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Memorial and Thoughts of a Man with Great Ideas — Pharis Williams

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Abstract

Pharis Edward Williams was from Missouri. During his lifetime, he possessed an amazing ability to conceive original technical ideas. He raised questions that others would ignore. This created a 'new' perspective that would lead him to increasing knowledge and experience while in the Navy as well as in research laboratories. His Master of Nuclear Physics dissertation demonstrated this prevalent view. He proposed generalizations of the classical Thermodynamic Laws leading to the fundamental principles of what he termed 'The Dynamic Theory'. In this theory, an important role is played by identifying an integrating factor that makes the energy exchange with the environment a total differential and leads to the definition of a mechanical entropy. Equilibrium and stability conditions for dynamic systems are derived and together with the principle of increasing entropy provide a geometrical structure from which the theories of relativity, Maxwell's electromagnetism, and quantum effects may be derived. By applying simplifying or restrictive assumptions to the main body of the theory, Pharis shows that the major fields of physics are contained within the extensions of this theory. In these extensions, new field quantities appear to become important for systems and technical disciplines. Thus, the Dynamic Theory that he created would unify the various branches of physics into one theoretical structure. Only the future can tell what will be the impact of Pharis' dynamic theory contributions and how engineers and scientists can gain and find new insights.

I. Introduction

Pharis Edward Williams was a precocious pre-teen growing up in southern Missouri when he first discovered the magic of ideas contained in books at the local library. He read books voraciously, and absorbed the knowledge they contained. When he came across a topic new to him, he would ask his favorite uncle "How do they know what the weather will be tomorrow?" His uncle invariably would respond "Look it up and see what you think." That

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routine of always questioning the source of knowledge would develop through the years to become a major part of Pharis' personality. He questioned all statements with "Why is that so?" or "What is your evidence for that belief?"

Pharis grew up in the hills of southern Missouri and was fond of relating Ozark hill philosophy. One of his favorite stories goes like this:

> *A native Ozarkian was giving directions to a stranger who was trying to find a certain fishing hole. The directions went something like this: "See yonder road going down that holler? Well, go down thar 'bout five mile and you'll come to a fork in the road. Take the right hand fork. Now that's the wrong one but you take it anyways. After you've gone a piece, you'll come to a log across the road. Now you know you're on the wrong road. So go back and take the left hand fork. You can't miss it."*

His major concern with the various fields of science was that we were not heeding this valuable down-home philosophy. For many years, science had been coming across logs in the road of our favorite theories—experimental results that did not fit the established model. Yet instead of returning to ground truth—the fundamentals (where the forks diverged)—we insisted on patching up our theories (cutting up the logs in the road) and continuing on. However, Pharis always looked at everything from a different perspective than most people. He insisted that we should take the other fork and return to fundamentals by first establishing a simple set of physical laws that could apply to all fields. If we could formulate a set of unassailable principles, he thought we might find that we could derive the foundations of the various branches of physics by making simplifying assumptions.

The sections that follow will give you a feel for his unique approach to the study of physics foundations. This paper is not intended to be a rigorous dissertation of Pharis Williams' work. Rather, we will present here an overview of the Dynamic Theory and resultant concepts and predictions. For those readers who are not yet calcified by years of immersion in "What we now know" we challenge you to study Pharis' work in papers and books. His two most recent books are referenced in the End Notes and form the basis of this paper.

II. Discussion

Pharis started his career as an enlisted man in the Navy. He went to Officer Candidate School to gain a commission and retired at the rank of Lieutenant Commander. During this time period and later portions of his career, he covered several important milestones in his life. We would like to share some of these experiences to demonstrate the type of personality of this unique 'Maverick' as well as the kinds of contributions he made.

A. The "Popcorn" Project[5]

The questioning approach that Pharis developed as a child would result in later years in his examination of the source of the US Navy's documented statement of the yield of a certain special weapon. Since he was teaching students at the Navy's Nuclear Weapon Training Center he considered the proof of the Navy's yield to be of extreme importance. Using a hand-held calculator that his wife, Jeri, had given him, Pharis decided to prove to himself that the Navy publication was correct. Starting from first principles—$E = mc^2$—Pharis derived the expected yield of nuclear weapons to be at least 150% of the official documented yield. That Navy publication was used to establish operational doctrine for the use of such devices. In response to this unexpected result, he and his commander called the attention of high level US Navy commanders to this finding.

After years of intense back-and-forth communications, a meeting was called in Albuquerque, NM to have this young Mustang Lieutenant defend his conclusions. The meeting was packed with high-level Navy officials and scientists from the three major nuclear weapons laboratories—those scientists who had made the official calculations. While one scientist was at the dais holding forth in opposition to Pharis' claims, Pharis was hard at work on his hand-held calculator. The room grew very quiet and the senior Admiral asked Pharis: "Lieutenant, what is so important on that gadget that you cannot pay attention to what this scientist is saying?" Pharis looked up and said "Well Admiral, if this feller is even 10 percent wrong, we have a bigger problem than I thought." Pharis later explained that these errors could cause a major disaster related to how the Navy intended to use and store these weapons. One young mustang Lieutenant had held the day against all the gathered opposition from the Navy brass and the nuclear weapons laboratory scientists.

From that conference, the US Navy initiated an expensive program called "Popcorn" to solve the problems that Pharis had exposed. You may read about this program in the archives of the London Daily Mail. Otherwise, we suspect that there are classified files regarding this program somewhere in government archives.

