Quantum Magnetodynamics' Governance of the Cosmos

David W Gold

Torquay, Devon, England UK

Email: david.gold@scienceau.uk

Updated [1]: 19 August 2018

Abstract

Quantum Magnetodynamics is presented as a foundation for Quantum Gravity where the solution realized perfect unity with *magnetic* and *electrical fundamental* forces, and in realizing a plausible resolution for Dark Matter. This conceptual foundation is extended to explore what the influence of magnetodynamical processes would have on the cosmos from, evaluation of the evolving conditions within the early universe succeeding the Big Bang event, to current compact cosmic objects associated with powerful magnetic fields. Magnetodynamical processes will ultimately unite the extreme classical scale of the universe, with its structural formations and containment, to a governing process that originates at the utmost quantum scale, thus reconciling the microscopic scale with the macroscopic scale.

PACS numbers: 98.80.Qc, 95.35.+d, 97.60.-s, 98.80.Bp

1. Introduction

In the inceptive hypothesis [1] assessment was given to *quasi*-magnetic monopoles, experimentally discovered in tetrahedral crystal structures of spin ices [2-3], as conforming functionally to the hypothetical particles theorised by Paul Dirac to retain the duality symmetry between the electromagnetic unified fields. This serendipitously led to an association that existence of the hypothetical graviton would constitute to hypothetical magnetic monopole paired particles from which form hypothetical 'Gravity Strands'; the *modus operandi* as to the *vera causa* of the gravitational force. This pivotal premise readily developed; in consequence realizing a solution for quantum gravity in perfect unity with *magnetic* and *electrical fundamental* forces, thereby forming a foundation for Quantum Magnetodynamics.

[1] This work is ongoing by evolving processes of development and enhancements in an open and transparent communication of continuing progress.

1.1 Hypothetical 'Gravity Strands'

Premise: Rationalises that magnetic monopoles would emanate from non-confinement in QCD (in furtherance of [4]); as cause, the by-product of quark/gluon interactions. The effect will be continuous streams of polar charged magnetic monopole '*graviton*' particles expelled, in opposite polar directions, from nucleons' nuclei along their axes of spin.[1] Nucleons will naturally pair together as a consequence of their continuous streams of gravitons self-organising into 'strands' of alternating charged particles, whereby initiating a gravitational force (see figure 1.1); hence the name 'Gravity Strand'. The force of attraction manifests from continuum head-on attraction and annihilation of opposite charged gravitons.[2] Single/unpaired nucleons (or paired nucleons where protons' spin orientations readily invert in response to an electrical or magnetic field or magnetized state) will produce same charged gravitons 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 will formalize in unification: in Gravitymagnetic unified fields.

