A PHOTON-NONPHOTON UNIVERSE
(Technical Brief)

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A simple model of the universe is emerging from a series of studies conducted over a period of some fifty-plus years. Late 1940's studies of a possible photon-like inner structure of electrons, protons and neutrons and the particle-interaction studies of fission chain-reacting systems during the following three decades merged with those on black body radiation to suggest a "photon-nonphoton" model. Like other recently proposed models, the concept sketched here is not offered as "a theory of everything". However, it does suggest simple explanations of what constitutes dark energy, what appears to be dark matter and what causes gravitational forces.

A detailed report on the history and status of the model's construction is given in the 19 November 2002 document entitled "A Photon-Nonphoton Universe"(1). The following represents a technical brief on the main ideas detailed in the 134-page Reference 1 document. The two-vector formalism used to define properties of photons and nonphotons, the two basic pointlike particles of the modeled universe, is defined as is the fission-fusion postulate underlying their symbiotic coexistence in such a universe. How the equilibrium densities of such particles are derived and their relative magnitudes in a 2.73 Kelvin universe are then noted. Redshift in the static universe model is explained in terms of special features of the above postulate. How Newtonian-level gravitational forces may be understood in terms of elastic impacts of nonphotons on the photon-like constituents of matter is then sketched. The features of the emerging photon-nonphoton universe model are summarized. These include estimated values of the properties of the model's point-like constituents and of photonic-ring models of electrons and nucleons. Estimated values of probability-related quantities for various interactions between pairs of the model's point-like constituents are summarized. Special features of the model's nonphotons, such as their abilities to mimic the existence of dark matter and of repulsive gravitational forces, and their potential to fuel a nonphoton fission reactor are noted. This technical brief concludes with notes on possible future theoretical and experimental efforts to determine the true potentialities of the photon-nonphoton universe concept.

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The model here sketched assumes the universe is infinite in both its extent and age. Accordingly, it predicts that, as we become able to look farther and farther, we will continue to find galaxies in the same stages of development that have been previously observed for the nearby galaxies. On the largest cosmological scale, the model assumes that a uniform distribution of the various entities making up the universe exists at all times. On lesser scales, patches of the universe may experience "mini big bang" events that produce the observed mix of light nuclei as these hot spots cool toward the 2.73 Kelvin level of the infinite universe. As later explained, there exists an ample "dark" energy density in the model's ethereal non-photons for the not-so-ethereal photons to cause such mini big bang events.

PHOTONS AND NONPHOTONS

The model assumes all things consist of point-like particles whose properties conform with special relativity and whose interactions conform with the conservation of mass-energy and momentum. The properties of such a particle are expressed in terms of two vectors, $\underline{E}$ and $\underline{B}$, whose lengths are denoted by E and B. Features of this two-vector formalism are:

(i) $\underline{E}$ is perpendicular to $\underline{B}$.

(*ii*) In units of the speed of light, c, the speed of a particle is given by

$$\beta = \frac{2EB}{E^2+B^2}$$

which falls in the range: $0 \leq \beta \leq 1$. For photonic particles, E=B and $\beta=1$. If $E \neq B$, we refer to the particle as a "nonphoton" which moves at a speed in the range $0 \leq \beta < 1$. "Photonics" and "Nonphotons" are the two basic particle species assumed to make up a photon-nonphoton universe.

(iii) In units of ε/c^2, where ε is a tiny unit of energy, a particle's inertial mass, m, is given by

$$m = E^2 + B^2.$$

(iv) In units of ε/c, the magnitude of a particle's momentum, p, is

given by

$$p = 2EB.$$

A particle's momentum is perpendicular to the plane of its formalism vectors, $\underline{E}$ and $\underline{B}$ in the direction of $\underline{E} \times \underline{B}$.

PARTICLE FUSION AND FISSION

Underlying the construction of a photon-nonphoton universe model is the postulate that a particle with vectors $\underline{E}$ and $\underline{B}$ may fuse with a particle with vectors $\underline{e}$ and $\underline{b}$ to form a particle with vectors $\underline{\mathcal{E}}$ and $\underline{\mathcal{B}}$ (and the converse fission of the latter into the former pair may occur) if

$$\underline{E} + \underline{e} = \underline{\mathcal{E}}$$

$$\text{and} \quad \underline{B} + \underline{b} = \underline{\mathcal{B}}$$

as such events would be viewed in a preferred inertial frame. In that frame, an observer would see the microwave background photons to move isotropically. As explained in detail in Sections II and III of Reference 1, the above, together with the mass-energy and momentum conservation laws, leads to a universe model where photons and nonphotons exist symbiotically. That is, a pair of photons may fuse to form a nonphoton which may later fission to return the same two photons to the universe.

In other than the preferred frame, the above postulated "law" for fusion or fission is expressible in terms of the observable velocity of such a frame relative to the preferred frame. A possible experiment to determine a frame's relative velocity is described in Appendix A and the transformed fusion-fission postulate is examined in Appendix B of Reference 1. Since the preferred frame offers the simplest examination of the fusion-fission processes, the following considers these processes in that particular frame.

