# Theoretical principle model of forces

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## Abstract

A premise that Nature arises, at the quantum scale, from simplistic fundamental structures that progress into the complexity of functional structures, has highlighted an important requirement for the forces of Nature to be formulated from such a fundamental structural viewpoint. A model has been established by revisiting an existing paradigm for a methodological approach to revealing such a structure relating to the fundamental forces. This foundational representation provides a powerful predictive tool, which has pointed to the potential source of Dark Energy; in its revelation as a fundamental force and its essential counterbalance to gravity.

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## 1. Introduction

Fundamental structures constitute the most simplistic compositions and are representations of Nature's absolute simplest solutions originating at the quantum scale – from which they develop into complex functional structures. As is illustrated in the example of the three elementary fermions, comprising of up and down quarks and electrons, being the sole constituents in the formation of all nuclei, atoms, molecules, and proteins, from which arises the enormous variety of chemistry, physical objects, and hierarchical structures within the universe. Again, this is further illustrated in the two-base pairing of nucleotides making up the DNA that codifies complex tertiary structures resulting in the vast diversity of life on Earth. Hence, demonstrating the conceptualism of simplistic fundamental structures that then gain in complexity as each functional structure is revealed.

[1] This work, originally conceived in June 2010, has been updated based on ongoing development and enhancements to communicate its evolving progress openly and transparently.

The fundamental structures can be deduced from recognisable patterns, symmetries, or other properties, and where any mathematical explanation will be supported at the functional levels. A case in point is when Dmitri Mendeleev, using deductive logic, discovered a characteristic repeating pattern of chemical and physical properties within the list of then-known elements, when sorted by atomic mass in creating the Periodic Table. A representation of a fundamental structure is then used as a predictive tool to signify the existence of undiscovered elements. With the previous examples, in the forming of atoms and DNA, these fundamental structures are interrelated. Liken to Nature's design specifications, different fundamental structures will conclude in absolute correlative solutions and where the branches of functional structures will be responsible for the complexity and diversity within Nature.

## 2. A methodological approach to a comprehensive model of forces

Our present best description of the forces of Nature is derived from several theories, including quantum chromodynamics (QCD) and quantum electrodynamics (QED), to produce an overall quantum field theory. Symmetries, and especially gauge symmetries (where symmetry groups link the forces), are an essential component in this theory: without gauge symmetries, the theory fails. However, in the absence of a quantum theory of gravity, quantum field theory is incomplete, in that it only deals with the strong nuclear, electromagnetic, and weak nuclear forces. Even so, it has been an enormous achievement at the more detailed and complex functional level.

In my preceding paper entitled *Quantum Magnetodynamics of Gravity* [1] (which should be read in conjunction with this paper), assessments of the *quasi*-magnetic monopoles, experimentally discovered in tetrahedral crystal structures of spin ices [3–4], exhibit conformity with the theoretical particles that Paul Dirac theorised to retain duality symmetry between the electromagnetic unified fields [5]. During deliberation into the magnetic force led to the serendipitous insight that the existence of gravitons would consist of magnetic monopole dual particles, which self-organise into theoretical 'Gravity Strands' – the *modus operandi* as to the *vera causa* of the gravitational force. A theoretical premise readily developed, from which evolved a solution for quantum gravity in perfect unity with *magnetic* and *electrical fundamental* forces (see Appendix A).

In achieving the conceptual foundation for quantum gravity realised a requirement to present the forces in a fundamental way, which further led to a realisation of the substantiality of fundamental structures. By revisiting an existing paradigm (used by, among others, Dmitri Mendeleev) as a methodological approach for uncovering fundamental structures, and from which crucial knowledge can be derived. This paper applies this methodology to reveal an understanding of the forces of Nature from such a foundational viewpoint. Extensive contribution gained at the quantum level and supported by experimental scrutiny is aided by revelation into the functionality of the gravitational and magnetic forces, as presented in [1]. This combination provides the information necessary to support a comprehensive model of forces. Consequentially, this goes beyond the current Standard Model insomuch that the inclusion of gravity is very much integral to formulating a *Principle Model of Forces*. The final model has resulted in a powerful predictive tool that can be used to highlight significant gaps in our current knowledge that become readily apparent at the fundamental structural level.

This paper is reliant on, but not conclusively, the rational solution for quantum gravity, as presented in [1]. For this process to continue, then a degree of reliance is required but also becomes a two-way supportive process in respect of the submissions tendered by both papers.

## 3. Construction of the model

A graphical representation of the currently known forces is presented in figure 1.1, which includes the gravitomagnetic unified fields [1]. At this early stage, it should be noted as to the present, incorrect, classification of electromagnetism as a fundamental force in the Standard Model. It will be demonstrated that the magnetic and electrical forces are individually unified with other forces and, therefore, must remain classified as separate fundamental forces, making a total of five established forces of Nature: strong nuclear, gravitational, magnetic, electrical, and weak nuclear. It was substantiated by deduction that magnetic monopole *graviton* massless gauge-bosons do not couple with massless photon gauge-bosons, and that only subatomic particles possessing presumably integer units of electrical charge can couple with the quanta of light [2].