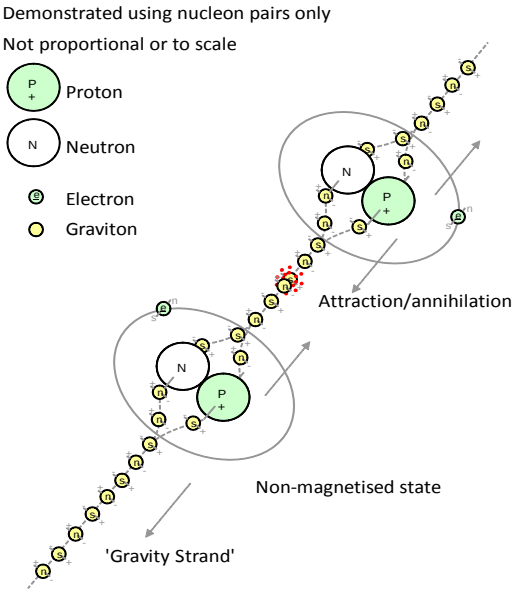

Figure 1.1: Gravitational Force

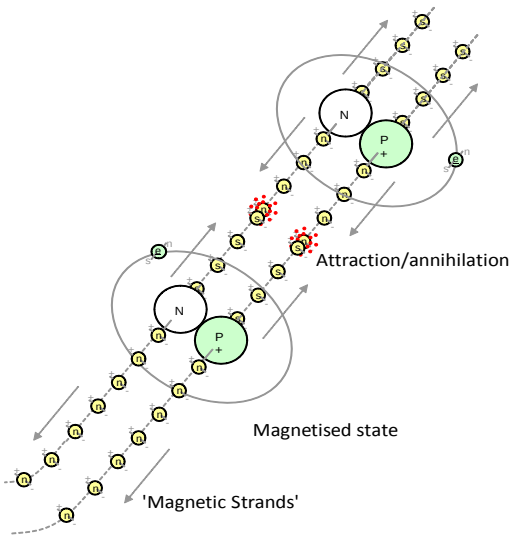

Figure 1.2: Magnetic Force

[1] It defines all forms of hadronic matter to be the only sources of gravitons. It will quantify the masses of black holes to extremely dense quark-gluon plasma interiors. Correspondingly, neutron stars' sources of gravitons are limited to the neutrons constituent in these stars. (Gravitons duality utilization will then go on to explain both the very strong gravitational and magnetic fields of these compact cosmic objects.) In regard to particles, only nucleons (as the only stable hadron particles) can have gravitational interactions to the exclusion of all other subatomic particles.

[2] It infers monopole gravitons are massless gauge-bosons comprising of opposite charged particle and antiparticle, which facilitates annihilation. Head-on attraction/annihilation of leading particles, in opposite travelling gravity strands, exposes the next pair of opposite 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 is deduced that the magnetic monopole will have a electric moment, enabling interaction by interconnection of fields between magnetic monopoles, travelling in magnetic strands, and electrically charged subatomic particles. (In gravity strands, the overall affects of electric moments and magnetic charges are neutralized throughout the length of each strand with only the leading particle retaining a net surplus magnetic charge.) It is plausible that lines of magnetic flux, when made visible, are displaying same charged monopoles in traceable streams curved progressively apart by their mutual repulsion (and where opposite charged streams meet in head-on attraction/annihilation).

[4] Exception arises within very powerful magnetic fields resulting in localize interference of gravity strand activity [5]

1.2 Interactions of magnetic monopoles

The difference in configurations of magnetic monopoles in gravity and magnetic strands are two distinct aspects in the interactions of magnetic monopoles that distinguish the gravitational and magnetic forces. It is established that opposing Coulomb and Gravitational interactions attain equilibrium, which will sustain the position of atoms and molecules within the heterogeneity of matter [1]. This duality symmetry of Coulomb-Gravitational interactions is explicable for the molecular synthesis of matter. In which any asymmetry in these interactions will be the cause of expansion or contraction in matter, until equilibrium of state is re-established, or any restricted asymmetry in the gaseous states will be the cause to pressure.

It is forwarded as a proposition that, atomically, solids are consolidated by continuous alignment of gravity strand interactions between atomic nuclei. Liquids are synthesized by distinguishable combinations of alignment and intermittent interaction of gravity strands. And gases are synthesized purely by intermittent interaction of gravity strands, due to the random kinetic motion and orientation of atomic nuclei. All gravity strand interactions will be inversely proportional to molecular kinetic motion/energy, which is dependent upon temperature. Single/unpaired nucleons, including atomic hydrogen, will involve Coulomb-Magnetic interactions in either (e.g. hydrogen bonds in attraction) or (e.g. negative thermal expansion in repulsion) alignment of magnetic strands.

2. From the quantum to the classical scale

2.1 A fundamental principle of mass

Taking Einstein's famous equation for mass-energy in relating to particles and breaking down the mass element into its components of volume and density:

$$E = mc^2 = V\pi c^4 \tag{1.0}$$

where the mass element is: [1]

$$m = V\pi c^2 \tag{1.1}$$

and therefore density is:

$$\rho = \pi c^2 \tag{1.2a}$$

or alternatively:

$$\rho = \frac{\pi}{\mu_0 \varepsilon_0} \tag{1.2b}$$

It establishes particle density is relativistically constant. Volumetric size, distinct or relativistic variant, of particles is then determined by the energy carried as verified by the Einstein-Planck formulation:

$$Vf\pi c^4 = hf \tag{1.3}$$

where h = Planck constant and f = wave frequency. (This would question the notion of massless particles, but is not the purpose of this topic.) What is important is the densities of particles are identical and invariant, thereby inferring density has reached a finite universal limit: an absolute density or, in other words, the limit to which energy can be concentrated, where, as a consequence, energy has condensed into the manifestation of mass. The significance of Eqn. 1.2b would deduce that, as energy cannot be created or destroyed and therefore must have an origin, the origin to energy is in the vacuum wherein vacuum energy density = $1/c$ J/m^3 and, as such, must be eternal and infinite: profoundly, it will be the genesis to everything that exists.

[1] Used to ascertain electron radius = 9.166 x 10^{-17} m and proton radius = 1.122 x 10^{-15} m.

2.2 Black holes

When a dying star collapses in a supernova and the mass density of the remnant core exceeds the Tolman-Oppenheimer-Volkoff limit for degeneracy pressure of neutrons, the object left is a stellar black hole, which is currently assumed a singularity; an infinitesimal dense volume. If considered logically, singularities present implausible entities where Nature's physical laws would break down and all known forces in their current form will be prohibited including gravity.

It is defined in the initial premise that all forms of hadronic matter will be the only sources of gravitons. It can be rationalized that for black holes to emit gravitons then consistency of their interiors must allow quark/gluon interactions and, therefore, the most plausible explanation for their interiors would be the existence of extremely dense quark-gluon plasma. As to how dense the quark-gluon plasma is, then the notion of absolute density is assumed, and together with the established mass, will ascertain a black hole's volume and surface radius.

The event horizon of a black hole is established by Schwarzschild radius:

$$r_s = (2Gm)/c^2 \qquad (1.4)$$

If the mass of a stellar black hole is less than 8.0786 solar masses then the event horizon will be below the surface and, therefore, the black hole and its surface will be observable.

It forwards a supposition that all black holes are ultimately composite particles: superfluid quark-gluon plasma at absolute density. Technically, they will be quark stars. It is disclosed in a paper by Jinfeng Liao and Edward Shuryak [6] that magnetic monopoles play an essential role within quark-gluon plasma. It is presented in the initial premise that magnetic monopoles stem from the by-product of quark/gluon interactions within the strong nuclear force and, as predicted, extend beyond.

2.3 Gravitational radiation

The external gravitational field of a hadronic object will consist of high concentrations of unconfined free radiating gravity strands in an outward gravitational radiation[1] and, including gravitational radiation from all hadronic matter within the universe, would make gravitons among the most numerous of any particle. Their substantial non-annihilated accumulative surplus would advance an explanation as to the unexplained existence and amount of Dark Matter; the explanation becomes resolved by the continuing existence of a Cumulative Gravitational force (clarification given later). Furthering substantiation by deduction, magnetic monopole graviton massless gauge-bosons do not couple to the quanta of light, therein, leaving photon-coupling only with electrically charged particles.[2]

[1] The density of gravity strands in gravitational radiation, which decreases inversely proportional to the square of the distance from a hadronic object, arises proportional to the mass of that object and will fluctuate in degree from any variability in mass densities within the mass. This last facet is in agreement with data coming from the ESA GOCE geoid project [7]. Consequence of gravitational radiation (relativistic) has been observed with binary pulsar PSR 1913+16 [8]. (General relativity predicts that accelerating masses should emit '*gravitational radiation*' in the same way that accelerating charged particles emit electromagnetic radiation.) Radiation is conveyed by particles.

[2] In similarity with neutrinos, it would forward an explanation why magnetic monopoles remain undetected by the fact of their apparent 'invisibility', whereas unlike neutrinos, magnetic monopoles are not free radical particles but have precise functionality.