PHOTONS AND NONPHOTONS IN EQUILIBRIUM

To establish the densities of photons and nonphotons that symbiotically come to equilibrium, we follow the approach used by Bose to replicate Planck's black body photon spectrum*. The energy of a particle, as seen in the preferred frame, is taken to equal an integer times ε, now a tiny quantum of energy that is much smaller than the energy of an average microwave

**See Section IV of Reference 1*

background photon. On this basis, the densities of photons and nonphotons in an equilibrium mix are determined. As shown in Figure 1, Planck's photon curve is extended into a surface that represents inertial mass-energy densities of nonphotons as well as photons in an equilibrium particle mix. Figure 2 displays these densities as functions of particle inertial mass energy and speed as seen in the preferred frame. In those figures, the usual symbols, k and h, represent Boltzmann's and Planck's constants.

Special features of the particles in a modeled 2.73 Kelvin universe are displayed in Table 1. The average energies of both particle species are seen to be comparable—about a thousandth of an eV (electron volt). In the preferred frame, the speed of the average nonphoton is found to be ~81% of the photon speed. However, the total densities of the two particle species differ widely. Nonphoton densities dwarf those of photons by a factor of order kT/ε. For the $T = 2.73$ Kelvin universe and a value of ε compatable with the nonphoton gravity concept later discussed, a value of kT/ε of about 1.21×10^{77} has been estimated.

According to Reference 2, apparently various computations compatible with quantum mechanics yield numbers in the range 10^{55} to 10^{120} for the ratio of vacuum energy density to that of matter and radiation. Table 1 information, together with the above-cited kT/ε value, yields an inertial mass-energy density of nonphotons of about 2×10^{77} eV/cm^3. And, $c^2 \times (10^{-30}$ grams/cm$^3)$, or 850 eV/cm^3 represents the average energy density of matter and radiation in the universe. Hence, the emerging photon-nonphoton universe model implies a "dark energy" density of ethereal nonphotons of about 2×10^{74} times that of observable matter and radiation, a number in the wide range compatible with quantum mechanics. A divergent chain reaction, where photons induce the fission of nonphotons into photon pairs, offers an explanation of mini big bangs in portions of an infinite photon-nonphoton universe. The matter and radiation in a 10-billion light-year radius sphere, for example, has an inertial mass-energy equal to that of the photons born from the fission of all the nonphotons in a 32-meter radius sphere.

PHOTON REDSHIFT IN A STATIC UNIVERSE

The observed redshift of light that has traveled cosmological-scale distances is generally attributed to special relativistic Doppler effects. Being based on special relativistic point-like particle dynamics, the photon-nonphoton universe model, of course, also recognizes this type of redshift. However, we do not require that the observable universe be expanding to explain redshift as does a “big bang”scenario. In Section V of Reference 1, we detail how redshift would occur in a photon-nonphoton universe that is not only infinite but also static when viewed on the largest cosmological scale.

Basically, as a photon emitted from a source travels to a detector, the tiny ε-quanta of the source photon are progressively lost via fusion with the quanta of microwave background photons. Half of the mass-energy of the nonphoton debris equals that lost by the redshifted source photon. For small source-to-detector distances, this type of redshift is roughly proportional to distance. At large distances, the redshift tends to increase exponentially with distance. Thus, a dark night sky is assured in an infinite static universe that is uniformly populated by photon sources. It is noted that if the near-exponential increase of redshift at large distances is used to compute a speed via the Doppler equation, the results might be interpreted as an acceleration of the rate of expansion of an expanding universe.

NONPHOTON GRAVITY

The photon-nonphoton universe model assumes the bodies in solar-type systems present very thin targets to the ethereal nonphotons of 2.73 Kelvin space. On this basis, it may be demonstrated that the Newtonian gravitational force between bodies can be understood in terms of elastic collisions of nonphotons with the basic photon-like constituents (photonics) making up such bodies of weighable (ponderable) matter. To accomplish the demonstation, the ethereal nonphotons and the photonics making up ponderable matter are represented by the average of each species. Section VI of Reference 1 details the demonstration task which required the specification of three quantities: λ, (kT/ε) and γ.

A nonphoton must travel through an average of λ grams/cm^2 of weighable matter to experience its first elastic collision with a photonic constituent of such matter. Nonphoton Newtonian gravity is a first collision concept. The effects of second collisions are assumed to cause the uncertainty in the measured values of G, Newton’s gravitational constant. That uncertainty is taken to be about one part in 10^5. The probability for a second collision in the sun would be about 10^{-5} if $\lambda = 10^{16}$ grams/cm^2, the value of λ taken here. And, of course, such a large λ-value satisfies a basic requirement of the nonphoton gravity concept—namely that solar system bodies present "thin targets" to nonphotons.