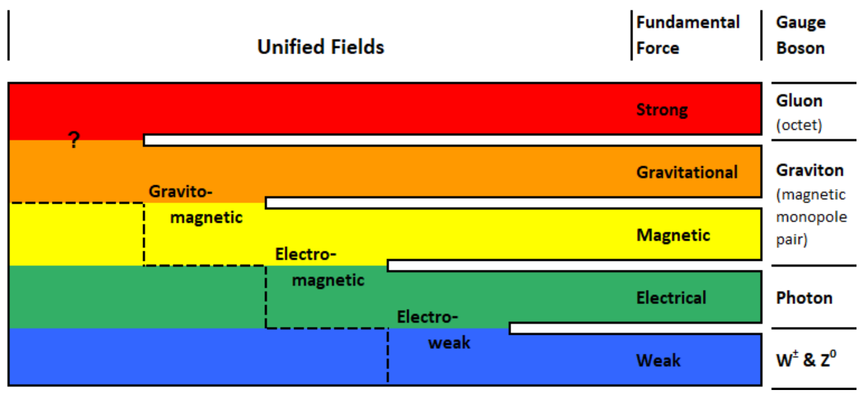


Figure 1.1: Current model of forces

The definition of unified fields (at low energies) is different aspects of two fundamental forces in perfect unity. Above a certain high-energy threshold, the two forces would, theoretically, merge and act as a single force. In consideration at low energies, the gravitomagnetic unified fields are two different configurations of magnetic monopoles that distinguish the gravitational and magnetic forces: whether paired nucleons produce alternating charged magnetic monopoles in gravity strands, or single/unpaired nucleons produce the same charged magnetic monopoles in magnetic strands (see Appendix A). Magnetically charged monopoles will have an electric dipole moment across their axis of spin congruent with the magnetic dipole moment of electrically charged particles. This enables interaction by the interconnection of fields between magnetic monopoles (in magnetic strands) and electrically charged subatomic particles; thus, generating the two different aspects of the electromagnetic unified fields. The positive and negative electrically charged $W^{\pm}$ gauge-bosons of the weak nuclear force are involved in the transition of photon gauge-bosons of the electrical force, and in nuclear decay or nucleosynthetic processes involving *charged-current* interactions in the transformation of electrically charged subatomic particles that establishes the two different aspects of the electroweak unified fields.

A recursive pattern immediately becomes apparent in Figure 1.1 where successive forces combine to give unified fields. A key extrapolation can be applied to Nature's intentional dual usage of fundamental forces, which must eventually extend throughout the model. The chronological order for the fundamental forces is fixed by the unified fields' order of unity. The position for the strong nuclear force has significance and will become apparent in due course. In Figure 1.2, where the type and range of the fundamental forces are taken into consideration, a recurring structure within the fundamental forces is revealed. It should be noted that in the figure, 'long range' essentially means that the gauge-bosons can traverse the entire universe.

| Fundamental Force | Gauge Boson | Fundamental Force Type | Range |
|---|---|---|---|
| Strong | Gluon (octet) | Attraction | Short |
| Gravitational | Graviton (magnetic monopole pair) | Attraction | Long |
| Magnetic | | Attraction/ Repulsion | Short |
| Electrical | Photon | Attraction/ Repulsion | Long |
| Weak | $W^{\pm}$ & $Z^0$ | Repulsion | Short |
| ? | ? | *Repulsion* | *Long* |
| | | ***Fundamental Extrapolation*** | |

Figure 1.2: Recurring structure within the fundamental forces

Extrapolating the recurring structure of the fundamental forces implies that there is a missing long-range repulsion force. The only recognisable force that can be associated with this implication is dark energy, an inflationary force responsible for the current accelerating expansion of the universe, as supported by considerable observational data [1] [6–9]. Although the effect of this force cannot be directly experienced on Earth, the evidence for its existence is compelling and therefore must be considered an unrepresented force of Nature.

There are other theoretical references to a missing force of Nature. One such concept, proposed by Justin Khoury and Amanda Weltman, concerns a theoretical Chameleon force [11], suggested as an alternative to the Higgs field. [2] This alternative is again proposed in a theoretical Technicolor force [12] and is, interestingly, linked to quantum chromodynamics (the three colour charges of quarks within the strong nuclear force and hence the name for the proposed missing force). These theoretical forces, including the Higgs field, are expected to be linked to the weak nuclear force and interact with the $W^{\pm}$ and/or $Z^0$ gauge-bosons. This consensus for a possible missing force agrees with the extrapolation presented above. The Technicolor force is the most interesting proposition as it is linked to both the strong and weak fundamental forces and, as will be seen, has significance in the final model. If, for simplicity and to indicate functionality, the gauge-bosons of the Technicolor force were a coalesce of the three colour charges of the strong nuclear force (thus remaining compliant with the conservation of colour charge), each Technicolor boson would have an identical white colour charge, [3] and since like charges repel, this would result in a repulsive force.

[1] Verified and announced in 1998 by the High-Z SN Search Team and confirmed by the Supernova Cosmology Project. $\Omega_m = 0.3$, $\Omega_\Lambda = 0.7$ or, in other words, the content of the universe is accounted for by unexplained dark matter ~30%, dark energy ~60% and visible/dark baryon matter ~10% [6–7]. Subsequently, updated in 2003 by the WMAP team as dark matter ~23%, dark energy ~73% and visible/dark baryon matter ~4% [8].

[2] The Large Hadron Collider at CERN, in 2012, detected the theoretical Higgs bosons, which are postulated to endow elementary (not composite) particles with mass and as the participatory particles in a scalar Higgs field. (Note: Higgs bosons with spin 0 are not force carriers, so a Higgs scalar field is not a force.) [10].