2.4 Compact cosmic objects associated with powerful magnetic fields

Gravitons duality utilization that culminate in Gravitymagnetic unified fields, as forwarded in the initial premise, will realize a correlation with gravitational field strengths in relation to compact cosmic objects containing powerful magnetic fields. The stronger the magnetic field of an object will inversely affect the strength of its gravitational field. The explanation would derive from the fact that, during the instigating stage when the object forms, a higher proportion of gravitons, instead of self-organising into gravity strands, are remaining as magnetic strands responsible for the magnetic force, therein, explaining the origins to such strong magnetic fields.

Magnetars with extremely powerful magnetic fields of 10^8-10^{11} tesla are up to a 1000 times more powerful than the magnetic fields of neutron stars. The powerful magnetic field of a magnetar rapidly decays over a period of approximately 10,000 years [9-10] to that of a regular neutron star. A hydrodynamic dynamo process from rapid rotation of magnetars, as a postulated source for the magnetic field, cannot then be explanatory to this rapid decay as, over this time period, rotation conversely increases in rate, from the 5-12 seconds for most magnetars [10], to less than one second for typical neutron stars [11].

It is from reasoning, that as the magnetic field of a magnetar decays over a period of time, its gravitational field will progressively become stronger as magnetic strands become more organised into gravity strands; thus explaining the inversely declining magnetic field strength. The intensifying density of gravity strands, and with it increasing gravitational field strength, will proportionally increase the mass density of the magnetar; evidential in starquakes and glitches as the internal structure contracts. (Magnetars increasing rate of rotation is then explained by conservation of angular momentum due to increasing mass density and contracting volume.) It is predicted that a magnetars, starting out at an upper limit in mass, will transmute into a black hole during its period of magnetic field decay where increasing mass density eventually overcomes the Tolman-Oppenheimer-Volkoff limit for degeneracy pressure of neutrons; as potentially proceeding initial supernova of DES14X3taz [12] and in the disappearance of N6946-BH1 [13].

The above can also be considered for super-Chandrasekhar mass supernovae where the mass of white dwarf stars can achieve singularly up to 2.8 solar masses before exploding in these supernovae thereby breaking the Chandrasekhar limit of 1.44 solar masses maximum for a white dwarf star. It has been identified in a paper by Upasana Das and Banibrata Mukhopadhyay, 'Violation of Chandrasekhar Mass Limit: The Exciting Potential of Strongly Magnetized White Dwarfs' [14], as a plausible connection to this phenomenon. This again would associate compact cosmic objects and powerful magnetic fields. A white dwarf star formed with a powerful magnetic field (with a surface magnetic field of up to 10^5 tesla [14]) would give rise to a weaker than expected gravitational field where the internal gravitational force attributes to reduced electron degeneracy pressure that results in greater than expected volume and lower mass density. This would allow extra mass to be accreted before its mass density grows to a critical 2×10^{12} kg/m^3, thereby, the weaker internal gravitational strength allowing the mass of the white dwarf star to grow beyond the Chandrasekhar limit before resulting in a supernova explosion.

The above occurrences provide opportunities to test for quantum gravity. With regard to compact cosmic objects associated with powerful magnetic fields, any deviation in an object's expected gravitational field strength being inversely proportional to its magnetic field strength, and detectable in unexpected larger object volume and lower mass density, would be attributable to quantum magnetodynamical processes as presented.