To estimate the value of kT/ε, we utilize the fact that almost all the mass of solar-system bodies is that of their protons and neutrons. Those nucleons are represented by a thin-ring model which builds on a 1949 study of circulating-photonic systems (3)*. We first determine the pressure P that must be felt by the surface of a ring to hold its circulating photonics in a state of dynamic equilibrium**. This requires that

$$PV = Mc^2$$

where V denotes the ring's volume and M ($\sim 1.67 \times 10^{-24}$ grams) its rest mass***. Assuming the thin-ring's surface is impermeable to nonphotons, one finds its half-thickness is inversely proportional to λ. This yields

$$P = (\pi^4/8)\lambda^2 c^2 \cdot (R/M) \cong 0.69 \times 10^{64} \text{ dynes/cm}^2$$

where R ($\sim 1.05 \times 10^{-14}$ cm) is the ring's radius. We assume the ring's impermeable surface perfectly reflects the nonphotons that impact it. In this case, the pressure felt by a ring's surface would be given by

$$P = (\alpha^2/3)\, n\mu c^2\, (kT/\varepsilon).$$

Equating the two P-expressions, yields

$$(kT/\varepsilon) = 3\pi^4/8\alpha^2) \cdot (\lambda^2/n\mu) \cdot (R/M) \cong 1.21 \times 10^{77}.$$

Above, α represents a nonphoton-to-photon speed ratio and μc^2 the average mass-energy of nonphotons as seen in the preferred frame. Their values are given in Table 1. The quantity n is defined by

$$n \equiv (I_3/6)\, [8\pi(kT/hc)^3] = (4\pi^5/45) \cdot (kT/hc)^3 \cong 184\text{cm}^{-3}.$$

Section VI of Reference 1 details how the λ and (kT/ε) quantities were

* *See Appendix E of Reference 1*
** *See Appendix G of Reference 1*
*** *See Appendix D of Reference 1*

utilized to specify the value of γ, which denotes the ratio of the magnitude of photonic's momentum to that of a nonphoton. It was shown that, if bodies of photonics present thin targets to nonphoton beams, then the elastic impacts of nonphotons on photonics would cause each of two bodies to feel the gravitational force prescribed by Newton. In essence, one body perturbs the isotrophy of the directional nonphoton flux that would otherwise exist to bombard a second body in its neighborhood. As a result of such anisotrophy, elastic impacts of nonphotons with a body's photonic constituents pushes each of the bodies toward the other.

For nonphoton gravity to equal Newtonian gravity, γ must be very small and must satisfy

$$(3\pi/8)\gamma^2 \cdot (kT/\varepsilon) \cdot \lambda^{-2} = (2\pi^2/\alpha^2) \cdot (G/n\mu c^2).$$

By use of the above kT/ε prescription, one finds

$$\gamma = (4/3\pi) \cdot [2GM/\pi c^2 R]^{1/2} = 7.34 \times 10^{-20}.$$

Summarizing, we took $\lambda \cong 10^{16}$ grams/cm^2 on the basis of the uncertainty in G and the requirement that solar-system bodies present thin targets to nonphotons. Next, we modeled nucleons by photonic rings. By asserting that the pressure resulting from particle bombardment of a ring's exterior be proper for dynamic equilibrium of the ring's circulating photonics, a value of the pressure was obtained. Equating this pressure to that felt by a perfectly reflecting surface of nonphotons, we found that a "central parameter" of the photon-nonphoton universe must be $kT/\varepsilon \cong 1.21 \times 10^{77}$. With the values of λ and kT/ε in hand, we found $\gamma \cong 7.34 \times 10^{-20}$ via the λ-(kT/ε)-γ connection required for nonphoton gravity to equal Newtonian gravity.

It may be noted that the value of λ and the λ-(kT/ε)-γ connection derived from considerations of phenomena on the scale of the solar system. In contrast, a (kT/ε)-λ connection derived from consideration of phenomena on the scale of a nucleon. By combining the findings of the considerations on these vastly different scales, a first set of specific values of λ, (kT/ε) and γ were obtained and, thence, could be utilized to define various features of the emerging photon-nonphoton universe model.

EMERGING FEATURES OF THE MODELED UNIVERSE

In a photon-nonphoton universe, three varieties of point-like particle species exist: photons and nonphotons and the photonics of ring-like particles such as electrons, protons and neutrons. Features of the average microwave photon, nonphoton and photonic are here computed using the following input:

(1) $kT = 2.35 \times 10^{-4}$ eV;

(2) $n = 184$ cm^{-3};

(3) I_i values shown below Table 1;

(4) $\alpha = [1 - (3\pi/16)^2]^{1/2} \cong 0.81$;

(5) $(kT/\varepsilon) = 1.21 \times 10^{77}$;

and (6) $\gamma = 7.34 \times 10^{-20}$.

The speed of light, the electron's charge and its mass are denoted by c, e and m, respectively. The energy of an ε-quantum is 1.94×10^{-81} eV as obtained by dividing (5) into (1).

