

# Degenerate Angular Momentum in the Hotson-Westergard Universe Model

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The theory of the object known in general relativity as a Black Hole is not fully worked out and remains a source of various controversies. This paper shows that true black holes do not exist in nature due to forces that prevent the formation of singularities and event horizons. A reconstruction of the derivation of the Einstein field equations of general relativity shows that a force causes a phase-change transition from matter to energy near the Planck scale. The energy produced by the phase-change is Degenerate Angular Momentum. Degenerate, because the location of the phase-change occurs at the bottom of a deep gravitational well prior to the formation of a singularity. We show that this phase-change connects our positive energy universe to an all pervasive negative energy field (the BEC), which consists only of negative energy epos (mass less electron/positron pairs). Degenerate Angular Momentum is the force which draws negative energy epos into our reality, which ultimately results in the formation of gas, dust, stars, and other structures throughout the universe.

**Key Words:** Angular Momentum, Black Holes, Beta Decay, BEC, Bose-Einstein Condensate, Degenerate matter, Degenerate Hydrogen Well, Dirac's Equation, General Relativity, Gravitation, Gravitational Collapse, Hotson/Westergard Universe, Matter Creation, POAMS, Quantum of Time, Quasar Ejection, Singularities, Speed of Gravity, Strong Nuclear Force, Structure Formation.

## 1. Introduction

In the theory of general relativity, the entity known as a 'Black Hole' (BH) is a geometrical object, which represents the end point of the gravitational collapse of a massive degenerate object. A BH forms when a body of matter is sufficiently dense and massive that its' internal gravitational attraction is great enough to overcome the repulsive electron and neutron degeneracy pressure. According to the Standard Model (SM), when this occurs a gravitational collapse ensues in which all the mass of the object is ultimately compressed to a point singularity.

The spherical area surrounding the point singularity from which the escape velocity exceeds light speed is called the 'event horizon' of the black hole. However, according to the SM, all the mass of the black hole is contained within the point singularity.

## 2. The Heaston Derivation of Field Equations

The following is quoted from the classic paper by Robert J. Heaston, titled Derivation of the Einstein Field Equations of General Relativity [1]. Heaston's paper is a reconstruction of the derivation of the Einstein field equations of general relativity by relating Einstein's personal correspondence with his technical publications. In Fig. 1 (not shown in this paper) of Heaston's paper he shows 18 steps indicated by numbered circles that are involved in his derivation. Heaston states,

"The record indicates that Einstein derived his equations in two stages. The first phase or 'static stage' is indicated vertically by steps 1, 2a, 3, and 4. The static stage covered 1907 to 1911. The second phase, 'dynamic stage,' is given in steps 9 - 14 indicated horizontally in the middle of Fig. 1. The dynamic stage was from 1912 to 1916. Steps 2b, 6, 8, and 18 are alterna-

tive options, problem areas, or both. All other steps are contributions by others that support the reconstruction.

"The reconstruction dictates the path that Einstein had to take if he wanted his field equations to converge on the Newton gravitational force. The major lesson learned from this reconstruction is that Einstein probably overlooked, ignored, or bypassed some valid alternative options that radically change the interpretation of the field equations. The most significant option reveals that singularities are theoretically impossible, an observation that negates inflation theory and modifies the explanations of theories of black holes, the big bang, and strings."

Heaston found that gravitational collapse occurs until a mass reaches a finite point where it can collapse no more. Further application of force causes a phase-change transition from matter to energy. This phase-change is an alternative to collapse to a singularity.

Collapse to a singularity necessarily implies that the laws of physics, particularly the conservation of energy, fail at some point in the collapse process. One way to preserve the laws of physics is to identify a limit in gravitational collapse.

Six detailed reasons are given by Heaston to justify why gravitational collapse reaches a limit instead of continuing to a singularity. The six reasons from Heaston's paper are briefly listed as follows:

"A maximum magnitude of  $n=1$  is the *first reason* why gravitational collapse reaches a limit.

"The constant gravitation potential is the *second reason* that a gravitational collapse limit may exist.

"The critical collapse ratio is the *third reason* why a gravitational collapse limit exists.

"The existence of a maximum radiance is the *fourth reason* that has been identified which suggests a collapse limit.

"Convergence on the Planck scale is the *fifth reason* that the Einstein field equations reach a collapse limit.

"The Heaston superforce provides a *sixth reason* for justification of a gravitational collapse limit.

**In Step 8: The Critical Collapse Ratio**, Heaston states,

"Step 3 describing the gravitational collapse length can be rearranged one more way to define step 8, the critical collapse ratio.

$$\frac{r_s}{m} = \frac{G}{c^2} = 7.41 \times 10^{-28} \text{ m/kg} \quad (2.1)$$

"In words, a mass of one kilogram cannot be contracted to a length less than  $7.41 \times 10^{-28}$  meters and still be a mass. Additional collapse and that kilogram would be converted into energy. Any other mass will have a characteristic collapse limit of  $r_s$  based upon the critical collapse ratio.

"Other members of the Natural Philosophy Alliance have recognized a need for a collapse of matter to energy. Rydin [2] has referred to the critical collapse ratio in step 8 as the *Heaston limit*, because it fulfills a role in his *Big Wave model* [3]. Westergard [4] requires a limit like step 8 in the *Hotson-Westergard universe model*. The critical collapse ratio also provides a mechanism that is consistent with Scarborough's *LB-FLINE model* [5] of energy generation within astrophysical objects..."