[3] It can be considered that the colour charges of quarks are partial colour charges and a white charge exists as a full colour (non-neutral) charge in strength in exactly the same way as to the partial electrical charges of quarks.

These theoretical forces remain conjectures until the gauge-bosons , essential for the mediation of this missing force, are discovered experimentally. Nevertheless, this sixth fundamental force is required to complete the recurring structure and, therefore, is to be included in the model. For continuity, and to keep to the current naming convention for forces to reflect their functionality, this fundamental force will be referred to as the *Inflationary force*. From its position in the recurring structure, the inflationary force will become unified with the weak nuclear force and the new unified fields incorporated into the model will be technically referred to as *Weakoinflationary*. Rationalisation will be discussed in detail later.

The recurring structure of the fundamental forces reaffirms the chronological position for the strong nuclear force. Unification between the strong and gravitational forces, as implied from extrapolating Figure 1.1, specifically emerges from the original theoretical premise [1] in which magnetic monopoles *gravitons* emanate from non-confinement in QCD, as a by-product of quark/gluon interactions within the strong nuclear force. Therefore, the extrapolation is an additional justification for the new unified fields, technically referred to as *Strongogravitational*. Further rationalisation will be discussed in detail later. This completes the construction of a fundamental model of all forces, as presented in Figure 1.3.

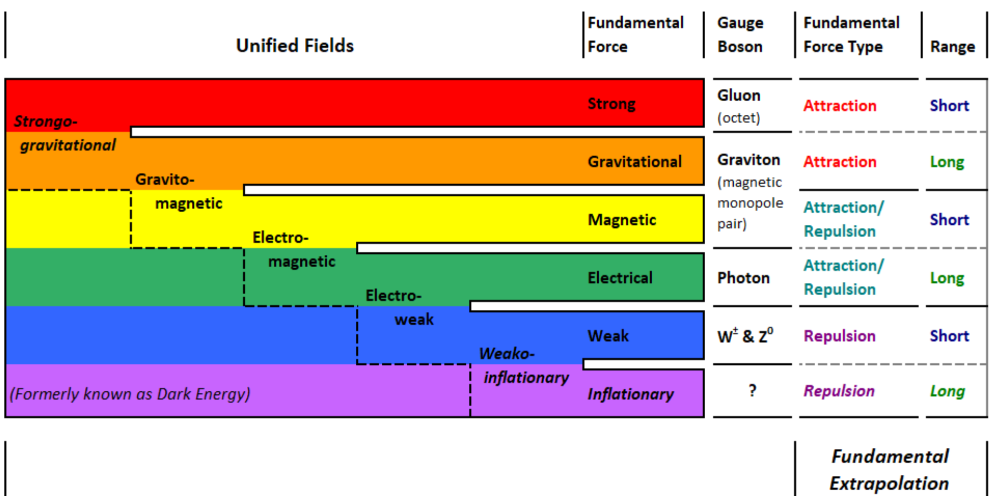


Figure 1.3: Fundamental model of forces

If we go back to the definition for unified fields concerning the electrical and weak nuclear forces, whereby they are unified as electroweak, the positive and negative electrically charged $W^{\pm}$ gauge-bosons of the weak nuclear force are involved in *charged-current* interactions in the transformation of electrically charged subatomic particles. The neutrally charged $Z^0$ gauge-bosons of the weak nuclear force are involved in *neutral-current* interactions of neutrally charged subatomic particles. By inference, this points to a potential secondary unification between the weak nuclear force and an alternative fundamental force concerning these neutrally charged particles. This secondary unification has been affirmed by the model in identifying a missing fundamental inflationary force. At this stage, it should be noted that neutrally charged particles cannot, themselves, be responsible for a force unless unification were to imply that these particles may not be neutral after all. If that notion were true, it would give rise to an important assumption that *all* particles retain interactivity with relevant fundamental forces.

The recurring structure for fundamental forces is taken a step further by applying the same logic to the unified fields. The outcome of this application produces a useful deductive tool within its recurring structure. (Note that the neutral unified field types refer to the cumulative neutralising effect with respect to oppositely charged particles, magnetic or electrical.)

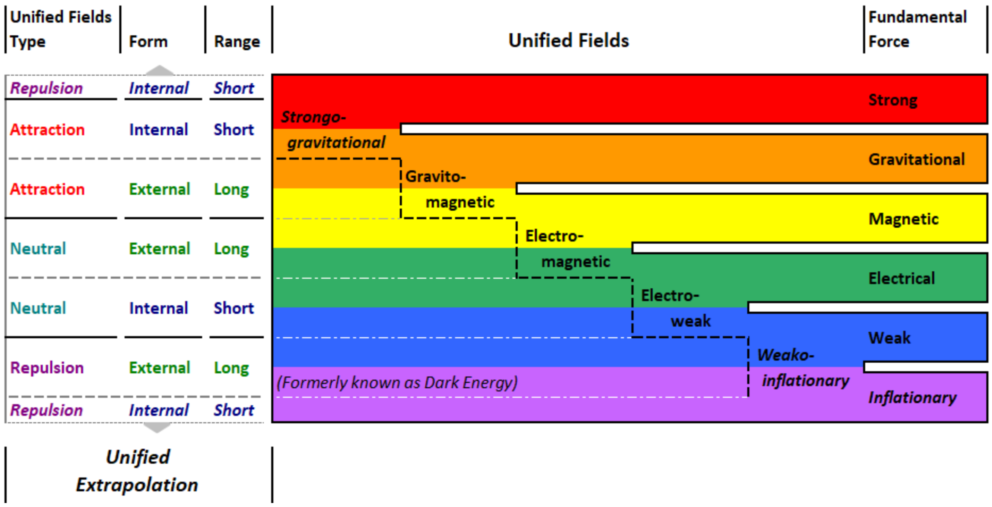


Figure 1.4: Recurring structure within the unified fields'