Average Microwave Photon Features

Speed = c

Energy = $(I_3/I_2)\, kT = 6.36 \times 10^{-4}$ eV

Number Density = $6(I_2/I_3)\, n = 4.09 \times 10^2$ cm^{-3}

Energy Density = $6nkT = 0.260$ eV cm^{-3}

ε-quanta per photon = $(I_3/I_2)\,(kT/\varepsilon) = 3.27 \times 10^{77}$

Average Nonphoton Features

Speed = $\alpha c \cong 0.81c$

Inertial Mass-Energy = $\mu c^2 = (I_4/I_3)\, kT = 8.95 \times 10^{-4}$ eV

Number Density = $n(kT/\varepsilon) = 2.23 \times 10^{79}$ cm^{-3}

Inertial Mass-Energy Density=$(I_4/I_3)\, nkT\, (kT/\varepsilon) = 1.99 \times 10^{76}$ eV · cm^{-3}

ε-quanta per nonphoton = (I_4/I_3) $(kT/\varepsilon) = 4.64 \times 10^{77}$

<u>Average Photonic Features</u>

Speed = c

Energy = $\delta = \alpha\gamma$ (I_4/I_3) $kT = 5.34 \times 10^{-23}$ eV

Number Density = $(\alpha/3\gamma)$ $n(kT/\varepsilon) = 3.28 \times 10^{98}$ cm^{-3}

Energy Density = $(\alpha^2/3)$ (I_4/I_3) $nkT(kT/\varepsilon) = 4.34 \times 10^{75}$ $eV \cdot cm^{-3}$

ε-quanta per photonic = $\alpha\gamma[I_4/I_3)$ $(kT/\varepsilon) = 2.75 \times 10^{58}$

Charge = $\zeta = \pm\sqrt{2}\ \alpha\gamma(I_4/I_3)$ (kT/mc^2) $e = \pm 7.10 \times 10^{-38}$ esu or zero.

The nonphotons give the microwave photons "something to come symbiotically in equilibrium with" in a 2.73 Kelvin mix where the energy density of the former, (I_4/I_3) $nkT(kT/\varepsilon) = 1.99 \times 10^{76}$ $eV \cdot cm^{-3}$, dwarfs that of the latter. Also, nonphotons impact photonics to confine them in ring-like particles and to explain the Newtonian gravity acting between bodies of such particles. It is noted that the energy density of a ring's confined photonics is $\alpha^2/3$ times that of its external nonphoton environment. That is, the energy densities inside and outside a particle-ring's envelope are near the same order of magnitude. However, the energy of a ring's photonic is only $\alpha\gamma$ times that of a nonphoton. Here $\gamma = 7.34 \times 10^{-20}$ is the ratio of the magnitude of a photonic's momentum to that of a nonphoton. For the circulating photonics to be confined in small-radii ring-like models of electrons, protons and neutrons, it is necessary that γ be such a small number. The larger number density of the weaker interior photonics relative to that of the exterior nonphotons times the appropriate energy per interior and exterior point-like particle explains the comparable energy densities noted above.

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Multi-ring models of the electron, proton and neutron have been designed to conform with four of each particle's important properties: mass, charge, angular momentum and magnetic moment*. Two or three circles, all of radius R, represent the orbits of a model's photonics. The circles' planes are parallel and closely spaced; and, their centers lie on the model's

* *See Appendix D and pages 67 – 69 of Reference 1.*

“axis”, a line normal to these planes. On one circle, N^+ photonics, each carrying a $+\zeta$ charge, orbit the axis in one direction. On a second circle, N^- photonics, each carrying a $-\xi$ charge, orbit in the opposite direction. The electron was modeled by only two circles, the N^+ and the N^- circles. A third circle is required to model a proton or a neutron. On the third circle, N^o electrically neutral photonics orbit in the direction that enhances the net angular momentum of the charged photonics.

Table 2 displays the photonics population figures for the three modeled particles. Also shown are r^+, r^- and r^o, the half-thicknesses of the N^+, N^- and N^o rings compatible with dynamic equilibrium under the pressure $P = 0.69 \times 10^{64}$ dynes/cm^2, the pressure felt by perfect reflectors of nonphotons. It should be noted that these half-thickness values are obtained by use of the $PV = Mc^2$ equation with $N^+\delta/c^2$, and $N^-\delta/c^2$ and $N^o\delta/c^2$ written for M.

According to these multi-ring models, when seen in an inertial frame where an electron or a nucleon is at rest, the observer sees photonics moving in circular orbits, the system’s mass-energy being that of the community of circulating photonics. A nonphoton seen at rest may be visualized as a system of photonics moving around a circle of a certain radius. As seen by an observer moving at a speed βc in the direction of the normal to the circle’s plane, the photonics would move along helices on the cylinder generated by the moving circle. Thus, nonphotons, like electrons and nucleons, may be visualized as a community of photonics moving along paths which look closed to observers in a nonphoton’s rest frame. The angle θ between the tangent of the helix along which a photonic of a nonphoton moves and the helix’s axis is defined by $\cos\theta = \beta$.