**In Step 14: Geometrized Units Format**, Heaston states:

"Both Einstein and Grossman were students of mathematics taught by Minkowski, who apparently began the use of geometrized units in his 1908 paper [6]. Einstein continued this practice of assuming units where  $c = 1$  in those units in a footnote to his 1916 paper [7]. 'The unit of time is to be chosen so that the velocity of light *in vacuo* as measured in the 'local' system of coordinates is to be equal to unity.' Misner [8] and others expanded this practice: 'Throughout this book, we use geometrized units, in which the speed of light  $c$ , Newton's gravitational constant  $G$ , and Boltzmann's constant  $k$  are all equal to unity.'..."

"Others [9] have extended geometrization to include the Planck constant. In my opinion, geometrized units are a big mistake. Much valuable information is hidden from view. Fig. 8 would be even more indecipherable in geometrized units.

"The assumption of geometrized units is the reason why the Einstein field equations collapse to a singularity. Dicke and Peebles [10] emphasize the impact of this choice of units, 'With the proper choice of units of measure (obtained by setting  $G, h/2\pi$  and  $c$  equal to 1) the Einstein field equations are satisfied, and the energy density and pressure are positive, so the usual singularity theorems apply.'

Heaston then concludes:

"In my opinion the choice of geometrized units is a *reductio ad absurdum*."

**In Step 17: Planck Scale**, Heaston states:

"The Planck constant does not appear anywhere in the Einstein field equations. The Einstein field equations have primarily been used in cosmology and theories about black holes, inflation theory, big bang theory and spin-offs to unified field theory and string theory. Efforts by cosmologists using the field equations with geometrized units result in gravitational collapse to a singularity. Most of the efforts by cosmologists have been concerned with bulk matter.

"A parallel effort has been on-going since the 1950s to unify the four fundamental forces (gravitational, electromagnetic, weak and strong forces). The Planck constant was introduced through the characterization of the weak and strong forces. Progress in unifying the electromagnetic, weak and strong forces has been referred to as grand-unified theory (GUT). Efforts to unify gravity with the other forces have evolved under the standard model with the prediction of the convergence of all four forces at the Planck scale and some hypothetical superforce based mostly upon particle interactions rather than a bulk matter approach [11]. The Planck scale is included in Fig. 1 because of these efforts.

"There is no theory for the Planck scale. This scale was created [12] in 1906 when Planck used dimensional analysis to juggle the speed of light, the gravitational constant, and his own Planck constant to obtain natural units of mass, length and time. It was fortuitous that Planck scale physics had no application until the force unification efforts.

"Since the standard model predicts that the gravitational force, along with other forces converges on the Planck scale, then the field equations should do likewise. It can be shown for the first time that the field equations also converge on the Planck scale as indicated by the following equation.

$$R_{ab} - \frac{1}{2} g_{ab} R = \frac{8\pi T_{ab} r_p^2}{G m_p^2} \quad (2.2)$$

"This representation of the field equations is identical with step 13, but it converges on the Planck scale at the superforce  $c^4/G$  described in step 18 that follows. This convergence occurs when geometrized units are not used, because the consequences of the convergence are not visible with geometrized units, which mathematically normalize the equations with their presence. The Planck length divided by the Planck mass also meets the requirements of the critical collapse ratio in step 8.

"The equation above and the characteristics of the Planck scale tend to support the Bekenstein-Hawking formula [13] for the entropy of a black hole,

$$S = \frac{2\pi k A c^3}{4hG} \quad (2.3)$$

"where  $S$  is entropy,  $A$  is the surface area of the event horizon, and the other terms are the same as defined before. Note that the Planck length squared appears inverted in this formula.

"Convergence on the Planck scale is the *fifth reason* that the Einstein field equations reach a collapse limit."

**In Step 18: Heaston Superforce:**

"In his 1984 book **Superforce**, Davies says, 'At the Planck energy, all four forces of nature could be completely merged into a single superforce...'" [14]

Heaston first derived the only known specific superforce in 1976 and has explained its meaning in a number of presentations and papers [15]. Step 18 is the Heaston superforce.

"Seven reasons may be given for recognizing the existence of the Heaston superforce.

1. The Heaston superforce has the units of a force and has a tremendous magnitude of  $c^4/G = 1.21 \times 10^{44}$  N that fulfills the expectations described by Davies and others. **The magnitude of the superforce is to the strong force between nucleons as the strong force is to the gravitational force.** The relative strength of the superforce as compared with the gravitational force at the Compton length of a particular mass corresponds to the Eddington number [16] derived from the field equations.
2. If the Planck length and the Planck mass from step 17 are directly substituted into the Newton gravitational force in step 1, the result is the superforce in step 18.
3. When the collapse length in step 3 is substituted into the Newton gravitational force in step 1, mass vanishes, and the result is the Heaston superforce in step 18. The superforce is the consequence for any mass, since mass cancels out and apparently vanishes into energy.
4. The speed of light times the superforce in step 18 gives the resulting radiance flux in step 16.
5. The superforce in step 18 shows up in inverted form in step 13 in the field equations.
6. When  $c = G = 1$  in step 14, the superforce is equal to unity and the field equations are normalized and can converge on a singularity because of an asymptote.
7. Much of Fig. 1 is knit together by the superforce because steps 2a, 2b, 3, 4, 5, 6, 8, 11, and 15 when multiplied on both sides by  $c^2$  or  $c^{-2}$  will include the superforce.

## 2.1. The Hotson/Westergard Universe

The following is from "Commentary on the Work of Don Hotson" by Bill Zebuhr [17].