It immediately becomes apparent that applying an extrapolation to the recurring structure for unified fields produces a requirement for an additional repulsive unified field that is internal and short in range. As this recurring structure only applies to unified fields, this cannot be due to another missing fundamental force. The only way to complete the recurring structure is to wrap the forces around to form a cylindrical representation where the inflationary force is contiguous and also unified with the strong nuclear force. This new unified fields is referred to as *Strongoinflationary*. Again, rationalisation will be discussed in detail later. This then concludes in the principle model of forces, as presented in Figure 1.5.

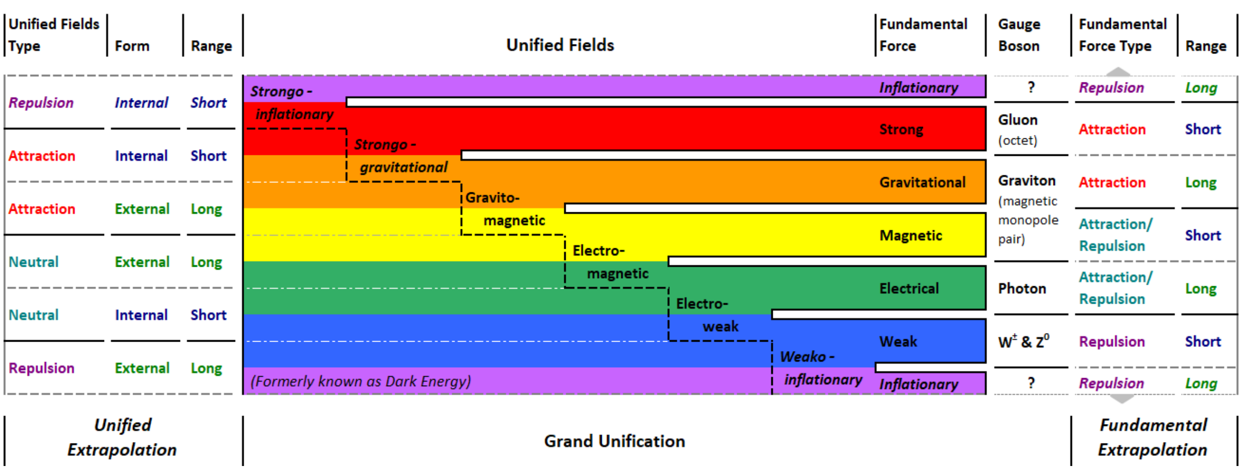


Figure 1.5: Principle model of forces

## 4. Discussion on extrapolated results

The final model includes *six* fundamental forces of Nature: strong nuclear, gravitational, magnetic, electrical, weak nuclear and inflationary. Although the methodological approach was relatively straightforward, before realising the full potential of the model as a predictive tool, it is essential to explicate these extrapolations from the viewpoint of substantiality and the crucial implications concerning the new inflationary force and the three new unified fields: the weakoinflationary (WI), the strongoinflationary (SI) and the strongogravitational (SG).

If we take up a preceding notion that neutrally charged particles may not be so neutral after all is now further strengthened. The model has established the unification of the inflationary force to both the strong and weak nuclear forces. Therefore, the colour charges of the strong nuclear force must be combinatorially connected with neutrally charged particles associated with the *neutral-current* aspect of the weak nuclear force. This refinement to the notion leads to a proposition that the neutrally charged particles particular to the inflationary force (which excludes photons) will carry a naturally occurring white colour charge (and antiparticles an antiwhite colour charge). The consequence of this would result in their exclusive interactivity with the inflationary force and, since like charges repel, fulfils the repulsive aspect of this force. The coupling strength of the inflationary force can be evaluated and is predicted to be stronger than the gravitational force by a factor of ~1.43.

Originating at the Planck scale, as proposed in several theories, the strength of gravitational attraction is predicted to be equivalent to that of electrostatic attraction [10, 13]. It has been established that this equivalence was prominent at the atomic scale [1]. Again in [1], the theoretical premise defines that all forms of hadronic matter will be the sole sources of gravitons. It will justify that for black holes to emit gravitons, then the consistency of their interiors must allow quark/gluon interactions. Therefore, the most plausible explanation as to their interiors would for them to be composed of a quark-gluon *superfluid* plasma at absolute density [1] [2]. (An excellent paper, *Physics of strongly coupled quark-gluon plasma*, is presented by Edward Shuryak [14].) The unified extrapolation, presented in figure 1.5, shows that both SG and SI unified fields are internal and short in range. It is again plausible that both these unified fields form independent forces that exist within the high-energised quark-gluon plasma of black holes.

It would then seem tenable that these two forces are acting together within black holes analogous to the forces acting within stars where the repulsive radiation pressure, resulting from nuclear fusion, is exactly counterbalanced by the attractive force of gravity. Within a black hole, SI would be a stored-up repulsive force exactly balancing the SG attractive force. This would also explain why the SG force cannot overcome the quark degeneracy pressure and create a singularity (an implausible entity where the fundamental physical laws break down and all known forces would be negated, including gravity).