B. Development of the Dynamic Theory[6, 7]

Following his duties at the Navy's Nuclear Weapons Training Center, Pharis attended the Naval Postgraduate School at Monterey, CA. While there, he began to question the basis of all physics. He reasoned that if the best minds of the Navy and science had made such fundamental and critically important errors in calculating the yield of weapons and the consequences of storage methods, the basis of physics itself might be faulty. Pharis' review of the current state of science revealed that there are several different branches of physics, each with a different set of fundamental laws or postulates. Although he could see how the distinctions between these physics disciplines could arise, he refused to accept that nature shared the same divisions. He firmly believed that all natural phenomena should be explained by a single set of fundamental laws. As a result, he turned to Thermodynamics, a field of science that had never been seriously challenged, and developed his three fundamental laws. A simple statement of these laws is as follows:

1. The First Law

The First Law is a generalization of the statement of the conservation of energy in a thermodynamic system such that:

$$đQ = dU - Pdv - F_x dx - F_y dy - F_z dz \quad (1)$$

where the left hand side represents the change in heat and $đQ$ indicates a path dependent process, U is the system energy, P is pressure, dv is the change in volume, F is the force applied to the system, and x, y, z are the three space dimensions. Since there are five terms in the equation, we will need five independent equations in order to solve it. Equation (1) generalized for mechanical systems can be written as:

$$đE = dU - đW = dU - F_i\, dq^i \text{ (i = 1, ..., n)} \quad (2)$$

where again U is system internal energy, W is work on the system done by forces that are functions of velocity (u) and coordinates (q) and can be expressed as:

$$đW = F_i(q^1, \ldots, q^n, u^1, \ldots, u^n) \quad (3)$$

Since we need five independent equations to solve these equalities, we must postulate five dimensions.

2. The Second Law

The Second Law uses the statement of the second law of thermodynamics by Greek mathematician Caratheodory such that:

> *In the neighborhood (however close) of any equilibrium state of a system of any number of dynamic coordinates, there exist states that cannot be reached by reversible E-conservative ($đE = 0$) processes or motions.*

Thus there are points or states around any given state that cannot be reached without exchanging energy between the system and its surroundings. From this Pharis states that solution paths for the First Law cannot cross. If the paths were allowed to cross that would mean a system could proceed from an initial equilibrium state to two different final states along reversible E-conservative paths. The prohibition of this process denies perpetual motion.

In addition, Pharis states that there will always exist a function (path independent) which, when used to multiply the First Law, will form a new system property that he calls mechanical entropy. By taking these first two laws together, Pharis determines the existence of an integrating factor, which when multiplied by the change in exchange energy ($đE$) changes the path-dependent First Law into a path-independent statement about the change in mechanical entropy (henceforth entropy). Thus the change in the exchange of energy is path dependent while the change in entropy is path independent. That relationship may be expressed as:

$$đE = \phi(u)\, f(\sigma)\, d\sigma \;\Rightarrow\; đE/\phi(u) = f(\sigma)\, d\sigma \quad (4)$$

and $1/\phi(u)$ is the integrating factor or $\phi(u)$ is the integrating denominator and $f(\sigma)$ is a function of a family of curves in phase space representing reversible E-conservative processes. Pharis continues with this line of development to show that there exists an absolute or limiting velocity. There is one such limiting velocity already known to us from Einstein's theory which has been repeatedly held to be true. Pharis takes these two limiting velocities to be the same—*c*—the speed of light.

3. <u>The Third Law</u>

The Third Law allows us to compare the entropy between two systems. It is stated as:

The entropy of a system is constant when the integrating denominator is zero (the integrating factor is infinite).

III. Results

Pharis Williams' decision to first seek a ground truth for all of physics by postulating three fundamental laws, which are widely accepted, led him—through painstaking mathematics—to a wealth of results. Visual representation of these results can be seen in Table (1) and by study of the Dynamic Theory Logic Flow diagram, both of which are shown in the Appendix. A review of this chart and diagram will show that Pharis has developed a mathematical basis for the separate fields of physics from microscopic to cosmologic.

Applying the three laws and imposing various restrictive assumptions, Pharis displays three dimensional thermodynamics, Einstein's Special Theory of Relativity (STR), the Maxwell Equations, a five dimensional (5-D) STR, and Expanded Maxwell Equations for 5-D manifolds. Going further, he finds Newtonian Mechanics for low velocity systems, and 4-D or 5-D Quantum Conditions for isentropic systems. He leaves unexplored what may result from non-isentropic systems.

Additional restrictive assumptions lead to the Non-Singular Potential, photons, and Quantum Mechanics. Given conservation of mass, he finds Einstein's General Theory of Relativity. If the potentials are given he discovers Quantum Mechanics. Applying the Non-Singular Potential to two unlike particle systems at atomic separations, he presents a model for the atom. Pharis describes the Weak Force for unlike two particle systems with nuclear separations. Using the Non-Singular Potential for three particles, he describes the Strong Force.

That is quite a menu of results for a southern Missouri boy who simply asks "Why?" Should we accept that the various fields of physics stand apart from each other because they were developed by different scientists over a span of centuries? Or should we take a fresh look at the whole structure of physics and propose that they can be derived from a simple set of fundamental concepts? Are we likely to be successful in unifying physics with a Theory of Everything or a Unified Field Theory if we simply take the piece-parts of current physics and tie them together at the top? Or should we look into the concept of a fundamental basis for all physics such as presented by Pharis Williams? The following sections will summarize some of the more interesting results of Pharis approach to physics.