"In 2002, *Infinite Energy* published a two-part article by Don Hotson, "Dirac's Equation and the Sea of Negative Energy" (Issues 43 and 44) [18, 19]. These are available online at:

[www.zeitlin.net/OpenSETI/Docs/HotsonPart1.pdf](http://www.zeitlin.net/OpenSETI/Docs/HotsonPart1.pdf)

[www.zeitlin.net/OpenSETI/Docs/HotsonPart2.pdf](http://www.zeitlin.net/OpenSETI/Docs/HotsonPart2.pdf)

"As a casual reader of IE at the time the articles first appeared, I did not pay close attention to the depth of the material; however, I was motivated to read them more carefully when Billie Westergard, an astronomer who published an article IE #68, stated that he thought Hotson's work might be the best published in physics. By then, I was a technical editor for IE and I reread the Hotson articles. First I read them through, realizing I was missing a lot. Then, I studied them, trying to see the justification for each assertion and came to the conclusion that Billie Westergard was probably right and these articles might be the best material written in physics."

## 3. The Dynamics of Degenerate Gravitational Wells

It has been shown by Chase, Crothers, Heaston, Westergard and others, that it is not possible to form singularities and event horizons under any circumstances [20]. Therefore, it can be concluded that true black holes do not exist in nature. However, massive degenerate gravitational wells do exist. A white dwarf star is prevented from collapse by electron degeneracy pressure if its mass is below the Chandrasekhar Limit (1.38 solar masses). If additional mass is added the star will collapse to form a neutron star. A neutron star is prevented from collapse by neutron degeneracy pressure if its mass is below about 2-3 solar masses. However, if additional mass is added the neutron star will collapse to become a Massive Degenerate Gravitational Well regardless of temperature. Collapse of degenerate matter, below the white dwarf state, does not produce heat.

The collapse of matter (beyond the neutron star state) causes a phase change of mass energy to spin energy and prevents the formation of a singularity. The spin energy is understood to be synonymous to photonic spin having no mass, but simply the conservation of angular momentum in the form of a massless left-handed vortex near zero degrees absolute which, at the center of the degenerate well, becomes the storehouse of entropy. The vortex is comprised only of left-handed massless angular momentum in the form of a vorticular storm (the Heaston Force, having no particles, inertia or gravity, and is surrounded by a degenerate neutron gravitational well).

Note that in the Hotson/Westergard Universe Model [20, 21] neutrons and protons are identical, being made of 9180 electron-positron pairs (epos) arrayed in a 10- dimensional vortex or hypersphere, except that the neutron has an extra electron.

All matter in the degenerate well, prior to the phase change, consisted only of neutrons, with inertia and electromagnetic fields. In a degenerate gravitational well with a very large mass, the contraction would be so strong that wave length and amplitude of the particles would be compressed to near zero and we would expect that evolution to the Phase Change of mass energy to spin energy is under way even prior to the Planck Scale, perhaps nearer to the area which (according to the SM) would have been the event horizon.

The original (1928) Dirac relativistic wave equation describes a quantum spinor field, which has as solutions four different kinds of electron: electrons and positrons of positive energy, and electrons and positrons of negative energy. Since in principle the Dirac field comprises everything that waves, the equation therefore predicts that the entire physical universe can be made from these four kinds of electron.

The Hotson/Westergard universe model shows that our positive energy universe is immersed in a negative energy field or sea of unlimited numbers of epo's which we refer to as the "BEC".

The Electron-Positron Pair: For a complete description of the positive and negative energy electron-positron pair (epo) see [18, 19].

The negative-energy electrons and positrons appear to be permanently associated in pairs—epos. What can this mean? In our experience, an electron and a positron form "positronium," then lose all their positive energy and become undetectable. Ac-



cording to Dirac's equation, they drop into the negative energy sea. What configuration do they assume there? For a possible answer, we need to consider what Dirac's equation says about the electron.

Dirac's equation describes a "spinor field." In such a field, rotation of the wave function through  $360^\circ$  does not get the electron back to its original state, but to its opposite: the electron has to "turn around twice" to get back to where it was. At  $360^\circ$ , its wave function  $\Psi$  becomes  $-\Psi$ , and it becomes, in effect, a positron travelling backwards, to arrive at  $0^\circ$  and switch back to an electron. (In QED, a positron is considered to be an electron travelling backwards in time [22]) So a positron is really only a totally out-of-phase electron.

This gives a possible model for a non-annihilating, non-spreading electron-positron pair. For one thing, they are both fermions, so the probability of them being in the same place at the same time is exactly zero. Therefore they must establish some stable relationship at a non-zero distance from each other. However, according to the above reciprocation, an electron and a positron could share a very stable relationship, vibrating in an imaginary direction while turning into each other every  $360^\circ$ . On this model, they would be "particles" only at  $0^\circ$ ,  $360^\circ$ , and  $720^\circ$ , turning into waves in between ("wave-particle duality") another reason they cannot annihilate. And if they traveled as electromagnetic waves, they would not interfere with each other as they passed. Since in the least-energy arrangement their spins and charges would cancel, the epo would appear to all the universe (and to the equations) as a neutral spin-zero boson, vibrating in an "imaginary" direction.

Moreover, the period of this reciprocation would have to be the "quantum of time,"  $\tau$ , equal to  $2\pi\hbar^2/3mc^3$ , or  $6.26 \times 10^{-24}$  seconds. This is the time required for an "appreciable change" in the wave equation, which therefore only changes in increments of  $\tau$  (tau). All epo's throughout the universe undergo this reciprocation in unison (at the same instant). Our universe is made of equal amounts of matter and antimatter.