The major interactivity of the weak nuclear force is involved in nucleosynthetic processes occurring within stars as a consequence of nuclear fusion. The link to the weak nuclear force presented by the WI unified fields will consequently deduce that nucleosynthetic active stars are therefore the major sources of the inflationary force.

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[1] It then implies that the quark-gluon plasma, and therefore black holes themselves, attain a mass density equivalent to atomic nuclei: 2.9213 x $10^{17}$ kg/$m^3$. (This equates to $3/\sqrt{\hbar}$, which is relativistically constant and therefore may be considered as an absolute density.)

## **4.1** A postulate for neutrinos as mediators of the inflationary force

Vast quantities of neutrinos are produced as a by-product of the weak nuclear interactions occurring during nuclear fusion in all nucleosynthetic active stars. [1] Thereby, indicating a potential link between the inflationary force and neutrinos, even though this initially appears unlikely. This is because a) neutrinos do not interact with matter, b) are neutral in charge and c) they are fermions as opposed to bosons – although there is no actual law in physics disallowing fermions from being mediators of a force. (Satisfying Bose-Einstein statistics for bosons would become meaningless regarding an inflationary force since fermions, by definition, obey the Pauli Exclusion Principle). On the affirmative side, the average energy density of the inflationary force in space (dark energy) would match as yet unobserved symmetry-breaking associated with the mass-energies of neutrinos [16]. In ordinary circumstances, neutrinos pass through matter as though it did not exist. In the final nucleosynthetic phase of dying stars greater in mass than the Chandrasekhar limit (1.44 solar masses), the core density becomes dense enough to trap neutrinos, which then assist in the impending supernova explosion of the star [16]. The bulk of the energy released by the supernova is carried away by neutrinos, whereas photon radiation (including the initial flash of light that can briefly outshine the entire galaxy), only amounts to less than 1% of the total energies released [15]. This would imply a repulsive force involving these neutrinos and potentially a manifestation of the SI force.

Elementary fermions, which are constituents of matter, are electrons (electrically charged), quarks (both electrically and colour charged) and neutrinos (potentially colour charged). If this were the case, symmetry would exist between these elementary fermion particles in compliance with Nature's symmetrical structuralism. The notion that neutrinos are colour charged is in accordance with the previously presented proposition. For neutrinos to carry a white colour charge (and antineutrinos an antiwhite colour charge) would postulate that neutrinos are gauge-fermions, force carriers, that mediate the inflationary force. [2] This would lead to an important conclusion, although remaining conjectural, that the combination of the three elementary fermions are symmetrically connected in the production of the forces, as proposed in the principle model of forces (figure 1.5).

The instance of the core density of a dying star, where neutrinos become trapped, would substantiate a case for neutrinos constituting the stored-up SI force within black holes.

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[1] The Sun produces ~2 x $10^{26}$ neutrinos every second [15], which is a vast number if it is considered there are, on average, 100 billion stars in a galaxy and approximately 350 billion galaxies amounting to ~3.5 x $10^{22}$ stars within the universe. All of these stars will be producing vast quantities of neutrinos, and this has been going on continuously for most of the lifetime of the universe. The lifespan of neutrinos is predicted to be stable, therefore, with each neutrino produced will infinitesimally increase the entropy of the universe. It can only be presumed, if neutrinos are not merely a waste product, and there is no redundancy within Nature, then Nature has intended a practical utilisation for all these neutrinos. The gravitational force of stars will not impede the emission of neutrinos and is in accordance with [1], where it was stated that only nucleons can have gravitational interactions. Therefore, neutrinos cannot be a constituent of dark matter.

[2] A further consideration is given to the potential that protons and neutrons will also carry a white colour charge of some magnitude as the coalescence of the different colour charges possessed by their constituent quarks. Any white charge field strength experienced by the nucleons would be completely overwhelmed by the strong nuclear force but could still be felt by neutrinos, and would thus explain why neutrinos only rarely interact with matter. Any white charge field strength of the nucleons could also apply to the repulsive aspect of nuclear decay processes instigated by the weak nuclear force. This consideration is supported by a paper on the *Evidence for solar influences on nuclear decay rates* [17] (the solar influence stem from neutrinos) and is potentially the first experimental detection on Earth of dark energy (the inflationary force).

## **4.2** Self-regulatory processes

In [2], clarification is given of the substantial surplus of non-annihilated gravitons comprising gravity strands that accumulate into a heterogeneous *cumulative gravitational force* (formerly known as dark matter). All hadronic matter in the universe – including galaxies, galactic clusters, and superclusters – is contributing to this cumulative gravitational force through gravitational radiation in the form of gravity strands. The influence of this cumulative gravitational force's negative pressure is participatory in the formation of galaxies and will extend to counter the existence of an inflationary force in local galactic regions, thereby enabling galactic clusters to stay together. In contrast, the inflationary force's positive pressure acts like bubbles pushing matter out to the periphery and, over aeons of time, enormous voids will dominate the space between galactic superclusters.

The realisation that nucleosynthetic stars are major sources of the inflationary force has led to considerations of scale over which the two forces of gravity (including cumulative gravity) and inflation will interact. Leading to the possibility of a balance between these opposing forces that manifest itself in hitherto undiscovered self-regulating phenomena.

On the scale of an individual nucleosynthetic star, the inflationary force emanating from the star will have no observable effect in its local region. The neutrinos radiating from the star will pass straight through any planetary system or celestial objects surrounding the star, thus these objects remain unaffected by the inflationary force and only feel the full gravitational field of the star. The influence of the inflationary force within binary star systems will have a more profound effect, as will be discussed in the next section.