***2.5** Dark Matter*

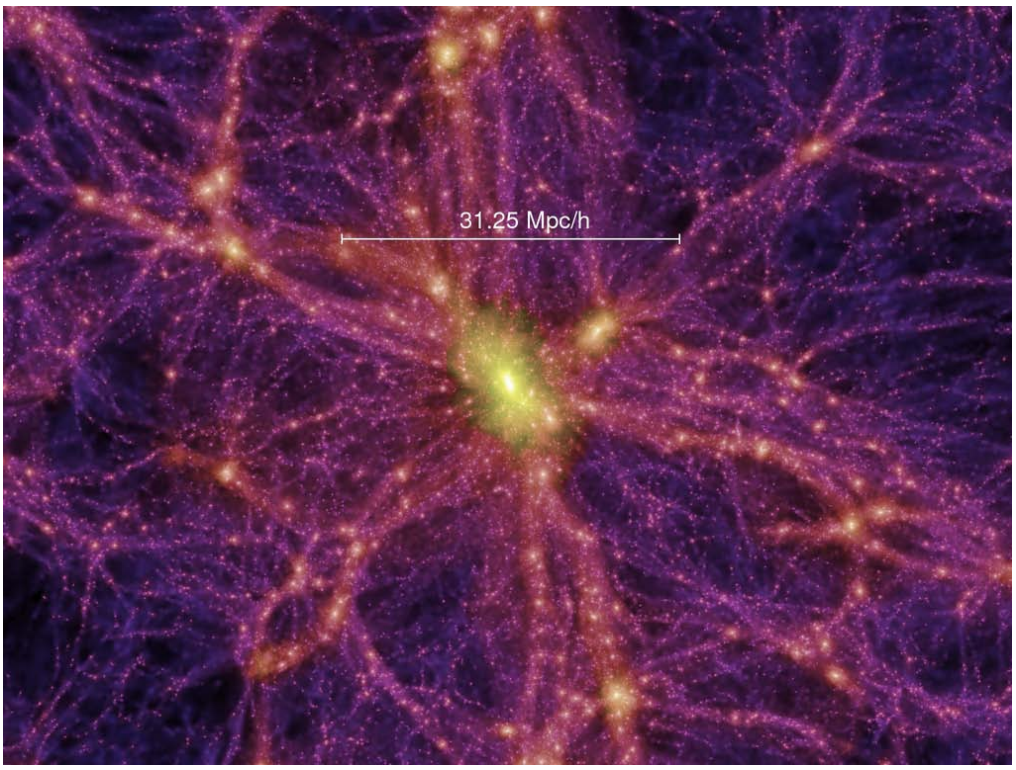

Image 1: Galaxies, Galactic Clusters and Superclusters

The cumulative mass of the galactic supercluster, at the centre of image 1, should cause curvature in space-time where surrounding structural material manifest, to some degree, in a spiral or orbital motion around the supercluster, which is non-evidential. The conglomeration of the overall megastructure is fibrous in characteristic which, on the grand scale presented by the image, emphasizes the heterogeneous nature that would, predicatively, emanate from gravity strand activity radiating from all cosmic hadronic matter where their substantial non-annihilated surplus, over substantial distances, ultimately accumulates into a Cumulative gravitational force[1] (formerly known as dark matter). This heterogeneous nature of the cumulative gravitational force attributes to the participating factor in the formation of galaxies.[2] (This is covered in a more explanatory account in: 3. The early quantum universe.)

The image produces an analogy that reflects, as a manifestation at the macroscopic scale, the multi-vectorial interactions of gravity strands occurring at the microscopic scale.

[1] Whereas the affect of the cumulative gravitational force over a large scale is heterogeneous in that propagation is non-uniform, the gravitational force in a local region is homogeneous and propagates uniformly. This infers there will be a dynamical transition from a gravitational force to a cumulative gravitational force relating to the change from homogeneous to heterogeneous; a consequence of the differentiation in scale that gives rise to two different aspects of the same force. (Magnetic monopole gravitons, intrinsic to all discrete scales of the gravitational force, would eliminate the need for any other non-evidential hypothetical exotic particles attributed to 'Dark Matter', which would need to be hadronic; matter/particles constituting of quarks.)

[2] This is in addition to the established activity of dark matter, now referred to as the cumulative gravitational force, involvement in the confinement of cosmic matter within galaxies.

3. The early quantum universe

The conceptual foundation for quantum gravity is applied to the early universe succeeding the Big Bang event to ascertain the conditions arising from magnetodynamical processes. The period to be considered is from after the universe was one second old, the juncture at which quark-gluon plasma condensed into protons and neutrons, to the universe at 400 million years old when the onslaught of the first stars formed, which ultimately led to the formation of the first galaxies at approximately one billion years.