Although the degenerate vorticular storm is only a reality of our positive energy universe, it does have an effect on the negative energy BEC. In the degenerate gravitational well every positive energy epo is surrounded by unlimited numbers of negative energy epos in the BEC. The degenerate vortex at the center of the well has no positive temperature but does have spin that provides a pathway that allows huge amounts of negative energy epos to flow into the vortex adding angular momentum to the vorticular storm. The BEC cannot tolerate spin or positive energy and must get rid of it into its 'dump' (our positive energy reality). But regardless of the furious activity caused in our reality, the BEC itself, each tau, must reach its unchanged, unmoving, perfectly balanced, still, unaffected, all under the same wave function state.

#### 4. Left-Handedness

At the phase change (from mass energy to spin energy) the degenerate left handed positive energy epos become left-handed degenerate angular momentum.

For epos exhausted from the BEC into the vortex, the spin must be left-handed because our left-handed positive energy

Universe is the origin of the vorticular storm. The road map is already in place, the BEC has no choice in the matter. Right-handed spin is not an option. The BEC consists only of mass less negative energy epos having photonic angular momentum, but no inertia or mass. The vortex acts similar to a huge suction pump, and the epos pulled up from the BEC are forced to become part of the existing left-handed vorticular storm. The effect of increasing the centripetal momentum acts to decrease the distance  $\hbar/p$  (analogous to a coiled spring being compressed) which stores entropy.

However, the degenerate gravitational well surrounding the vortex provides temporary stability until the vortex reaches a critical value of degenerate spin. The angle of the vectorial plane of angular momentum, the spin of the vortex, must point in both real and imaginary directions. Due to the Heaston Force, ejection of the degenerate angular momentum vortex must occur at some critical spin value. The ejection of degenerate angular momentum is superluminal and may appear as an instantaneous event some distance from the core of the ejecting galaxy.

After the **nonviolent** ejection, the environment of the ejected angular momentum is in a relaxed state, free from the gravitational well and, due to symmetry, begins a Phase Change from spin energy to mass energy in quantum steps, which result in the formation of massive amounts of epos which undergo fragmentation into globules of non uniform mass. The epos quickly combine to form neutrons which, via beta decay, produce Hydrogen within the globules. This becomes the birth place of proto-stars of various mass as well as other structures including quasars, planets, gas, dust, Helium etc. in our reality. Gravitational collapse of Hydrogen is not required to form stars because the Hydrogen is already in a collapsed (but not degenerate) state after ejection and the nuclear reaction in proto-stellar cores has begun. All structure formation in the Universe originates from nonviolent ejections of cold, angular momentum from what we call 'Degenerate Hydrogen Wells' [20].

Our Universe is old, very old, perhaps with no beginning and no end. Formation of structures is an ongoing process with new stars, planets, galaxies, quasars, gas, and dust being formed continually from existing degenerate positive energy matter in our reality combined with negative energy epos supplied from the BEC. Stellar birth is an inside-out phenomenon. The gas and dust surrounding the globules are the dissipating remnants of the ejection and stellar birth process.

It is quite possible that a large portion of the ejected angular momentum remains as an intrinsic property of the created particles similar to the intrinsic spin of the mass less photon. If so, it is speculated that this intrinsic property would continue to spin down in lengthening quantum increments of time over the lifetime of the universe. This effect could cause an increase in the mass of the particles as well as the red-shifting observed in the spectra of distant quasars and galaxies which would rule out the expanding universe model. The increase in mass may also cause Earth Expansion [23]. We predict that the redshift of very high redshift quasars will be found to move toward the blue end of the spectrum in quantum steps over a period of time as short as 25 years. This effect could be observed using current technology.

Here follow quotes by Hotson on the **Bose Einstein Condensate** [18, 19].

"The BEC is completely ordered, covered by a single wave function. But in detail, it is a hive of activity, full of charges going at the speed of light. Its frantically gyrating epos fill every cranny in every dimension of the negative energy realm. However, the close quarters and random configurations must frequently put electron adjacent to electron in positions that generate considerable amounts of positive energy. (Like charges repel, which is positive energy.) The BEC can't tolerate positive energy. It must get rid of it. (The BEC cannot tolerate positive energy spin and must get rid of it also.)

"The BECs we can generate (in a lab), at temperatures near 0°K, need fierce refrigeration to maintain their integrity. The (universal) BEC is somewhere below zero degrees absolute. How is it refrigerated? Where do its waste products go? Where does the BEC take out the garbage, and where is its garbage pile? We suggest that we are sitting in it. We seem to be, to put it bluntly, BEC excrement."

The BEC must generate positive energy in great quantities. All of its dimensions are full, even if it could accommodate the stuff. It has to get rid of it. So it is no coincidence that our reality has a large positive energy balance. We are the BEC's dump. (Literally, it's "heat dump").

We have seen that the effective boundary between the positive and negative energy realms is several degrees above absolute, as BECs, superconductivity, and superfluidity all begin to happen there. Mercury becomes a superconductor at 4.1°K. An "ideal gas" will form a condensate at 3.1°K. However, for real substances, because of interactions between the molecules, the figure is somewhat lower. (The critical temperature for helium liquid is 2.2°K.) This would seem to put the boundary right around 2.7°K, or at least too close to this figure to be coincidence. We would expect the number of photons "dumped" from the BEC to peak there, falling off randomly on either side of this peak to form a black body spectrum peaking at this temperature. This would seem to be the most probable explanation for some or all of the 'microwave background.' In any case, this vast number of photons seems much more likely to come from the negative territory adjacent to it, than from a Bang at the complete other end of the spectrum. (The infinite temperature of a Bang cannot be the 'proximate cause' of an energy field near absolute zero.)