On the galactic scale, the self-regulatory interaction depends on the ratio between star densities and matter densities within a galaxy. When this is low, the cumulative gravitational force would dominate, causing interstellar gas and dust to be drawn together leading to the birth of new stars. The resulting increase in the inflationary force from these new stars would counteract the cumulative gravitational force. On the other hand, with a high density of stars, such as in star clusters, the inflationary force would dominate and gradually increase the distances between stars until equilibrium is re-established with the cumulative gravitational force. Hence, galaxies can only remain stable if a continuous balance is achieved between the star-to-matter ratio and therefore all must have a finite lifetime. [1] This is analogous to the currently understood self-regulatory process inside stars between the repulsive radiation pressure, resulting from nuclear fusion, and the attractive force of gravity; where again, nucleosynthesis results in a finite lifetime. (In an advanced consideration: the repulsive radiation pressure will be induced by the repelling outward radiation of the vast concentration of neutrinos produced within the radiative zone of stars, as a by-product of nuclear fusion.)

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[1] A diminishing cycle occurs within a galaxy. The initial abundance of hydrogen and lesser abundant helium is gradually used up in star-forming interstellar gas and dust clouds to be replaced with higher proportions of heavier elements distributed by supernovae of dying stars. With increasing amounts of heavier elements in the star-forming gas and dust clouds, new stars will then form with proportionally shorter lifetimes, and release heavier elements in their supernovae. Eventually, the only elements available for new star-forming will be iron and heavier elements, which, because of binding energy considerations, will not allow nucleosynthesis to start. This would signal the end of star production. Dominance by the cumulative gravitational force would have occurred before this final stage, due to the reduced inflationary force, resulting in the galaxy collapsing in on itself in a central supermassive black hole. Within the present age of the universe, this event is unlikely to have happened so far except potentially in certain dwarf galaxies.

## **4.3** The inflationary force in binary star systems

If the inflationary and cumulative gravitational forces are effectively self-regulatory within galaxies (and the inflationary force continued propagation in the expansion of the universe), would imply that the strength of the inflationary field emanating from an individual star is proportional to its luminosity and will likely, in most cases, be stronger than the star's gravitational field. These two fields are effective at the same time and this is *only* applicable in relation to the interactivity between nucleosynthetic active stars. It would then establish why these stars within galaxies naturally stay or move apart and do not collide or merge. All non-nucleosynthetic hadronic matter – black holes, neutron stars, white dwarfs, planets, etc. – do not produce, and therefore remain unaffected by, the inflationary force and, hence, interact only via the full strength of the gravitational force (including full gravitational interaction with stars).

About two-thirds of stars created from collapsing interstellar clouds in star-forming regions of galaxies will be in binary pairs or more complicated systems. The inflationary force will cause closely formed stars in companion systems to progressively move apart with age. White and Ghez [18] found that young binary systems have separations in the range from 10 to 100 AU (1 AU = 149.6 million km), while in older binary systems the nucleosynthetic companion stars are up to ~1,000 AU apart. More observations are needed, but it is interesting that in every case when binary stars have been seen to move closer together, up to a point where material can be extruded by mass exchanging transfer, at least one of the companion stars is a non-nucleosynthetic stellar remnant, i.e. a white dwarf star, neutron star or stellar black hole – or where the binary pair are both remnants, their moving together can end in a full merger.

Figure 2 is a rudimental demonstration of how the different strengths of the gravitational and inflationary forces would cause two nucleosynthetic companion stars in a binary system to move apart, an effect which is greater the closer they are together and greatly diminishes with increase separation.