A. The Non-Singular Potential[8]

The Non-Singular electrostatic potential takes the following form:

$$\emptyset = \left(\frac{k}{r}\right)e^{-\frac{\lambda}{r}} \quad (5)$$

where the constant k is the Coulomb constant, r is he distance between particles, and λ is characteristic to the particle. In Fig. (1) we see a comparison between the standard coulomb potential force and the force created by the non-singular potential. The plot shows that the non-singular (or neo-coulomb) force is virtually indistinguishable from the Coulomb force for identical particles separated by greater than approximately 10λ. However, at a separation of exactly λ, the force is identically zero for the neo-coulomb force, but the Coulomb force has begun to rise toward infinity. In terms of the classical notion of nuclear forces, we would say that at separations greater than 10λ, the non-singular and coulomb nuclear force is negligible. The non-singular force

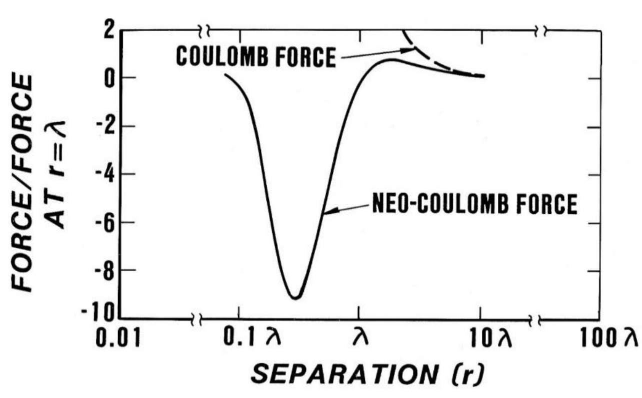

Figure 1. Comparison of coulomb and neo-coulomb (non-singular) forces at short range.

becomes an attractive force for separations less than λ and tends toward zero as r approaches zero.

Pharis continues by considering the forces created by two unlike particles—an electron and proton—on each other as the distance between them changes. Consider the electron and proton to be placed on a horizontal surface separated by a distance, *r*, with the proton to the right of the electron. Thus, the long range attractive forces between these two particles will cause the proton to experience a force to the left while the electron will experience a force to the right. He then writes the force on the proton that is due to the positive charge of the proton being in the electron field as:

$$F_p = q_p E_e = \frac{-e^2}{4\pi\varepsilon_o r^2}\left(1 - \frac{\lambda_e}{r}\right)e^{\frac{-\lambda_e}{r}} \tag{6}$$

where the electron field involving the electron lambda has been accounted for. The force on the electron due to being in the proton field is given by:

$$F_e = q_e E_p = \frac{e^2}{4\pi\varepsilon_o r^2}\left(1 - \frac{\lambda_p}{r}\right)e^{\frac{-\lambda_p}{r}} \tag{7}$$

Figure (2) plots both these forces as a function of the separation, *r*, where, $\lambda_p = 10^{-15}$ m, or $\lambda_p = 1$ Fermi has been assumed. The electron-electron scattering data show that the electron-electron interaction behaves in a coulombic manner even when separations are approximately 0.01-0.1 Fermi. To be consistent with this data, we have assumed $\lambda_e = 10^{-3}$ Fermi.

From this plot of the force on the proton and the force on the electron, we see that for separations less than about 10 Fermi's the forces become extremely unsymmetrical. This immediately and visually demonstrates that the non-singular exponential force violates Newton's third law requiring that the force on the proton be equal in magnitude and opposite indirection to the force on the electron. The question arises whether or not a violation of Newton's third law has ever been seen as the result of an interaction between an electron and a proton?

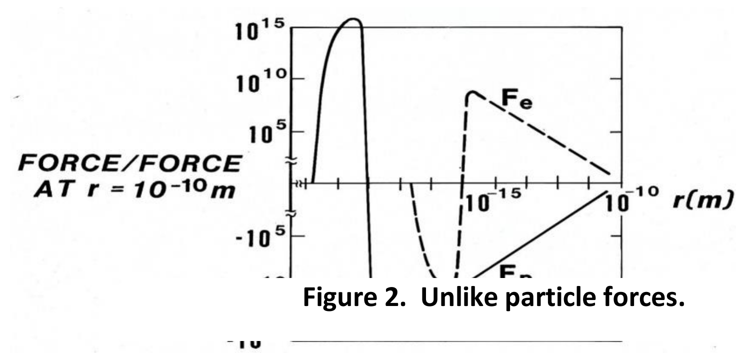

Figure 2. Unlike particle forces.

The answer, based on a neutron disintegration from which a proton and electron emerge, is definitely yes; Newton's third law was seen to be violated. To reinstate Newton's third law in neutron disintegration and all other beta decay, Pauli postulated the existence of the neutrino. Fermi later developed his theory of weak interactions, from which appeared the necessity to talk of a fourth force in nature.

Pharis continues with this unique line of investigation to consider that the neutron may be a tightly bound electron-proton pair. Most will say this violates Heisenberg's Uncertainty Principle and other accepted concepts. Pharis deals with all these objections straightforwardly. The reader is invited to follow his logic and math to see what you think. However, an honest inquiry into these concepts requires that you stay within the limits of the Dynamic Theory. Simply dismissing his conclusions because they violate accepted theory is not an honest argument.

B. Maxwell & Extended Maxwell Equations[9]

One of the most fascinating results of the Dynamic Theory is the development of the 5-D Maxwell Equations. Pharis states that the extension of geometry Weyl used to place electromagnetism on a geometrical basis allowed him to use his gauge principle to derive the Maxwell equations of electromagnetism. Weyl defined the gauge potentials as:

$$\emptyset_i \equiv \frac{\partial \ln f^{1/2}}{\partial x^i} \tag{8}$$

Now the electromagnetic field tensor is given by:

$$F_{ij} \equiv \emptyset_{i,j} - \emptyset_{j,i} \tag{9}$$

The field tensor given by Eq. (9) has 16 components when the indices range over four dimensions. This results in a four-by-four field tensor from which Weyl produces the five Maxwell Equations in Eq. (10). When Pharis followed Maxwell's derivation using the 5-D math of the Dynamic Theory, he developed a collection of eight partial differential equations (PDEs) which contained Maxwell's equations as shown in Eq. (11). This set of 5-D Expanded Maxwell Equations includes additional terms in three of the original set of five and three new PDEs.