Why would the numbers of photons peak at this temperature, instead of increasing all the way down to zero? This is because, if the boundary between positive and negative is 2.7K, photons with less energy than this would randomly drop back into the condensate and out of 'our reality' – the less positive energy, the faster they would drop, forming the lower curve of the black body.

If our positive energy reality is indeed made of 'exhaust' from the BEC, then everything must be made of electrons and positrons, as that is all the BEC has to offer. However, 'pair production,' one epo at a time splitting into electron and positron, leaves no net positive energy balance, as equal numbers of them must sink back into the sea.

The following quote is from a letter to Benni Reznik, PhD, Tel Aviv University from Brian Ahern, PhD, MIT [24].

"Dear Dr. Reznik,

"I would like to comment on your findings about vacuum entanglement. Your observations are in keeping with a prediction that the 'vacuum' acts like a Bose Einstein Condensate (BEC). Your exciting and original findings that unentangled probes inserted into the 'vacuum' rapidly become entangled, that the 'vacuum' as a whole violates Bell's Inequalities, and that the vacuum acts like a Bose-Einstein Condensate, appear to have been discussed in an article published in 2002 by Donald Hotson. I and many of my physicist colleagues have examined Hotson's articles and found them to be a useful way of thinking about the vacuum and how its properties arise. Hotson is not a 'main stream' physicist; he is a dedicated student of the history of Science with a special focus on Dirac. His study of Dirac shows how he initiated the negative energy positron and electron, but was convinced to abandon the concept by Heisenberg in the early 1930s.

"Nobel Laureate, Norman Ramsay published a short article in Physical Review in 1959 on the subject of Negative Temperature Systems. I interviewed Ramsay concerning this paper years ago. I suggested that his 1959 paper must have created quite a stir in the Physics community. He agreed (with a smile) that the article was provocative at the time, but it was ultimately accepted by his peers.

"Negative temperatures are not any easier to grasp than the concept of negative energy. In fact, negative temperatures are more difficult to conceptualize on any level. I think a similar acceptance of negative energy would have followed Dirac's conjecture if he had benefit of the recent data on entanglement. Dirac simply didn't have the resolve to continue with his unified view of the vacuum at that time.

"Both the Energy Equation and Dirac's Equation call for negative energy. The four routes of the Dirac equation directly call for electrons and positrons of both positive and negative energy. The negative energy roots have long been ignored or misinterpreted; but they would seem to call for a 'sea' of negative-energy electron-positron pairs. Since an electron-positron pair would be a boson, and since negative energy is 'below zero', such a 'sea' would necessarily be a Bose-Einstein Condensate.

"Using the kinetic definition of energy, Hotson suggests that 'negative energy' is merely a harmonic vibration at 'right angles to our reality' – in an 'imaginary' direction, and thus it would be virtually undetectable. However the 'sea' would be all around us, balanced negative and positive charges with a single wave function, providing the 'vacuum's permittivity and permeability, as well as those functions formerly ascribed to an aether. In addition, since the BEC is the only extended structure known to be non-local, this would explain non-locality and the violation of Bell's Inequalities by the 'vacuum' as a whole.

"Hotson's papers were too controversial to be published in Physical Review. Unlike Ramsay, he did not have the benefit of having a Nobel Prize winner (Rabi) for his thesis advisor. Hotson published in *Infinite Energy* magazine."

Could there be some other mechanism involved in the process of permanently expelling the large amounts of negative energy epos from the BEC into our reality? Do we really under-

stand what gravity is? Do we really know what constitutes the basic force in our Universe?

Recently, I was fortunate to find an existing theory that fits in with the Hotson/Westergard Universe Model very well. Some changes to one or both models will be required. My only interest is to find the correct model of structure formation in our Universe. The Big Bang is certainly not the correct model. What is?

## 5. Could POAMS be the Answer?

The following are direct quotes from Viv Pope's web site <http://www.vivpope.org> with Viv Pope's permission:

### 5.1. What Does POAMS Stand For?

POAMS is the acronym coined by a small but growing group of scientists for the 'Pope-Osborne Angular Momentum Synthesis'. This is the identifying title, not only of the thesis itself but also of the group which has formed itself around this new approach to physical science. It seeks to avoid the fallacies that are endemic in our traditional approach to the subject and to re-establish physics on the more positive lines introduced by the late nineteenth century philosopher-physicist, Ernst Mach.

Now anyone may plainly see that in the phenomenon of free space nothing is stationary. Everything is moving with respect to everything else. As far as POAMS is concerned, among those motions there is no absolutely rectilinear momentum  $mv$ . All free motion is *angular* momentum  $r \times mv$ , in which every body is automatically paired and balanced with every other around a common centre of moment. In that case, the only rectilinear momentum we may think of can be that of a body travelling in a circular orbit of theoretically infinite radius  $r$ , hence, of course, with an infinite angular momentum, which is unreal. It follows then that in all real cases, bodies are *finite* distances  $r$  apart, so their angular momenta with respect to one another are also finite, hence naturally curved, with no question of there being any invisible *in vacuo* 'forces' responsible for that curvature. POAMS presents an angular momentum equation according to which, particles with large amounts of spin angular momentum, such as that ascribed to 'electrons' and 'protons', follow (theoretical) orbital trajectories with parameters different from those of non-spinning bodies. In this way, POAMS explains the different types of orbits and the forces – that is, actually measurable and tangible forces – that have to be exerted to *prevent* bodies from moving in that free and natural, curvilinear way. These are real, ponderable forces, as opposed to those invisible and imponderable, purely theoretical *in vacuo* 'forces' called 'gravitational' 'electrostatics', 'magnetostatic', 'nuclear' and so on. This turns the traditional textbook 'force' concept inside-out and upside-down. This is insofar as it makes real force the torque that has to be exerted to prevent bodies from travelling in their natural force-free orbits, instead of the purely theoretical 'gravitational force' which Newton invented to explain that natural orbital motion.