Within the first few minutes after the Big Bang followed a limited period involving a nucleosynthesis process when helium and trace of lithium formed. With helium nuclei in which opposite spin orientations of the two pairs of nucleons will produce, outwardly, four monopole strands that combine by self-organising into two directional opposite radiating gravity strands. Whereas, the close confines of the inwardly directed monopole strands, being four individual magnetic strands, interact as attracting pairs of magnetic interactions that assist, to some degree, nuclear binding (as produced by the strong nuclear force in the exchange of pions between nucleons). In addition, it would form explanation to the pronounced stability of helium nuclei. This primordial element accounted for 25% of all baryonic matter and would primarily have been the only source effectuating a gravitational force, which remain the case until the recombination epoch.

The prevailing seventy-five percent of baryonic matter consisted of ionized atomic hydrogen each producing directional opposite radiation of magnetic strands of opposite charged magnetic monopoles (see Figure 1.2 with consideration to a single proton's magnetic monopole radiation). The accumulative effect of the predominant atomic hydrogen magnetic strand radiation would result in the magnetic force being the dominant force during the first 379,000 year period, between the nucleosynthesis and recombination epochs of the early universe. The dominance of magnetism would have produced very strong turbulent magnetic forces which changed the homogeneous and isotropic distribution of matter resulting in localized perturbation in densities. It is predicted that this period of magnetic turbulence will eventually become evidential in the CMB with achievement in finer resolution; as resembling the surface of the Sun but at a vastly greater scale.

At the recombination epoch, when the early universe had cooled sufficiently, matter decoupled from energy (photon radiation) allowing electrons to combine with atomic nuclei to form atoms. It is at this moment atomic hydrogen, in close proximity, will naturally combine to form molecular hydrogen H_2. Magnetic moment field strength within H_2 molecules will align the two proton's spin in opposite up/down orientations (in accordance with the Pauli Exclusion Principle whereby two identical adjoining fermions cannot simultaneously be in the same quantum state). Although the two protons remain repelled apart, their continuous streams of magnetic monopole gravitons will still self-organise into two directional opposite radiating gravity strands. Once bound, stability as H_2 molecules is inversely proportional to energy levels. Formation of molecular hydrogen would increasingly attribute to overall gravitational potential. Over the next 400 million years the dominant magnetic force greatly diminishes to present day level, as evidential in intergalactic and interstellar gas/dust clouds. The gravitational force inversely increases to become the predominant governing force and, at this early stage in the universe's development and without any significant structures for the gravitational force to interact with, the substantial non-annihilated surplus of gravity strands would rapidly accumulate in a Cumulative Gravitational force (formerly referred to as Dark Matter).

(Conceptualism of Modified Newtonian Dynamics – MOND – or in some other modified form is considered as, potentially, a necessary approach when dealing with the presents of Dark Matter, or as referred to the cumulative gravitational force, which must also take into account the complexity of such a force, as over large scales is heterogeneous; propagation of the force is non-uniform.)

Manifestation of a cumulative gravitational force within large scale regions would initiate the attraction process of drawing material together allowing localized perturbation in densities to grow. At first the process will be slow but will proceed to accelerate, eventually creating a voracious onset in an abrupt eruption of star formation at an unprecedented rate. (This is supported by analysis of Hubble Space Telescope deep sky images; that the first stars in the universe appeared in an abrupt eruption of star formation, rather than at a gradual pace, and is also evidential that localized regions were in the midst of rapidly accelerating gravitational contraction.) Those regions experiencing accelerating gravitational contraction would have continued, developing into a localized runaway process where all available regional material finalizes in a supermassive black hole. It therefore indicates the existence of some counterbalancing mechanism which prevented total collapse.

In my subsequent paper, 'Formulation of a Principle Model of Forces' [15], where a methodological use of extrapolations, from a recursive pattern relating to unified fields' and to previously unrealised periodic structures, deduced there was an additional fundamental *inflationary* force in unity with the weak nuclear force. The major sources of this inflationary force emanate from a by-product of nucleosynthetic processes taking place in active stars. The repulsive aspect of this force only interacts with other nucleosynthetic active stars establishing why the greatest majority of effectual stars within galaxies naturally stay or move apart and do not collide or combine. This inflationary force is also attributed to the force responsible for the current accelerating expansion of the universe (formerly known as Dark Energy).