A viewgraph of those eight expanded equations was on President Reagan's desk the night that he gave his Strategic Defense Initiative (Star Wars) speech. Pharis was told by well-placed Navy officials that pursuit of such ideas was exactly the type of research the president wished to encourage. Instead, the program managers at LANL decided to push for the many projects that had been languishing on the shelf and invite new proposals related to nuclear weapons. Nuclear science is of course LANL's strongest field of research. So their reluctance to chase after an unproven theory is lamentable, but understandable.

$$\bar{\nabla} \bullet \bar{B} = 0 \qquad [a]$$
$$\frac{1}{c}\frac{\partial \bar{B}}{\partial t} + \bar{\nabla} \times \bar{E} = \bar{0} \qquad [b]$$
$$\bar{\nabla} \times \bar{B} - \frac{1}{c}\frac{\partial \bar{E}}{\partial t} = \frac{4\pi \bar{J}}{c} \qquad [c]$$
$$\bar{\nabla} \bullet \bar{E} = 4\pi\rho \qquad [d]$$
$$\frac{\partial \rho}{\partial t} + \bar{\nabla} \bullet \bar{J} = 0 \qquad [e]$$

Equation 10. Maxwell Equations

$$\bar{\nabla} \bullet \bar{B} = 0 \qquad [a]$$
$$\frac{1}{c}\frac{\partial \bar{B}}{\partial t} + \bar{\nabla} \times \bar{E} = \bar{0} \qquad [b]$$
$$\bar{\nabla} \times \bar{B} - \frac{1}{c}\frac{\partial \bar{E}}{\partial t} + a_0\frac{\partial \bar{V}}{\partial \gamma} = \frac{4\pi \bar{J}}{c} \qquad [c]$$
$$\bar{\nabla} \bullet \bar{E} + a_0\frac{\partial V_4}{\partial \gamma} = 4\pi\rho \qquad [d]$$
$$\frac{\partial \rho}{\partial t} + \bar{\nabla} \bullet \bar{J} + a_0\frac{\partial J_4}{\partial \gamma} = 0 \qquad [e]$$
$$\bar{\nabla} \times \bar{V} + a_0\frac{\partial \bar{B}}{\partial \gamma} = \bar{0} \qquad [f]$$
$$\bar{\nabla} V_4 + \frac{1}{c}\frac{\partial \bar{V}}{\partial t} = a_0\frac{\partial \bar{E}}{\partial \gamma} \qquad [g]$$
$$\bar{\nabla} \bullet \bar{V} + \frac{1}{c}\frac{\partial V_4}{\partial t} = -\frac{4\pi J_4}{c} \qquad [h]$$

Equation 11. Expanded Maxwell Equations. *Note the additional terms in Eq. (11c, d, and e) and the additional Eq. (11f, g, and h).*

The strength of the mathematics in the DT and the broad spectrum of existing theory that can be found in its development (see the Appendix) should be enticing to young scientists who want to make a lasting impact on science. The extra terms in Maxwell's standard set of equations and the three extra equations could make several young scientists entire careers.

C. Phat Photons and Phat Lasers[10]

Using Dynamic Theory principles (DT), Pharis had an insight that at a particular frequency, higher density energy states in one photon were possible, if the photons had energy levels and therefore, a new quantum number.

The additional energy made the photon "fat" with a larger than normal electric field. However, the photons are energetic, so fat is not a good term. Pharis calls them phat photons since they contain more energy per photon than usual. How much energy?

Einstein derived the energy relation for his quanta of light from statistical methods and arrived at the expression:

$$\varepsilon = h\nu \tag{12}$$

The energy of the isentropic quantum of light that Pharis derived using DT principles was given by:

$$\varepsilon = N^2 h\nu \tag{13}$$

This expression may not at first glance appear to be that different from Einstein's, but Pharis' investigations showed that a phat photon leads to some very different physics that can prove to be of practical utility.

First, the appearance of the quantum number in the energy expression for the photon means that there may be photons of a given frequency that have more energy than the Einstein photon. He called these photons, with N>1, phat photons. Secondly, the expression for the energy of the phat photons argues that an electron in a higher energy state around the proton in a hydrogen atom would have the possibility of emitting an Einstein photon or one of the phat photons should the electron drop from the higher energy state to the lower energy state. He wondered whether these phat frequencies been reported.

The probability of emitting the phat frequencies diminishes inversely as N^2 which means the N=2 frequency should be seen one fourth as often as the fundamental frequency and the N=3 frequency should be seen only one ninth as often. Researching the phat photon on the National Institute of Standards and Technology website he discovered the original data reported by C.E. Moore[11] and found what he was looking for. The fundamental frequency for hydrogen was listed with a magnitude of 1,000, the N=2 frequency showed a magnitude of 80 and the N=3 frequency magnitude was 12. Similar numbers were reported by J. D. Garcia & J. E. Mack[12] for the helium atom. Based on these results, phatlasers might be possible

What potential benefits may be gained by employing phat photons and phat lasers? Consider that the phat frequencies represent greater energy at a given frequency for each phat photon. Therefore, in seeking a benefit of phat photons one needs to keep in mind what we are asking the photon to do. For example, suppose you wish to know how phat photons might be used in transmitting data across the country using fiber optics. The limit to the energy that can be passed through the fiber before the fiber begins to break down is controlled by the electric field strength of the photon because the electric field interacts with the atoms of the fiber and causes the structure of the material to break down.

The energy of the phat photons is proportional to N^2, but the electric field is only proportional to N. This means that the electric field may be held at a fixed value in the fiber if we reduce the number of photons by a factor of 1/N while we increase the frequency by a factor of N. We get more energy through the fiber optics by going to higher quantum numbers while keeping the fiber from being damaged by the additional energy. A secondary advantage in this example is that the number of required amplifier stations needed in a long transmission fiber will be reduced by a factor of N as well.

For satellite communications, additional energy may be transmitted using phat photons of higher quantum numbers than increasing the number of photons of lesser quantum numbers while still keeping the electric field below the breakdown level. The additional power per photon means less beam dispersion and therefore longer distances. The phat photon is equivalent to many photons in phase, a feat that is challenging to achieve.

For power transmission, phat lasers and phat masers may be used in orbiting solar arrays to compact the power which is beamed to earth with less dispersion. By using a phat laser beam, reducing the antenna footprint requirements for the space transmitting antenna and the earth station receiver to a fraction of a regular antenna at the same frequency.