In POAMS, then, in the same way that there is no light-velocity *in vacuo*, there are no invisible *in vacuo* 'forces', of 'gravity' or whatever. It follows, therefore, that there are none of the various 'fields' or 'ethers' of the sort that have to be postulated in order to mediate those assumed 'forces'. All the free motions of bodies are correlated in an overall-conserved and reciprocally balanced relation of angular momentum, as observed with the

planets and other objects in the solar system. With there being no 'fields' to speak of, the perennial problem of how to 'unify' these *in vacuo* fields is automatically solved – or, rather, dissolved – simply by dispensing with them altogether in favor of a universal and unified nexus of *angular momentum*.

Now although angular momentum itself is a non-local relation, all *changes* in angular momentum are *local*. What this means is that in accordance with the law of conservation of angular momentum, it is impossible to change the overall angular momentum of a system *en bloc*. The only way in which angular momentum can change, therefore, is by local changes in subsystems, of angular momentum where each change in the one subsystem (body or atom) is accompanied by a compensatory, balancing change in the angular momentum of some other subsystem somewhere else – that is, immediately and instantly in what is called *action-at-a-distance*, without the angular momentum of the system as a whole being at any time disconserved. (It is to be emphasized that all 'forces' applied to bodies to change their free orbital angular momentum are, in essence, *torques*.)

Although on the fundamental quantum level all interactions are proper-time instantaneous, on the ordinary macro-phenomenal level of relativistic observation these local changes in angular momentum (torques) are propagated throughout the surrounding subsystems at the distance-time rate  $c$ . (Recall that in POAMS,  $c$  is not a speed, but simply a *constant* relating observational distance measures in meters and time-measures in seconds in the way that was first observed by the seventeenth century astronomer Olaus Römer.) Originally interpreted as 'the speed of light', this constant was re-interpreted by Herman Bondi in 1954, as simply a dimensional 'conversion factor', not a 'speed' in any true mechanical sense of the word. Thus, unlike the traditional Faraday-Maxwell theory of light as a 'wave' consisting of alternately generating electrostatic and magneto-static field-vectors, propagating away into a virtual limbo, in POAMS the action is more like that in a movie which, as everyone knows, consists of time-sequences of purely distance-extended 'stills' in which objects are instantly connected to one another in the same photographic frame, so that the *action* consists of successions of those quantum stills in the running of the film. In this kinematical process, quantum instantaneity (action-at-a-distance) is like the immediate connection between objects in the cinematographic stills themselves, while the observational or delayed-time interaction  $s/c$  between those objects is like the constant rate of succession of stills in the running of the film.

This 'cinematic' or quantum-sequential combination of instantaneous and delayed interaction obviously requires no supporting conception of mediating agencies such as the 'ethers' or 'fields' of classical imagining. True to its Machian, Positivist lineage, POAMS requires no all-pervading and invisible, continuous medium for the conduction of distant quantum interaction. Every quantum is, in itself, both its own interaction and its own 'medium' for that interaction. In those interactions between atoms that we know as light, an amount of angular momentum lost by one atom (in quantum units of Planck's constant  $\hbar = h/2\pi$ ) is immediately gained by another atom of lower or higher angular momentum  $\hbar = h/2\pi$  in an instantaneous blip of transferred energy in action units of  $h$ . The transfer is immediate



because, since the overall angular momentum is conserved, there can be no delay between the disappearance of the quantum at the one place and its appearance at the other. And because the quantum is irreducible, there is no possibility of there being either a non-consummation of the interaction between source and sink or any loss of action in the intervening distance. From this it follows that the quantum can in no way be conceived as an emitted particle (e.g., a 'photon') wandering around looking for a billet. It is simply the ratio of the macroscopic – i.e., observational – distance in meters between the directly interacting (resonating) atoms to the time in seconds noted by Romer, the ratio that has been traditionally interpreted (or rather, misinterpreted) as the 'speed of light in vacuo'. All that is involved at this quantum level are the two resonating atoms, and nothing else – far less any intrinsic property of some pre-existing vacuum, 'field' or 'ether'. As for 'light-waves in vacuo, what can possibly wave in a vacuum?

The constant  $c$ , therefore, in this Machian/Bondian interpretation, has the dimensions of a speed but none of its mechanical accompaniments. So although it is time-delayed, there is no need to think of anything travelling, in the form of a wave, a particle or anything else. This dispenses with the notoriously enigmatic concept of the 'photon' as a 'travelling wave-particle' with a motion which, like that of a bullet, is of an entirely 'hit-or-miss' character, and the delivery of whose energy, if it takes place at all, is entirely fortuitous. In place of the capricious 'photon', POAMS proposes the word '*photum*' as signifying a quantum of pure interaction with no suggestion of its having motion or any other properties of the sort traditionally conceived as 'mechanical'. The quantum interaction between a pair of distance-separated atoms, as POAMS conceives it, is like a collision between two vehicles in accordance with Newton's law of direct and reciprocal action and reaction. Think of the absurdity of reporting this collision as an accident involving three vehicles, the two vehicles and the accident itself! This is the sort of confusion modern physics creates by talking about quantum interactions between particles as if they were also 'particles' in the same sense (that is, 'mesons', 'gluons', etc).