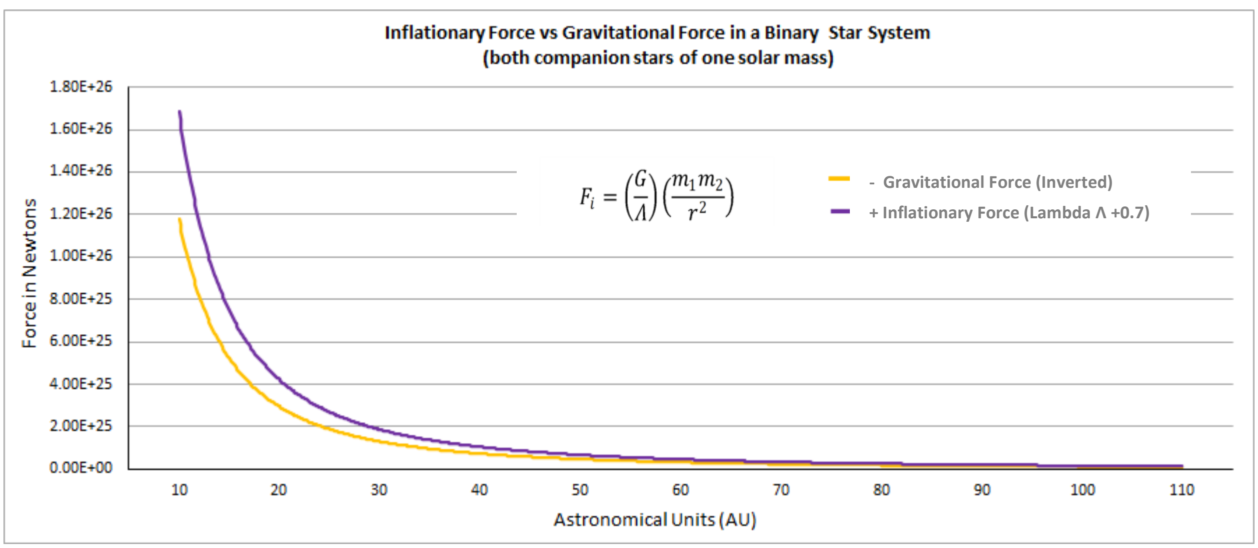


Figure 2: Inflationary force vs gravitational force in a binary star system

## 5. Consequences for the fate of the universe

Attainment of the final model leads to surmise that as the majority of the stars come to the end of their lives within a galactic supercluster, which as previously stated, would be at vast distances from any other superclusters, production of the inflationary force will have diminished substantially in this local region. The cumulative gravitational force would then become the dominant force causing all matter within the supercluster to produce an accelerating collapse in on itself that finalises in an isolated Big Crunch. The termination culminates when the momentum of the final matter, drawn into one central evolving gigantic black hole, causes its sudden gravitational collapse and is counteracted by an immense upsurge in the SI force. The resulting rebounding force or 'bounce' manifest in a Big Bang. Followed, instantaneously, by the violent release of gauge-fermions stored up in the SI force [1] thus accounting for superinflation, a period of tremendous exponential expansion lasting ~$10^{-32}$ seconds while minimal separation between gauge-fermions drove the repulsion. Due to magnetodynamical influence [2], inflation will increasingly decelerate in this region of space, allowing the evolution of another universe to begin. As galaxies form, the production of the inflationary force recommences and, in due course, expansion resumes. These phenomena described several events that involve self-regulatory processes and, importantly, in forwarding why superinflation was limited (crucial if galaxies are eventually to form). The asymmetry between the inflationary force and the gravitational force, which manifested in the expansion of the universe, is ultimately conserved during entropy phase transitions of individual big bangs (see Figure 3).

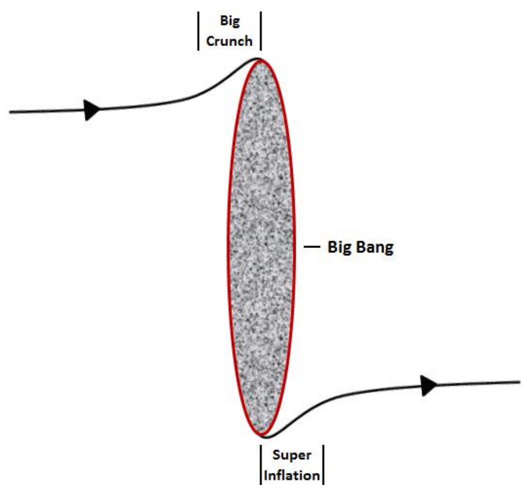


Figure 3: Entropy phase transition

Our universe is still relatively young, and its expansion will continue to accelerate, driven by the inflationary force. Existing and future galactic superclusters will all be *seeds* for eventual individual big bangs. The distances between multiple universes created from separate big bangs will be immense, and, where either neighbouring universes recede at a combined speed exceeding the speed of light, or else likely appear indistinguishable from very faint distant galaxies. In endeavours to understand, will ultimately conclude that space and time, together with vacuum energy, are infinite and eternal, and that, overall, the entropy of space will remain constant.

[1] Quarks and gluons of the SG force are also released as energy. The energy that ensues from the Big Bang, in the annihilation of the entire entity, will likely be analogous to pair-instability supernovae, where the collapse produces a runaway production of particle and antiparticle pairs and, in the case of the Big Bang, asymmetry leads to the creation of the next generation of elementary particles. This enhances a notion that the reason there are three generations of particles in the Standard Model is nothing more than a reflection of our present universe as a third-generation universe.

## 6. Further regarding the self-regulatory principle

The appearance of symmetries throughout Nature can be interpreted as signs of equilibria resulting from self-regulating processes. Occurring naturally, such phenomena would resolve the enigma surrounding 'fine-tuning', where the physical constants in the laws of Nature appear to be precisely those required for the existence of life. Naturally occurring self-regulatory processes could conceivably extend throughout Nature's activities at all hierarchical scales, from quantum through to cosmic, or extend beyond.

The principle could extend to answering questions such as whether there is a self-regulatory evolutionary process involved in successive big bangs? String/M theory proposes a multiverse consisting of more than $10^{500}$ universes, each with a different configuration of physical constants but only a small number having the exact configuration compatible with life. These are likely to be the only universes able to form galactic superclusters, which in turn will seed the next generation of universes in successive big bangs – in which the life-compatible physical constants will be replicated by conservation of information. Without the formation of black holes during the lifetime of a universe, the evolutionary progression fails with no further replication. It would be in accord with Nature replicating successful evolutionary strategies at different hierarchical scales.

Self-regulatory processes are essentially the precursor to a *Theory of Everything*. The point of origin in such a theory would see the infinite scalar energy of the vacuum as the source of the foremost fundamental regulatory process; resulting in vacuum energy condensing into the emergence of subatomic particles. This process has been the genesis of everything that exists in our universe, and, potentially, in numerous or even infinite multiverses.

## 7. Conclusion

The primary deductions that have arisen from the logical construct of the principle model of forces have presented the inflationary force (formerly known as dark energy) as a new fundamental force of Nature. Also, it has been proposed that the new SG and SI unified fields manifest as independent forces that are in equilibrium within black holes. The inflationary force, as the constituent of the new WI unified fields, has been deduced to originate from the by-product of weak nuclear interactions within all nucleosynthetic stars. This fundamental force will be involved in self-regulatory processes concerning galactic systems and be responsible for the current accelerating expansion of our universe.

