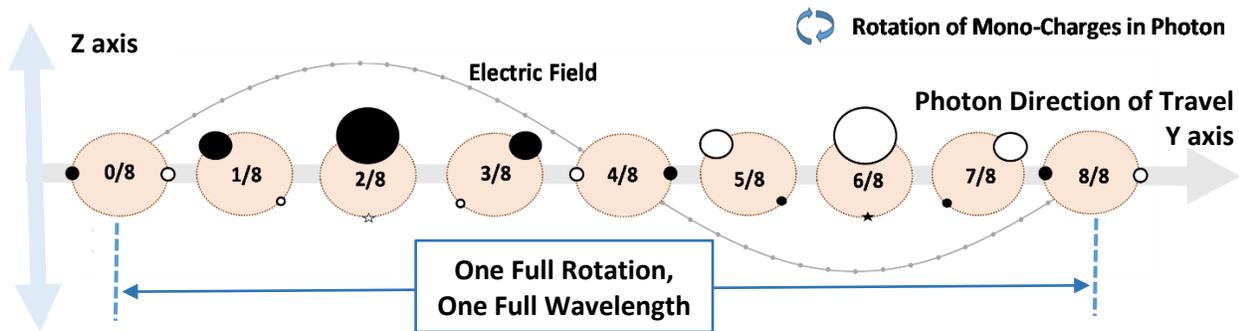


Figure 2: Physical Photon Structure at Different Stages of a Complete (8/8ths) Rotation While Travelling, representing One Complete Wavelength.



Inferred from the Photonic Model and both drawings are:

- i) Alternating singular electric fields are primarily propagated in in the X-Z plane (into and out of the page) due to relativistic space compression effects (from 3D to 2D).
- j) Alternating induced singular-pole magnetic fields are generated from the alternating singular mono-charges moving at relativistic speeds. Those mono-poles then propagate alternating magnetic fields in the X-Z plane (into or out of the page), also via relativistic compressed space, with a field strength directly proportional to each MC's strength and velocity.

- k) Smooth circular rotation and relativistic effects are shown, but it is anticipated that the true resultant EMF signature is not symmetric, due to the highly varying charge strength forces and inertia/ masses on either side of the maximums.

Conclusions

A new physical model of a photon is presented that provides all known characteristics and properties of photons. It requires a photonic sub-structure of two rotating opposite-charged electro-static mono-charges that are alternately relativistic enhanced while travelling at an average velocity of c , in a vacuum. Those relativistic enhanced charges, which also provide inertia and mass, propagate an Electro-Magnetic Field from/through relativistic compressed space. This model also requires that the relativistic inflection point, and possibly the mass-energy conversion equation, must be based on a velocity greater than the speed of light, c .

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