For propulsion and power systems, as a form of amplitude conditioning phat photon theory suggests combinations with various modulation techniques and topological considerations as conditioned photons that unlock and direct energy.

The Dynamic Theory Logic Flow Diagram in the Appendix shows how a photon, a massless particle of energy, is derived in the theory. That simple box titled “photon” is really an open door where Pharis takes us from basic research to applied physics in his paper “Phat Photons and Phat Lasers.[13]”

D. Compact Reactor [14]

In another paper titled “Compact Reactor”[15] Pharis takes us into Phatland where phat photons from a phat laser form the source of ignition of a deuterium-deuterium process that produces helium as the resultant byproduct—no radiation, no shielding. In Pharis’ paper the linkage between the Dynamic Theory and the Compact Reactor are explained. Pharis states: [16]

> *“Weyl's Gauge Principle of 1929 has been used to establish Weyl's Quantum Principle (WQP) that requires that the Weyl scale factor should be unity. It has been shown that the WQP requires the following: quantum mechanics must be used to determine system states; the electrostatic potential must be non-singular and quantified; interactions between particles with different electric charges (i.e. electron and proton) do not obey Newton’s Third Law at sub- nuclear separations, and nuclear particles may be much different than expected using the standard model. The above WQP requirements lead to a potential fusion reactor wherein deuterium nuclei are preferentially fused into helium nuclei.*
>
> *“While the deuterium nuclei are preferentially fused into helium nuclei at temperatures and energies lower than specified by the standard model there is no harmful radiation as a byproduct of this fusion process. Therefore, a reactor using this reaction does not need any shielding to contain such radiation. “*

He goes on to show how a clean fusion design enables compact reactors which are highly useful for power in space. Pharis offers a novel way of using spin aligned deuterium molecules to create a compact reactor design. Such a compact reactor has many applications including power for a vehicle propulsion system, portable power for explorers and settlers on Mars, or as a neighborhood power plant. He says: [17]

> *"The energy released from each reaction and the absence of shielding makes the deuterium-plus-deuterium-to-helium (DDH) reactor very compact when compared to other reactors, both fission and fusion types. Moreover, the potential energy output per reactor weight and the absence of harmful radiation makes the DDH reactor an ideal candidate for space power. The logic is summarized by which the Wyle Quantum Principle (WQP) requires the above conditions that make the prediction of DDH possible."*

Pharis' paper on the "Compact Reactor" (2007) was followed by "Fusion for Earth and Space" (2009) where based on Dynamic Theory and Phat Photons, Phat Lasers and Compact Reactors, Pharis looks to the applications of the future. So it's best we end with Pharis vision of the future from the 2009 paper.[18]

> *"The concept (of the Compact Reactor) also would make it possible for each plant or remote location to have its own power source, on site, without the need for a connection to the power grid. This would minimize, or eliminate, power blackouts. The concept could replace large fission reactors and fossil fuel power plants plus provide energy for ships, locomotives, trucks and autos. It would make an ideal source of energy for space power applications and for space propulsion."*

E. Shock Physics[19]

In the world of shock physics, temperature is the Holy Grail. However, for all practical purposes it is impossible to attain, since by the time the temperature reading shows up on the oscilloscopes, the shock wave has passed by several milliseconds. Knowledge of the temperature inside of a shocked material would allow us to know everything we need to know about the material, including its energy dissipation processes. It would connect us to every state variable.

The viscosity of the material undergoing shock compression is tied up in the time it takes for the material to reach steady state amplitude, as well as the shape of the rise to steady state through plastic deformation. As late as 2011, physicists have tried various methods to model viscosity.

What separates Pharis' work from others was that his approach was simply based on the idea of mass density. In his own words from Chapter 12 of the 2011 Dynamic Theory book he wrote: [20]

> *"...Recalling Eqn. (12.43), it may be seen that the viscous-like effects of the geometry of the hyper-surface depend upon the density gradient. If these terms exist, they must be very small in everyday phenomena. Yet if we consider phenomenon which involve very large density gradients, these terms could become large enough to see. One field of physical phenomena that displays large density gradients is shock waves."*

Equation (12.43) from the book is reproduced here as Eq. (14):

$$T^{\alpha\beta} = \gamma\, u^{\alpha} u^{\beta} + \frac{P}{c^{2}}\left(u^{\alpha} u^{\beta} - g^{\alpha\beta}\right) \tag{14}$$

In classic shock wave physics, which is based on Euclidean space, mass density after compression is given by the relationship:

$$\rho_1 = \rho_0/(1-(u_p/U_s)) \tag{15}$$

where ρ_0 is the initial mass density, u_p is the mass particle velocity accelerated by the wave and U_s is the shock wave velocity. The shock wave velocity is the time it takes for the wave to go through a thin disk of shocked material. In this view, the density is based on a ratio between the two velocities. But since the shock velocity of any material is actually measured at the free surface of an accelerated material (these days), the shock velocity is actually based on the amplitude of the amplitude of the shock wave, or the particle velocity.

Pharis did not see this phenomenon "exactly" the same way. He expressed viscosity as a negative velocity gradient. Again from his 2011 book on Dynamic theory he wrote

$$\sigma = P + \eta_{eff}\left(\frac{du}{dx}\right) , \tag{15}$$

where

$$\eta_{eff} \equiv \eta - \frac{P k_1^2}{a_0^2 u^4}\left(\frac{du}{dx}\right) \tag{16}$$

Another way of seeing this equation is that if anyone knows the particle velocity, then they know the stress (or pressure) and therefore, the viscosity coefficient, η, can be determined. If someone takes a closer look, they can see that the viscosity coefficient increases by an exponent to the particle velocity (which is captured in the pressure term).