It appears that all particle-types considered in constructing a photon-nonphoton universe model may be considered to be systems of constituents that are seen in all frames to move at the same speed—that of the speed of light. Since a system cannot move faster than its fastest constituent, we may understand why the speed limit for the particles of nature is c, the speed of light. Also, we may note that with the particles made up of zero-rest-mass photonics, one has Wilczek’s particles with “mass without mass” as seems to be a recent trend of thought (Refs. 6 and 7).

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To round out a reasonably complete listing of the features of the emerging universe model, we include estimates of probability-related quantities for certain interactions between pairs of the model's point-like constituents: ε-quanta, photons, nonphotons and photonics*. Some Reference 1 findings are summarized below.

The microscopic cross section for ε-quantum fusion that offers an explanation of redshift in a static universe is denoted by μ_{11}. That "redshift" cross section is given by

$$\mu_{11} = [6n\wedge (kT/\varepsilon)]^{-1}.$$

$\wedge$ represents the average distance traveled by a source photon for one of its ε-quanta to fuse with a quantum of a microwave background photon. Taking $\wedge$ to equal c times a Hubble time of $\sim 10^{10}$ years, $\wedge \sim 10^{28}$ cm, which yields a μ_{11} value of $\sim 7.48 \times 10^{-109}$ cm^2.

The microscopic cross section for the elastic collision of an average nonphoton with an average photonic of weighable matter is

$$\bar{\sigma} = 2(\delta/c^2\lambda) = 2(\alpha\mu) \cdot \lambda^{-1} \cdot \gamma \cong 9.5 \times 10^{-72} \text{ cm}^2.$$

Table 1 shows the average energy of a microwave background photon is $\sim 6.36 \times 10^{-4}$ eV, which equals $\sim 1.19 \times 10^{19} \times \delta$. If the equivalence of mass and energy and that of inertial and gravitational masses are to hold, the microscopic cross section for an elastic encounter between a nonphoton and a background photon must be $\sim 1.19 \times 10^{19} \times \bar{\sigma} \cong 1.13 \times 10^{-52}$ cm^2. The number density of background photons is 409/cm^3. Thus, the mean-free path for such encounters in free space is $[409 \times 1.13 \times 10^{-52}]^{-1} \cong 2.16 \times 10^{49}$ cm, or about 2.16×10^{31} light years.

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Two interesting features of the model's nonphotons are their abilities to mimic the existence of a gravitating "dark matter" and of a repulsive gravitational force between bodies of photonic constituents. Appendix F of Reference 1 offers explanations of these possible nonphoton roles. In both cases, tiny variations of the temperature in patches of an infinite

* *See pages 66 – 67 of Reference 1*

universe about its nominal T = 2.73 Kelvin value and a tiny—but finite—microscopic cross section for nonphoton-on-nonphoton elastic scattering underlie such nonphoton roles.

To explain an apparent existence of dark matter that is ten times the average density of observed inertial matter, a cross section of $\sigma_0 = 8.92 \times 10^{-121}$ cm^2 is required. This σ_0 value is based on the fact that temperatures in patches of the universe have been observed to be about $10^{-5} \times T$ above the nominal T = 2.73 Kelvin figure. The corresponding mean free path for nonphoton elastic encounters is $\wedge_0 = 5.3 \times 10^{22}$ light years, a value quite compatible with the nonphoton gravity concept. To explain how nonphoton gravity could—under some conditions—be repulsive, temperatures in patches of the universe must be more than $\sim 10^{-6} \times T$ below its nominal T = 2.73 Kelvin value.

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Perhaps the most important feature of the modeled universe is the possibility of converting some of the energy stored in its ethereal nonphotons into a form useful to mankind. To explain this possibility, we recall Einstein's "A/B coefficient" approach to Planck's law (4). He used the label "molecule" when referring to objects that absorb and emit photons. He assumed two types of emission occur: photon-induced and spontaneous emission. It is noted that the nonphoton object may play the same role—on a cosmological scale—as Einstein's undefined molecule object. That is, the loss of photons via absorption by a molecule corresponds to the loss via photon-photon fusion—the event that creates a nonphoton. And, the emission of photons by molecules corresponds to the production of photons via nonphoton fission into pairs of photons.

Following Einstein, we have assumed two types of events yield photons; namely, photon-induced fission and spontaneous fission. In photon-induced fission, one photon causes the birth of two additional photons. Hence, one has the makings of a nonphoton fission chain reaction. The mass-energy of dormant "nonphoton fuel" is released in the form of useable photon energy. Indeed, similar to the production of collimated photon beams via photon-induced emission in conventional lasers, such beams may be yielded via photon-induced fission of nonphotons. (Perhaps beams of this type may offer a candidate explanation of "gamma burst" observations.)

Clearly, if mankind can make nonphoton fission chain reactors that produce useable photon energy at controlled rates, he becomes able to fuel his future operations anywhere within the infinite photon-nonphoton universe.