In these and many other ways, notwithstanding the purely practical benefits that have accrued from the 'Standard Model' of quantum physics, POAMS seeks to purge Modern physics of its historical proliferation of pure nonsense. Based on numerous papers, some published under the aegis of the Department of Mathematics, Keele University, England, what is now called the POAMS group of natural philosophers have convened workshops and seminars (at the University of Wales, Swansea and the University of the West of England, Bristol). These seminars are for like-minded physicists, philosophers and mathematicians to discuss the relevant issues. Follow-up debates are conducted by email. Publications of the Proceedings of some of these discussions may be found on this website in the section Seminal Publications and Resources. <http://www.poams.org>.

## 6. The Angular Momentum Synthesis: The Orbital Dynamics of Normal Realism

Angular momentum is the product of the three measures, mass, velocity and radius ( $mvr$ ) in the relation  $L = mvr$ , where  $L$  is

the sign for orbital angular momentum. This relation is one in which all bodies within the system are automatically paired and balanced, each with every other in the system, permutatively. In a closed system of angular momentum – i.e., one in which there is no outside influence – the overall angular momentum is conserved, both in amount and direction. This implies an immediate and instantaneous connection between those bodies, such that a change in motion of any one of them automatically affects the motions of some one or other, or all of the other bodies, with there being no question of how or by what means – i.e., by postulated *in-vacuo* 'fields' or 'forces' – that effect is conveyed. In other words, in a closed system of angular momentum, the orbital – and spin – motions of all free-moving bodies are automatically correlated. This, of course, is what quantum physicists such as CERN's John Bell, have discovered, to the consternation of the Einsteinian Relativists (ref. the famous 'Bell's Inequalities').

Let us, then, consider a simple angular momentum system such as that of our earth orbiting the sun. Ignoring the effect of all the other planets, satellites and so on, the formula for the angular momentum of that system is

$$L = mvr = \frac{GmM}{v} \quad (6.1)$$

where  $M$  is some central, or nuclear mass, like the sun,  $m$  is the mass of the planet and,  $r$  is the distance between the two bodies in ideally circular motion, with  $G$  being the usual empirical factor whose value, like  $c$ , is no more than a product of the arbitrary choice of conventional units of measure. Plainly, given that the measures  $v$ ,  $m$  and  $M$  in this simple formula are known – and, of course,  $G$  – the size of the orbital radius  $r$  (the distance between the two bodies) is:

$$r = \frac{GM}{v^2} \quad (6.2)$$

In this way, it is plain that these formulae prove that angular momentum is sufficient in itself to explain basic orbital motion with no need of Newton's *in vacuo* 'gravitational' or any other similar kind of 'force'.

This change in conception of orbital motion is far from trivial. Replacing the 'gravitational' equation by the angular momentum equation means that the total angular momentum of an orbiting body must include that of *both orbit and spin*, whereas 'gravitation', eminently, does *not* – at least, not to the extent that the momentum does. That is to say, Newton's 'gravitational force' on a body is largely the same whether or not that body is spinning.

This neglect of spin in the 'gravitational' equation creates serious anomalies. For instance, from Eq. (6.1) we have:

$$G = \frac{v^2 r}{M} \quad (6.3)$$

Now from the standard kinetic energy formula  $K = \frac{1}{2}mv^2$ , we have  $v^2 = 2K/m$ , whence Eq. (6.3) becomes

$$G = \frac{2Kr}{mM} \quad (6.4)$$

So now let the orbital kinetic energy be signified by  $K_O$  and the spin kinetic energy by  $K_S$ . In terms of the total kinetic energy  $K = K_O + K_S$ , this formula for  $G$  becomes:

$$G = \frac{2(K_O + K_S)r}{mM}. \quad (6.5)$$

Plainly, with the same values for  $m$  and  $M$  in this formula, the value of  $G$  is greater than in the previous equation, and the greater the value of  $G$ , the more closely the body orbits the centre of mass. From this it follows that for the masses of prodigiously fast-spinning galaxies, the value of  $G$  must be far greater than the standard textbook value, so that these galaxies are crowded more closely together than if they were not spinning. This explains why these galaxies, plus the total of all the other spinning objects, stars, planets, satellites and so on, appear to have more mass than they should have according to the traditional 'gravitational' account which NASA and the astrophysicists still use to calculate the trajectories and masses of orbiting bodies. So the reason for this 'extra mass' is, quite plainly, not the presence of some spooky 'dark matter' or 'dark energy' but 'dark spin', where 'dark', here, simply means 'neglected'.

The only *anomaly* one can discern lies in Newton's inadvertent and perfectly understandable failure of his 'gravitational' account of motion to include *spin* in the total angular momentum of an orbiting body. Extending Newton's ingenious formalism to include both spin angular momentum and spin kinetic energy brings him out of the undoubtedly illustrious age of falling apples and steam technology up to speed with our second-millennium space-age.