A proposition has been put forward that what were once thought of as being neutrally charged particles (excluding photons) would instead carry a naturally occurring white colour charge associated with the interactivity of the inflationary force. Neutrinos would carry this white colour charge and were postulated as the mediatory gauge-fermions of the inflationary force. The coupling strength of this force would be stronger than the gravitational force by an estimated factor of ~1.43.

## **Appendix A:** Theoretical premise for quantum gravity

The theoretical premise is based on the reasoning that magnetic monopoles would emanate from non-confinement in QCD (in furtherance of [19]); as cause, the by-product of quark/gluon interactions. The effect would be continuous streams of oppositely charged magnetic monopole *graviton* particles expelled from nucleons in opposite directions along the axes of spin. [1] The natural pairing of nucleons in up/down spin orientations enables their streams of gravitons to self-organise into *gravity strands* of alternating charged particles, thereby initiating a gravitational force (see figure 1.1). The force of attraction manifests due to continuous head-on attractions and annihilations of alternating pairs of oppositely charged gravitons. [2] Single/unpaired nucleons (or paired nucleons where protons' spin orientations readily invert in response to an electrical or magnetic field or magnetised state) produce gravitons with the same charge flowing in the same direction, thereby instigating a magnetic force [3] (see figure 1.2). The gravitational and magnetic forces are normally distinct in that they retain non-interaction,[4] whereas their interchangeability would formalise in unification: in Gravitomagnetic unified fields.

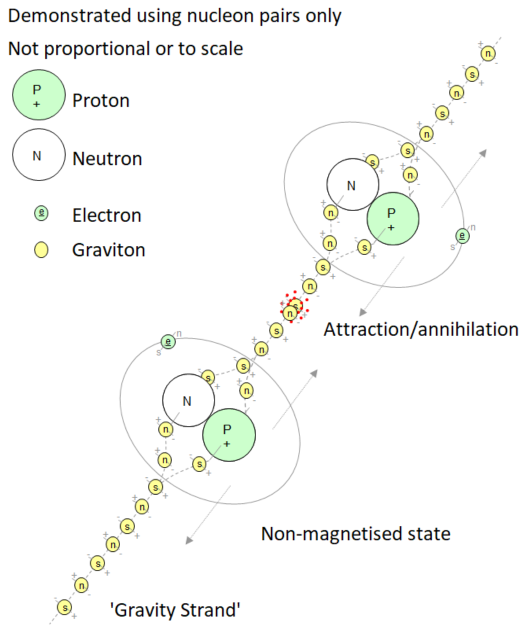


Figure 1.1: Gravitational force

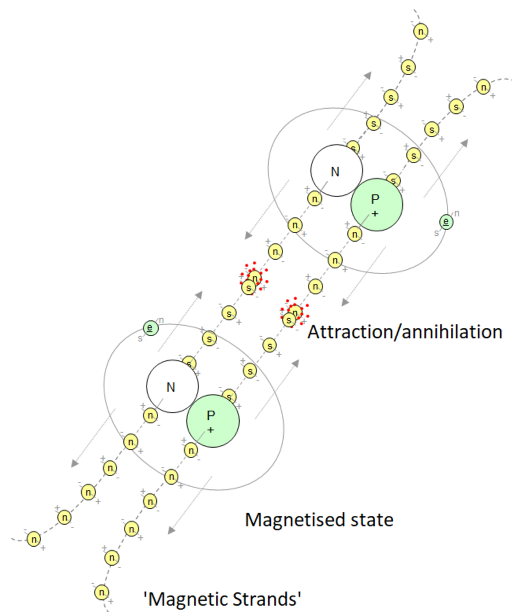


Figure 1.2: Magnetic force

[1] It defines all forms of hadronic matter as the only sources of gravitons. This would attribute the mass of black holes to extremely dense quark-matter interiors. Correspondingly, neutron stars' sources of gravitons would originate from the neutron constituents of these stars. Gravitons' duality utilisation would thus explain both the very strong gravitational and magnetic fields of these compact cosmic objects. Regarding particles, only nucleons (as the only stable hadron particles) can have gravitational interactions to the exclusion of all other subatomic particles.

[2] It infers that gravitons are paired massless gauge bosons, comprising of monopoles and antimonopoles of opposite charges, which facilitates annihilation. Head-on attraction/annihilation of leading particles, in converging gravity strands, exposes the next pair of oppositely charged particles in continuation of the process. The pulling force generated by the leading particles is transferred via each opposing strand formation to the source objects.

[3] It produces plausibility that lines of magnetic flux, when made visible, are displaying monopoles with the same charge in traceable streams that curve progressively apart by their mutual repulsion (and where oppositely charged streams meet in head-on attraction/annihilation). It can be deduced that the magnetic monopole will have an electric moment, enabling interaction by the interconnection of fields between magnetic monopoles in magnetic strands and electrically charged subatomic particles. In gravity strands, the overall effects of electric moments and magnetic charges are neutralised throughout the length of each strand with only the leading particle retaining a net surplus magnetic charge.

[4] Exception arises within very powerful magnetic fields resulting in localise interference of gravity strand activity [20].

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(Also see http://www.ru.nl/hfml/research/levitation/diamagnetic/)