LOOKING BACK AND LOOKING FORWARD

This technical brief on the emerging photon-nonphoton universe model detailed in Reference 1 is written a hundred years after Einstein's "miracle year". The model is strongly based on Einstein's 1905 work on special relativity and also on his "A/B coefficient" approach to Planck's equation about a decade later.

The model here sketched offers an explanation of Newtonian-level gravity in terms of elastic impacts of the copious and ethereal nonphotons on the photonics making up the ring-like particles of ponderable matter. This is in contrast to Einstein's warped space-time approach to an understanding of gravity. Nonphoton Newtonian gravity necessarily assumes "thin targets" where only first collisions significantly contribute to gravitational force. To bring the nonphoton gravity concept into accord with the successes of Einstein's general relativity gravity may require a consideration of bodies that present "thick targets" to nonphoton beams.

A thick target analysis should include a deduction of the elastic-impact microscopic cross sections compatible with the known successes of Einstein's warped space-time concept. Recall that we represented both nonphotons and photonics by an average of each in order to demonstrate the nonphoton Newtonian gravity concept. Such an exploratory "one group" analysis may be refined by use of a "multigroup" approach, which requires a knowledge of cross sections as a function of nonphoton energy. That is, a useful set of multigroup cross sections might be deduced that fit successful applications of Einstein's general relativity.

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Looking back in time, it may be noted that Newton considered bodies to translate or rotate relative to an "absolute space" which appears to correspond to the "preferred inertial frame" of the photon-nonphoton universe model. And, Einstein conjectured that "The general theory of relativity renders it likely that the electrical masses of an electron are held together by gravitational forces" (5). The same nonphotons that cause gravitational forces in a photon-nonphoton universe also act to confine the electrically charged photonics of an electron within a small toroidal region. Thus, the emerging universe model is in accord with Newton's concept of an absolute space and also with Einstein's conjecture on gravitational-force confinement of a fundamental particle's contents.

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Looking forward in time, a few possible experiments to test aspects of the photon-nonphoton universe model come to mind. First, redshift observations should yield a constant when the distance to the photon emitter is divided by ln (λ_d/λ_e). Here, λ_d and λ_e are the wavelengths of the detected and emitted photons, both emitter and detector being at rest in the preferred frame. Second, the average nonphoton, bearing news that a strong gravitational event had occurred, should be found to travel at ~81% of photon speed in the preferred frame. Third, if nonphoton bombardment of the photonics of the photonic-ring models of electrons and nucleons is a valid representation of their response to a gravitational field, then the weight of a magnet may be found to vary with its orientation relative to the gravitational field. Fourth, possible experiments related to the feasibility of controlled nonphoton-fission reactors should be identified.

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Reference 1 draws together a group of studies that led to an unconventional model of the universe; it represents a progress report on a continuing construction of the "photon-nonphoton" model. Thus far, we have been able to bring into coarse focus some of the model's features by noting the multiple roles that nonphotons might play in explaining old and new observations. Future studies will attempt to sharpen the focus while exploring other candidate roles of nonphotons.