One thing more: The ultimate paired and balanced angular momentum system is the angular momentum quantum  $\hbar/2\pi$ , known to quantum physics as  $\hbar$ , where  $h$  is Planck's constant, the quantum of *action*. The two masses involved in this angular momentum coupling, into which all angular momentum systems ultimately reduce, are those which have been conventionally called the 'electron' and 'proton'. In the Angular Momentum Synthesis, however, the conventional 'charge' on these particles in coulombs is cashed-out in equivalent terms of spin *kinetic energy* in joules, where the spin is that ascribed to the 'electron' by Uhlenbeck and Goudsmit. Due to the conservation of angular momentum, when one atom loses a quantum of angular momentum, another, somewhere else, has to gain that lost amount in a resonant interaction which begs no question of how and by what means that action, in units  $h$ , is conveyed. In Normal Realism, these quantum interactions, in statistical numbers, are what is called light. This present account is, perforce, somewhat sketchy and condensed, but is fully explained in the POAMS books and papers. For this complete paper see [www.vivpope.org](http://www.vivpope.org)

## 7. Pope's Unifying Angular Momentum Equation

The straight-line, so-called 'inertial' motion, or momentum  $mv$ , envisaged by Galileo and Newton was seen, by Pope, as counter-empirical. As he saw it, straight-line motion is purely theoretical, being a special, ideal case of angular momentum of magnitude  $mvr$  with  $r$  at theoretical infinity (a straight line and a circumference of infinite radius being one and the same). But with  $r$  at infinity, the magnitude of the angular momentum  $L = mvr$  is also infinite, which is unreal. It follows, then, that for all real (*i.e.*, finite) angular momentum  $r$  is finite, hence the motion

naturally curved or orbital, without having to postulate invisible *in vacuo* 'forces' being responsible for these curved trajectories.

Moreover, angular momentum is a naturally paired and balanced (*i.e.*, non-local) relation between masses according to the equation

$$L = mv_m r_m = Mv_M r_M \quad (7.1)$$

By this relation, the motions of the masses  $m$  and  $M$  are automatically linked, so that any forced change in the motion of either of the masses immediately affects that of the other, that is, directly, in accordance with Newton's third law of instantaneous and reciprocal action-reaction. This, of course, is without any need to postulate mediation by the fictitious and invisible 'forces', of classical conception, such as those of 'gravitation', 'electrostatics' and 'magnetostatics'.

Pope's unifying angular momentum formula (stated simply, for orbital motion assumed circular and in the same plane \*) is therefore:

$$L = mvr = 2 \frac{(K_O + K_X)r}{v} = \frac{GmM}{v} \quad (7.2)$$

where  $L$  is the orbital angular momentum,  $K_O$  is the orbital kinetic energy and  $K_X$  is some extra-orbital kinetic energy such as, for example, spin or some other convoluted form of angular momentum.  $G$  (call it 'curly gee') is a variable which, when  $K_X$  is negligible, is equivalent to the usual 'gravitational' constant  $G$  ( $= 6.67259 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$ ).

When  $K_X$  is made equal, in mechanical units of joules, to the so-called 'electron charge' in coulombs ( $q = 1.602 \times 10^{-19} \text{ C}$ ) multiplied by the ionisation potential for elementary hydrogen (13.595 volts), then  $K_X$  is  $2.179907344 \times 10^{-18} \text{ joule}$ . The orbit defined in these purely mechanical terms, with  $G = 1.5141474 \times 10^{29} \text{ N m}^2 \text{ kg}^{-2}$ , then becomes that of the electron mass  $m = 9.1094 \times 10^{-31} \text{ kg}$  around the proton mass ( $M = 1.6725 \times 10^{-27} \text{ kg}$ ) in Bohr's 'electrodynamical' model of the hydrogen atom.

In this way, with suitable step-changes in the value of  $G$ , the free orbits of 'electric' and 'magnetic' particles are included with 'gravitation' in the unified angular momentum equation. (For details see Publications Nos. 18, 28, 30, 31)

In this way, all forces become real, *i.e.*, *measurable* forces. For instance, the only 'gravitational' force it makes sense to speak of is that which a body exerts on the earth's surface (*e.g.*, on a weighing-scale) when that surface prevents the body from orbiting where it should according to the angular momentum equation for the free-motion case of  $G = G$ . The real force pressing on the earth's surface is therefore:

$$F = \frac{mM}{r}(G - G) \quad (7.3)$$

where  $m$  is, say, a standard kilogram mass,  $M$  is the mass of the earth and  $r$  the radius of the earth's surface at that point. In this case,  $G$  has the value, from Eq. (7.2):

$$G = \frac{Lv}{mM} \quad (7.4)$$

where  $L$  is the angular momentum of  $m$  at that point due to the earth's rotation and  $v$  is the rotational speed at that same point. (For details of this see, again, Publications Nos. 18, 28, 30, 31).



## 8. Conclusion

Observational astronomy shows that active and peculiar galaxies eject matter. Not just small amounts of radiation, but massive amounts of matter in the form of subatomic particles, gas, dust, quasars, galaxies and, no doubt, planets and stars. See the web site of Halton C. Arp [25], the greatest observational astronomer of all time, for detailed information concerning ejection of matter from galaxies. The force required for this type of ejection process cannot be attributed to accretion discs around black holes as some have suggested. The Hotson-Westergard Universe Model details an ejection process that solves this age old problem. However, it remains to be seen if POAMS is or will be a good fit within the Hotson-Westergard Universe Model. Perhaps we must fit the Hotson-Westergard Universe Model within POAMS. We look forward to suggestions and constructive criticism from all interested colleague. Is POAMS to good to be true or is POAMS to good not to be true? I would like to thank Viv Pope and Anthony Osborne for their private communications and interest in this paper.

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