In Pharis' words *"…the effective viscosity varies approximately as the square of the shock velocity or, essentially, as the pressure."*

Using this perspective, Pharis was able to show the discrepancy in the 1978 Sandia report from Asay-Bertholf[21] in the low and high limits to viscosity in aluminum. He was also able to correlate Soviet data with the n=1 and the new universal constant a set to 0.365.

In this regard Dynamic Theory correlates the data that appear contradictory by classic Newtonian physics, while simultaneously showing that existing data produce a new universal constant to the theory.

There are 3 areas of concern in shock physics, where DT could further be used to obtain predictions. The first is that the shock wave somehow knows how much material there is in front of it. For example, a thin piece of aluminum has a faster rise time than a thick one. How does the material know how much room there is to respond? The second is that the thermodynamically inconsistent Mie-Gruneisen equation of state[22], is used as a means to effectively give a nod to temperature, but creates a situation where any temperature prediction in a material in the shocked state is unreliable, at best. The third is that artificial viscosity is used to hold shock wave calculations together. That is because a shock wave is considered a discontinuity. Without the artificial viscosity, the computer would blow up trying to calculate the meaning of infinite stress.

So, the question is, "Would we be able to get closer to a temperature prediction using DT effective viscosity is an energy dissipation process that ties back to entropy?"

Perhaps then the plasma generated by a shaped charge can be captured by using one thermodynamically consistent shock wave code, which also captures shear, void nucleation and growth and other mechanisms. These are all areas of interest which could benefit materials science, cosmological physics as well as quantum physics.

And as Pharis used to say at the end of every communication—"Have fun."

IV. Summary – Pharis' Impact[23]

Pharis Williams was one of the "Crazy Ones" that Steve Jobs mentioned in the 1997 ad campaign for Apple Computers.[24] Just like the Apple catch-phrase of those days, Pharis "thought differently." He refused to accept "what we now know" of the flame keepers of physics. Especially when he determined mathematically that "what we now know" was appallingly detached from reality in the "Popcorn" episode. Through his diligent study of current physics, he determined that there was no ground truth for the collection of theories leading to the various fields of physics. Looking for unassailable foundations to build upon, he selected thermodynamics. Einstein said years before:[25]

> *"A theory is the more impressive the greater the simplicity of its premises, the more different kinds of things it relates, and the more extended its area of applicability. Therefore the deep impression that classical thermodynamics made upon me. It is the only physical theory of universal content which I am convinced will never be overthrown, within the framework of applicability of its basic concepts."*

Therefore, Pharis appears to have chosen well for his theoretical foundation.

As a result of this judicious choice of fundamental laws, the Dynamic Theory is shown to contain all of the various branches of physics by the application of simplifying or restrictive assumptions. The assumptions and the fields of physics to which they lead are shown in Table (1) in the Appendix. Review of Table (1) and the Dynamic Theory Logic Flow Diagram (also in the Appendix) clearly will show the depth and breadth of impact by Pharis and his theory.

First consider that the First and Second Laws taken together show that there must exist a limiting velocity (*c*), there must be two geometrical manifolds associated with the motion of a system, one manifold is a non-integrable

Weyl geometry and the other is an integrable Riemannian geometry, there must exist a gauge function that acts as a geometrical integrating factor for the Weyl manifold, and this gauge function produces Maxwellian electromagnetism. These two laws also require that the curvature of a four-dimensional hyper surface, embedded into a five-dimensional space-time-mass manifold by the requirement for conservation of mass, must be given by Einstein's general theory of relativity (GRT). So we are given Newtonian and GRT mechanics and Maxwell electromagnetism from these two simple and unassailable laws.

Next consider all the various new concepts that arise from this theory:

- **The Three Laws** – Selection of three fundamental laws that govern all of nature.
- **Entropy** – For isolated mechanical systems, entropy must increase.
- **Coordinate Systems** – The coordinate system for the first law may be freely chosen. This together with the second law produces two metrics. These two metrics must then be used to obtain a solution that maximizes the entropy during any dynamics that occur.
- **The Arrow of Time** – The Entropy Principle requires that entropy never decrease—it must increase or remain fixed. This means that entropy—which is related to proper time in the DT—is the length of the entropy metric and it must never decrease—proper time must always go forward.
- **Space-Time-Matter** – The differential change in energy between a system and its surroundings is equal to the sum of five differential terms—change in system energy, thermodynamic work or *Pdv*, and three mechanical work terms and the differential change in position for each. That requires five independent dimensions to create five independent equations in order to solve the equality.
- **Mass Density as the Fifth Dimension** – If the claim that mass density can always be fully described within the four dimensions of space-time cannot be proven—and it has not been—then it may be assumed to be independent of space-time. Therefore, mass density is a proper candidate for the fifth dimension and predictions made using this assumption may be checked against experimental results.
- **Weyl's Quantum Principle** – In the standard model, quantization is adopted as a fundamental assumption. In the DT, quantization is a subset of the total allowed possibilities for the dynamics of an isolated system.
- **The Gauge Function is Fundamental** – The Entropy Principle leads to a gauge function. Gauge potentials are produced as the first order derivative of the gauge function and the gauge fields are the second order derivatives. Therefore, the gauge function is fundamental.
- **Quantized Electric Charge** – Experimentally, it has been shown that electric charge on particles comes in multiples of a fundamental unit of electric charge. To date there has been no theoretical requirement for this quantization. However, in the DT, the requirement that fundamental particles retain their identifying characteristics as they move around in space and time, establishes the requirement for quantization.
- **Non-Singular Fields** – The r^{-2} feature of standard electric and gravitational fields results in these fields approaching infinity as the separation (r) tends toward zero. The gauge function's dependence on space vanishes as the separation approaches either infinity or zero. Therefore, there are no singularities.
- **Proton-Proton Scattering** – As energies in proton-proton scattering have forced the protons closer together, the resultant data has begun to deviate from predictions of Coulomb forces. Because of the non-singular nature of the DT electrostatic potential and force, the repulsive force between protons begins to diminish as separation drops to nuclear distances. Thus, the DT predicts data similar to the data obtained in high energy proton-proton scattering experiments.
- **Dependence of Uncertainty on the Gauge Function** – The gauge function is the dominant feature of the geometry and the forces between particles are due to this gauge function. The DT shows that uncertainty, or the unit of action, varies with the gauge function. Thus, within nuclear phenomena, the unit of action varies from that used in atomic phenomena. This changes the interpretations and predictions within nuclear phenomena.
- **Phat Photons** – The wave-particle duality of light has been the source of discussion and experimentation for decades. In the DT, wave-particle duality is explained by the quantized wave of the vector potentials. In addition, the wave energy is quantized as $\varepsilon = N^2 h\nu$. This means that photons predicted by Einstein are those with $N = 1$. Photons of $N \geq 2$ have more energy for a given frequency—they are Phat Photons.
- **Weak Nuclear Force** – Non-singular forces for different particles do not satisfy Newton's Third Law. Within the DT, relativistic quantum mechanics for unlike particles produces the Yang-Mills equations. This means that weak nuclear forces are actually non-singular forces between unlike particles at nuclear distances.
- **The Neutron** – Every disintegration of a neutron produces an electron, a proton, and motion of the center of mass. The forces holding the electron and proton together within the neutron do not obey Newton's third