ACKNOWLEDGEMENTS

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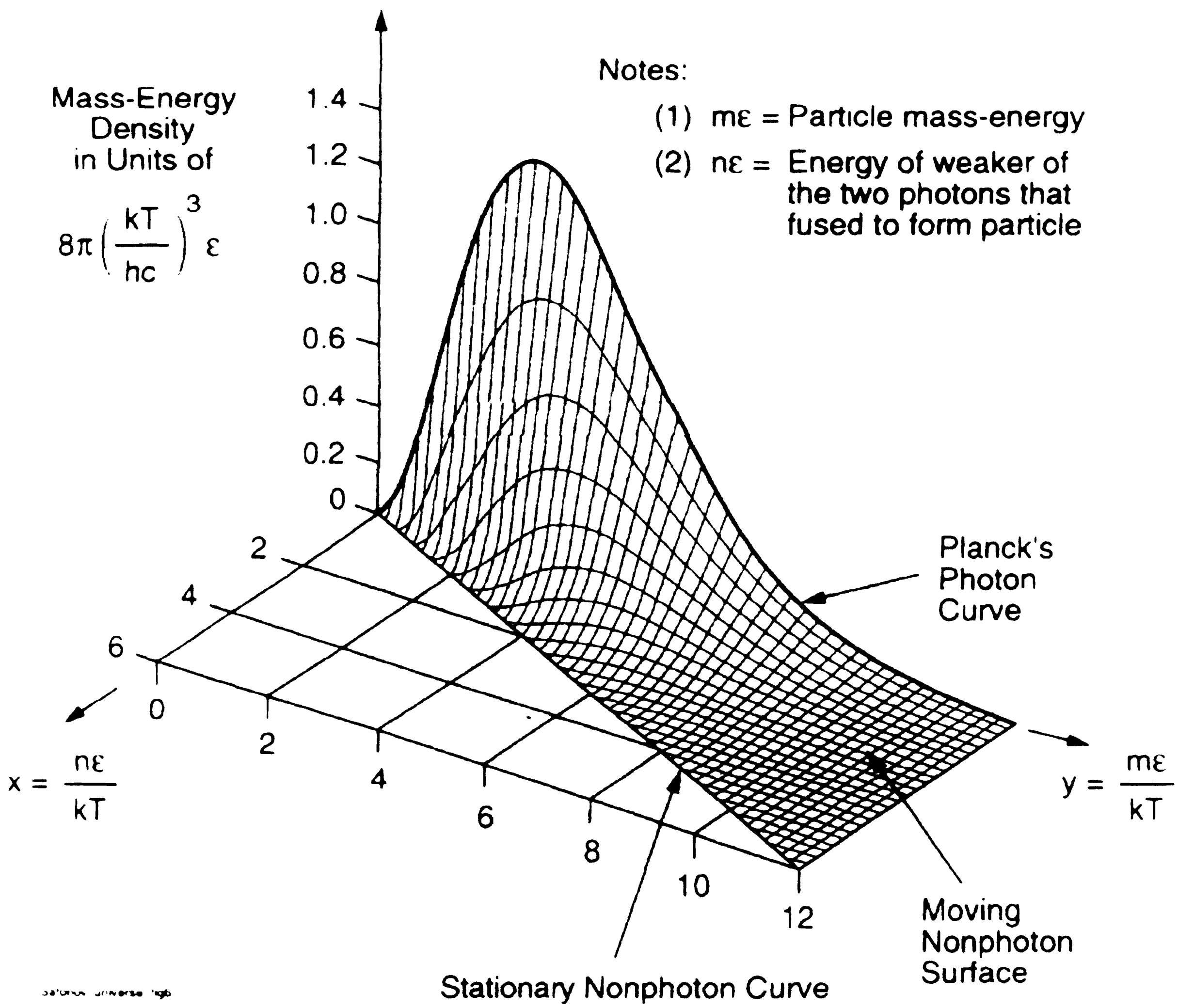

Figure 1. Particle Mass-Energy Densities: Surface Representation.