It would take the presents of this inflationary force to stop potential regional gravitational collapse. As regional stars formed, their activation attributes to the repulsive aspect of a localized inflationary force. This results in a self-regulatory counterbalancing process with the regional cumulative gravitational force and thus initiating the preconditions to allow formation of galaxies. Within galaxies, this self-regulatory counterbalancing process will be dependent upon the ratio between matter densities to star densities. In the initial abrupt eruption of star formation, the formation of black holes was still at the infancy stage. As a consequence, the first galaxies to form were dwarf galaxies and, in a large number of cases, their matter to star density was insufficient to overcome the dominance of the local cumulative gravitational force. In such cases, they finalize in total collapse thus accounting for, as an explanation, the large deficit in the current expected existence of dwarf galaxies and the mechanism, over a relative short timescale, in the significant leap from the infancy stage in the formation of black holes to the existence of supermassive black holes; the seeds in the same early abrupt evolution of large galaxies.

The conclusion is that the gravitational force gradually developed over the first 400 million years of the universe existence. Within approximately the first 400,000 years, total gravitation potential was just 25% of current potential. During this same period the magnetic force prevailed as the dominate force that effectuated disturbances in the distribution of matter. The introduction of the inflationary force, although appearing more speculative, is conceptually an essential precondition in the formation of galaxies.

Appendix A: *Loop Quantum Gravity*

Carlo Rovelli's informative account of the development and meaning of Loop Quantum Gravity, or referred to as Loop Theory, is presented in his book 'Reality Is Not What It Seems: The Journey To Quantum Gravity'. In which, at the quantum level, the gravitational field is described by Faraday's field lines. These imaginary lines represent the field emanating from a source where separation between the lines reflects the magnitude of the field. They are usually presented 2-dimentionially but are to be envisaged as 3-dimentionial representations. Illustrated below is the negative charged electrical field of an electron and the magnetic field surrounding a magnet:

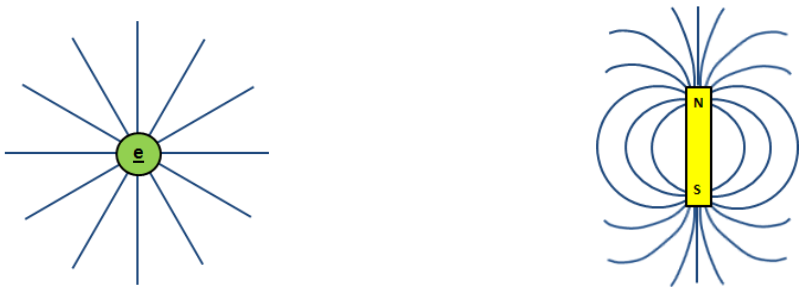

Figure A1: (a) Electron's Field Lines (b) Magnetic Field Lines

The following narrative by Carlo Rovelli on an early stage in the development of loop quantum gravity is extracted from his above mention book:

> *".... I remember a period of intense discussions and burning intellectual fervour.* [Abhay] *Ashtekar had rewritten the Wheeler-De Witt equation in a simpler form; and* [Lee] *Smolin, together with Ted Jacobson of the University of Maryland in Washington, had been the first to find some of the strange solutions of the equation. The solutions had a curious peculiarity: they depended on closed lines in space. A closed line is a 'loop'...."*
>
> *".... Remember Faraday's* [field] *lines – the lines which carry the electric force and which, in Faraday's vision, fill space? Well, the closed lines that appear in the solutions of the Wheeler-De Witt equation are Faraday lines of the gravitational field."* [16]

Interpretation of the loops, as presented in Loop Theory, concluded in quantum foam of space-time. In argument, as an alternative interpretation: for Faraday's field lines to loop on themselves is illustrated by the example of the magnetic field in (b) of figure A1. The field lines of an individual magnetic monopole will be identical to the field lines of an electron as illustrated by (a) in figure A1, but with consideration, the size of a magnetic monopole is anticipated to be extremely small in comparison to the size of an electron. In the case of gravity strands the field lines produced, in an individual strand, by the alternating charged magnetic monopoles will be loops and where the centres of the loops are at discrete distances apart:

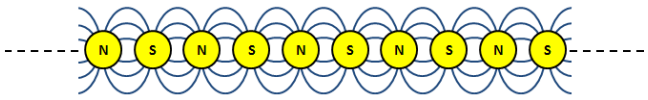

Figure A2: Gravity Strand (section of) Field Lines

Acknowledgment

Image 1 is with permission and courtesy of Prof. Volker Springel et al./Virgo Consortium in association with The Millennium Simulation Project at the Max Planck Institute for Astrophysics: http://www.mpa-garching.mpg.de/galform/virgo/millennium/

References

[1] D W Gold 2009 Quantum Magnetodynamics of Gravity

[2] D J P Morris *et al.* 2009 Dirac Strings and Magnetic Monopoles in Spin Ice $Dy_2Ti_2O_7$ *Science* DOI: 10.1126/science.11788688 arXiv:1011.1174v1

[3] T Fennell *et al.* 2009 Magnetic Coulomb Phase in the Spin Ice $Ho_2Ti_2O_7$ *Science* DOI: 10.1126/science.1177582 arXiv:0907.0954v1

[4] M Eto, M Nitta and N Yamamoto 2011 Confined Monopoles Induced by Quantum Effects in Dense QCD *Phys Rev* **D83** 085005 doi:10.1103/PhysRevD.83.085005 arXiv:1101.2574v2

[5] M V Berry and A K Geim 1997 Of Flying Frogs and Levitrons *European Journal of Physics* **18** 307 doi:10.1088/0143-0807/18/4/012
(Also see http://www.ru.nl/hfml/research/levitation/diamagnetic/)

[6] J Liao and E Shuryak 2006 Strongly coupled plasma with electric and magnetic charges *Phys Rev C* **75** 054907 arXiv:hep-ph/0611131v2

[7] European Space Agency GOCE website: ESA - GOCE - GOCE giving new insights into Earth's gravity. Latest model: http://www.esa.int/esaCP/SEM1AK6UPLG_index_0.html

[8] J M Weisberg and J H Taylor 2007 Relativistic Binary Pulsar B1913+16: Thirty Years of Observations and Analysis arXiv:astro-ph/0407149v1

[9] P Arras, A Cumming and C Thompson 2004 Magnetars: Time Evolution, Superfluid Properties, and Mechanism of Magnetic Field Decay *Astrophys.J* **608** L49-L52 arXiv:astro-ph/0401561v1 doi:10.1086/422337

[10] D Bhattacharya and V Soni 2007 A Natural Explanation for Magnetars arXiv:0705.0592v1

[11] V Kalogera, F Valsecchi and B Willems 2007 Neutron Stars: Formed, Spun and Kicked *AIPConf.Proc* **983** 433-441 arXiv:0712.2540v1 doi:10.1063/1.2900269

[12] M Smith *et al.* 2016 DES14X3taz: A TYPE I SUPERLUMINOUS SUPERNOVA SHOWING A LUMINOUS, RAPIDLY COOLING INITIAL PRE-PEAK BUMP *The Astrophysical Journal* **818** 1 DOI: 10.3847/2041-8205/818/1/L8

[13] S M Adams *et al.* 2016 The search for failed supernovae with the Large Binocular Telescope: confirmation of a disappearing star arXiv:1609.01283v1

[14] U Das and B Mukhopadhyay 2012 Violation of Chandrasekhar Mass Limit: The Exciting Potential of Strongly Magnetized White Dwarfs *IJMPD 21* **11** 1242001 arXiv:1205.3160v2 doi:10.1142/S0218271812420011

[15] D W Gold 2010 Formulation of a Principle Model of Forces

[16] C Rovelli 2016 Reality Is Not What It Seems: The Journey To Quantum Gravity ISBN 978-0-241-25796-8 Penguin Random House UK 136-138