law and therefore, the center of mass is itself in orbit around a space point. Therefore, the disintegration of the neutron can be expected to display motion of the center of mass.

- **Lifetime of the Neutron** – The standard model does not produce a functional form for the weak nuclear force that may be used to predict the lifetime of the neutron. However, in the DT, the center of mass is trapped within a positive energy well. This means that quantum tunneling may be used to calculate the lifetime. The result compares favorably with the experimentally determined value, and
- **Magnetic Moments –** Discovered within the development of five-dimensional quantum dynamics, was the necessity that an electrically neutral spinning body must have a magnetic moment. The calculated value for the Earth's magnetic moment is verified by the experimental value.

There is so much more than time or space available to recite. Read and honestly study Pharis' books and papers. They are available at book stores, Amazon, and other retailers. Or you may search online archives here,[26] here,[27] here,[28] and here.[29]

The sheer magnitude of Pharis Williams' work is amazing. For several decades he labored over the very complex mathematics and concepts of a physically real five dimensional theory. He wrote articles and books and presented papers at various symposia. He would often say that he felt like the fellow standing at the bottom of the physics tree yelling at those climbing up their careers, "Hey, you are in the wrong tree!" That could not have been a pleasant thought for either Pharis or those in the tree.

There are several reasons why few have seriously pursued the concepts of the Dynamic Theory. The math is daunting to say the least, but it has been checked and validated by some of the best mathematicians in the world. The theory crosses all of the boundaries between the various branches of physics. Thus, the equation symbols alone are problematic. A Greek letter in one discipline may stand for one quantity and in another discipline mean something entirely different. Therefore, reading the theory becomes an exercise in the interpretation of symbols. A scientist who has spent a lifetime in his discipline is ill-disposed to climb down from his "tree" in order to start the climb up the Dynamic Theory tree. Then there are those who were publicly embarrassed by Pharis when he had the audacity to prove them wrong at the Albuquerque meeting.

That is why we wish to encourage younger scientists and students to take a serious look at the Dynamic Theory. There are so many predictions—some of which have been proven—that there exists a wealth of experimental work to do. There are unexplored avenues of research and incomplete or unaddressed derivations to finish. The young aspiring scientist or the adventuresome student will find scientific treasures. You may be the one to find an avenue of research that is worthy of the Nobel Prize. Who can know how many Nobels there may be within the Dynamic Theory?

V. Conclusion

In the land of the blind, the one-eyed man is king. Even when Pharis faced opposition and stood as the lone voice of reason, Pharis stood tall by simply thinking, carefully examining different approaches, and applying what was right, and in doing so, Pharis Williams made this world a safer and better place for all of us.

Pharis looked closely at mass density and then developed The Dynamic Theory, a five-dimensional theory from thermodynamics with mass density as the fifth dimension. By applying simple and restrictive assumptions, Pharis showed how major fields of physics are contained within the extensions of The Dynamic Theory. This unifies the various branches of physics into a usable theoretical structure where new field quantities become important for systems and technical solutions.

This unique maverick easily walked in both science and engineering disciplines and in doing so, found practical and important applications in shock physics and environmentally clean, compact reactors. From extending The Dynamic Theory to develop what Pharis described as the experimentally proven phat photon to the practicalities of the phat photon laser, such was the breadth of his skill sets where Pharis would then go the extra mile and propose applications in the fields of communications, energy and transportation. The future of The Dynamic Theory is up to the scientists and engineers of tomorrow who not only think outside the box, but can think and work in five dimensions and beyond.

Acknowledgements

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[5] **NOTE**: All statements are from personal stories related directly by Pharis Williams in an Open environment. You might, however, wish to look into this Popcorn Program. The embarrassment caused by the results of this meeting may have contributed to the extreme difficulties Pharis faced in dealing with the scientific community as noted in his book, *Physics Against the Odds*.