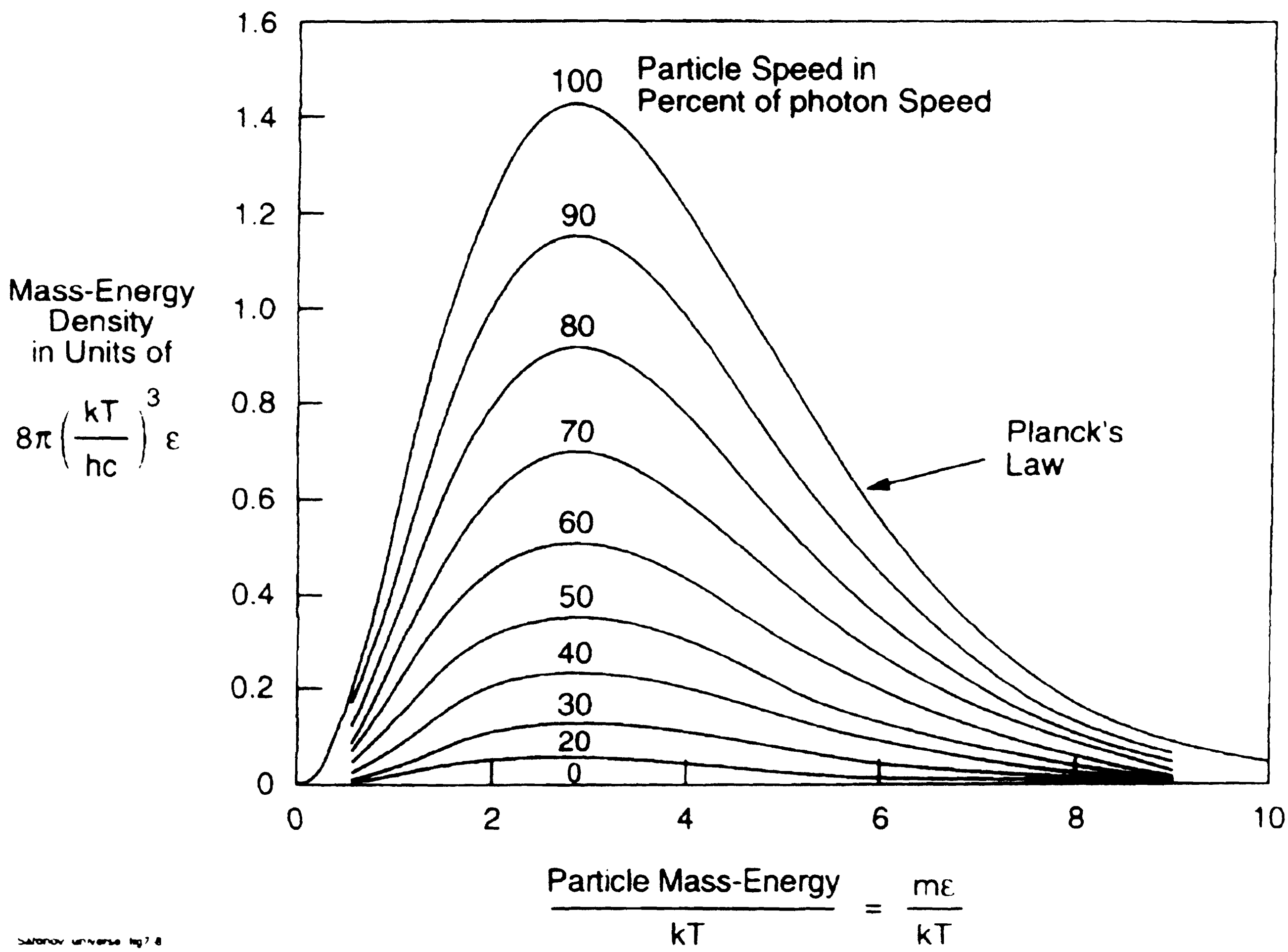

Figure 2. Particle Mass-Energy Densities as Functions of Particle Mass-Energy and Speed

Table 1. Features of Particles in 2.73°K Model Universe

Particle Property	Type of Particles		
	Photons (n = 0) ($m \geq 1$)	Nonphotons ($n \neq 0$)	
		Moving ($m > 2n \geq 2$)	Stationary ($m = 2n \geq 2$)
Number Density (cm^{-3})	$F = I_2[8\pi(kT/hc)^3] =$ $4.09x10^2$	$(I_3/6I_2)F\cdot(kT/\varepsilon) =$ $1.84x10^2(kT/\varepsilon)$	$(\Delta/2I_2)F\cdot(\varepsilon/kT)^2 \ln(kT/\varepsilon) =$ $3.54\ [(\varepsilon/kT)^2 \ln(kT/\varepsilon)]$
Mass Energy Density ($eV\cdot cm^{-3}$)	$U = I_3[8\pi(kT/hc)^3\cdot(kT)] =$ 0.260	$(I_4/6I_3)U\cdot(kT/\varepsilon) =$ $0.165\ (kT/\varepsilon)$	$(\Delta I_1/2I_3)U\cdot(\varepsilon/kT)^2 =$ $1.37x10^{-3}(\varepsilon/kT)^2$
Rest-Mass Energy Fraction	0	$3\pi/16 = 0.590$	1
Kinetic Energy Fraction	1	$(1-3\pi/16) = 0.410$	0
Speed ratio: Particle Average / Photon	1	$[1-(3\pi/16)^2]^{1/2} \cong 0.81$	0
Average of Particle Mass Energies (eV)	$U/F = (I_3/I_2)(kT) =.$ $2.70(kT) =$ $6.36x10^{-4}$	$(I_4/I_3)(kT) =$ $3.83(kT) =$ $8.95x10^{-4}$	$I_1(kT)/\ln(kT/\varepsilon) =$ $1.64(kT)/\ln(kT/\varepsilon) -$ $3.87x10^{-4}[1/\ln(kT/\varepsilon)]$

Safonov universe tables

Notes:

(1) $\Delta = 1/24$

(2) For T = 2.73°K, (kT) = $2.35x10^{-4}$eV

(3) $(\varepsilon/kT) << 1$

(4) $I_i \equiv \int_0^\infty [x^i/(e^x-1)]dx$

$I_1 = \pi^2/6 \cong 1.64493$

$I_2 \cong 2.40410$

$I_3 = \pi^4/15 \cong 6.49392$

$I_4 \cong 24.88627$

$I_5 = 8\pi^6/63 \cong 122.0808$

(5) Average kinetic energy of moving nonphotons is ~ 0.410x3.83kT = 1.57kT. Compare with 1.5kT = classical average of "hard sphere" atoms.

Table 2. Features of Photonic-Ring Particle Models.

Model Feature		Particle Modeled		
		Electron	Proton	Neutron
Mass Energy (MeV)		0.511	938.3	939.6
Photonic Populations	All Rings	0.957×10^{28}	1.757×10^{31}	1.7595×10^{31}
	N^+ ring	0.140×10^{28}	2.224×10^{28}	1.293×10^{28}
	N^- ring	0.817×10^{28}	1.548×10^{28}	1.293×10^{28}
	N° ring	0	1.753×10^{31}	1.757×10^{31}
Ring Radius, R (cm)		2.73×10^{-11}	1.053×10^{-14}	1.051×10^{-14}
Ring Half-thickness (cm)	N^+ ring, r^+	1.794×10^{-31}	3.640×10^{-29}	2.784×10^{-29}
	N^- ring, r^-	4.330×10^{-31}	3.036×10^{-29}	2.784×10^{-29}
	N° ring, r°	0	1.023×10^{-27}	1.026×10^{-27}

Safonov universe table2

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