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Appendix A

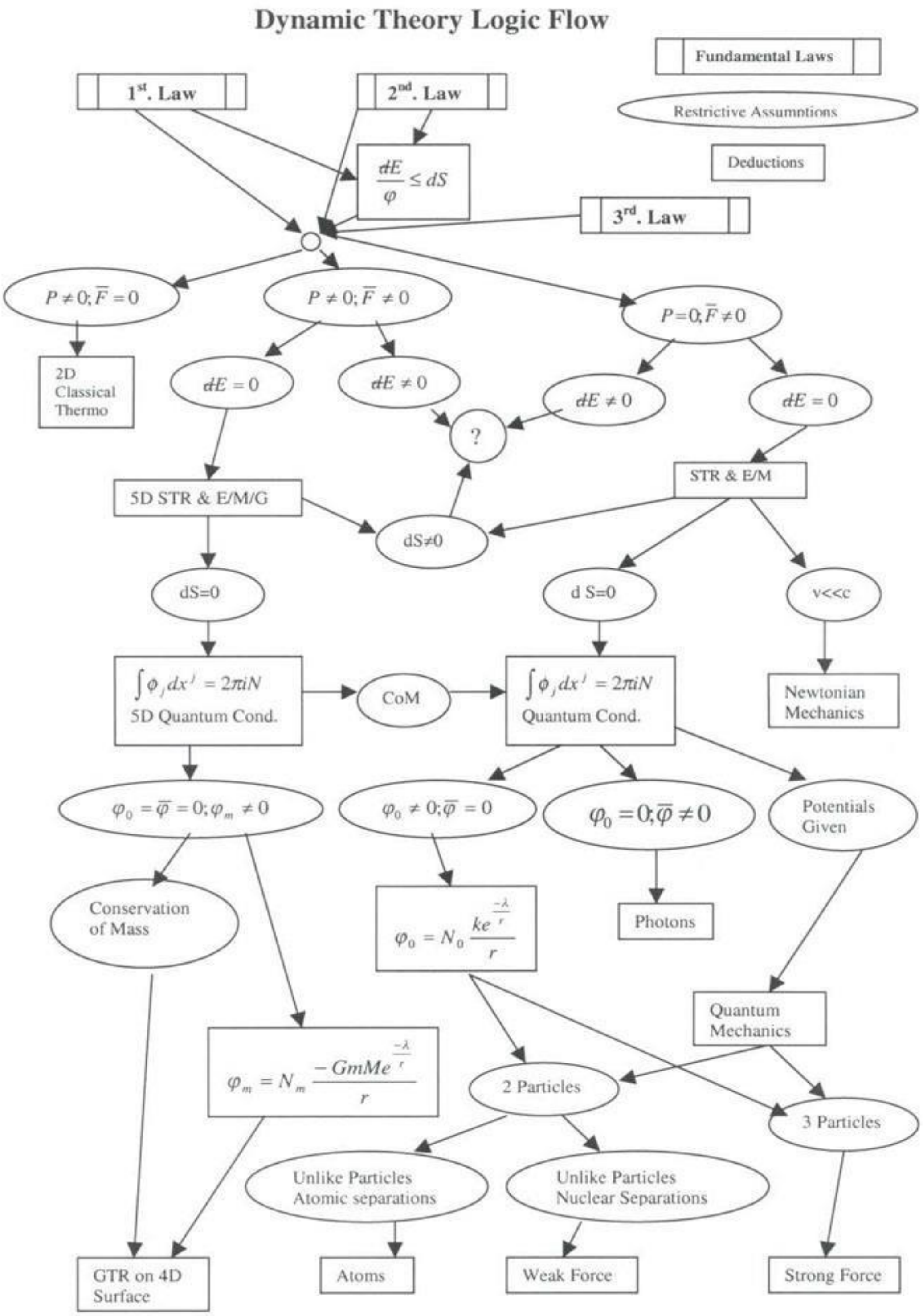
Dynamic Theory Logic Flow
Fundamental Laws
Restrictive Assumptions
Deductions
1st. Law
2nd. Law
$\frac{dE}{\varphi} \le dS$
3rd. Law
$P \neq 0; \overline{F} = 0$
$P \neq 0; \overline{F} \neq 0$
$P = 0; \overline{F} \neq 0$
2D Classical Thermo
$dE = 0$
$dE \neq 0$
$dE \neq 0$
$dE = 0$
?
5D STR & E/M/G
STR & E/M
dS≠0
dS=0
d S=0
v<<c
$\int \phi_j dx^j = 2\pi i N$
5D Quantum Cond.
CoM
$\int \phi_j dx^j = 2\pi i N$
Quantum Cond.
Newtonian Mechanics
$\varphi_0 = \overline{\varphi} = 0; \varphi_m \neq 0$
$\varphi_0 \neq 0; \overline{\varphi} = 0$
$\varphi_0 = 0; \overline{\varphi} \neq 0$
Potentials Given
Conservation of Mass
$\varphi_0 = N_0 \frac{ke^{\frac{-\lambda}{r}}}{r}$
Photons
Quantum Mechanics
$\varphi_m = N_m \frac{-GmMe^{\frac{-\lambda}{r}}}{r}$
2 Particles
3 Particles
Unlike Particles Atomic separations
Unlike Particles Nuclear Separations
GTR on 4D Surface
Atoms
Weak Force
Strong Force

Table 1. Restrictive Assumptions to Reach the Branches of Physics

Branch of Physics	Restrictive Assumptions
Classical Thermodynamics	i. Only a pdv work term
Special Theory of Relativity	**Group A assumptions** i. Isolated system, dE = 0 ii. Only 3 spatial work terms iii. Near equilibrium (ρ_{ij} = constant) iv. Variation of paths
Newtonian Mechanics (4-dimensional)	**Group A assumptions, plus** v. Only three spatial work terms
Electromagneto-Gravitic Fields	**Group C assumptions** i. Isolated system, dE = 0 ii. Gauge field equations
Maxwellian EM Fields	**Group C assumptions, plus** iii. Only three spatial work terms
Quantized Gauge Potentials [$(e^{-\lambda/r})/r$]	**Group C assumptions, plus** iv. φ_j Independent of path v. Isentropic states
Strong Nuclear Force	i. Like particle forces, $\lambda_1 = \lambda_2$
Weak Nuclear Force	i. Unlike particle forces, $\lambda_1 \neq \lambda_2$
Atom Physics (Classical)	i. 4-D Quantum Mechanics ii. $r \gg \lambda_{max}$
Perihelion Advance	**Group A assumptions, plus** vi. quantized gauge potentials
Redshifts	i. Quantized gauge potentials ii. Geometrical unit of action

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