A Dark Matter Model to Unify Gravity and Electromagnetism

Michael J. Underhill
Underhill Research Ltd, Lingfield, UK

Abstract— All fields and potentials in space have energy. The gravitational field and potential are no exceptions. Such energy is a 'super-liquid' having a non-particulate continuous distribution. It is not quantised. Field energy is thus defined as 'dark matter'. Any 'dark' matter has gravitational mass density proportional to energy density according to $E = mc^2$. But dark matter has low inertia. Its inertial mass is deduced to be $< 1/(2\pi)^2 =\sim 1/40$ of its gravitational mass. The gravitational potentials from any two or more objects combine at any point according to newly discovered RSS (Root-Sum-of-the-Squares) 'process capture' rules. This means that the stronger potential partially 'suppresses' the weaker potential. The weaker energy is thus partially suppressed and becomes 'excluded' in the region of stronger energy density from a dominant source. Total energy is reduced and gravitational attraction is thereby created. The 'lost' energy increases according to the inverse square law of two sources. This is the source of gravitational attraction of sources and masses. The gravitational field of a light particle terminates at a finite distance when it drops below the Zero-Point-Energy density of free space. These rules can be shown to apply both to gravity and to electromagnetic energy of any spectral distribution. Gravity and Electromagnetism thus become 'unified'.

1. INTRODUCTION

In previous papers feasible electromagnetic structures for all particles have been proposed [1–4]. These support the propositions that 'Everything is Electromagnetic' and there is 'An Electromagnetic Theory of Everything'. The prime basis for the 'Physical Electromagnetic Model' is the discovery of Electromagnetic (EM) Coupling [1–8]. Paper [9] suggested how this model could explain the ratio of measured stable masses of all the sub-atomic particles in the Standard Model [10].

Paper [8] also proposed that *any* form of energy has a *gravitational* mass in accordance with $E = mc^2$. We should note that this included the energy in fields and distributed potentials of low density particles such as photons and neutrinos [1, 8]. All forms of energy can be expressed as $E = \Phi \times \Psi$, where Φ is potential and Ψ is *substance* (charges, currents and matter-substance). This definition is common to both Gravity and Electromagnetism and therefore is itself a unifying concept.

In paper [8] an EM coupling mechanism was given for the *inertial* mass of particles having a dense central core. In this case inertial mass is defined to be equal to gravitational mass. The 'core-atmosphere' particle model in [8] is assumed as the basis for finding particle stability conditions [9]. The core consists of concentrated 'substance' which creates the surrounding 'atmosphere'.

Low density forms of energy such as heat, light and electromagnetic and gravitational fields are considered to be *dark matter* having a low inertia but with gravitational mass defined by $E = mc^2$. Thus even the fields created by and emanating from any form of 'substance', such as any type of charge, current, matter, or mass, do themselves have energy and mass and therefore are defined also as *dark matter* having full gravitational mass but low inertial mass. Note that particles are predicted to have line spectra with each spectral component having energy E_n and frequency f_n, given by $E_n = hf_n$. By contrast heat and in general dark matter have continuous broadband spectra. (Frequency is regarded as 'the fifth dimension').

Electromagnetic Coupling is now defined both as a trans-impedance $Z_{12}e^{-j\omega\tau}$ with delay τ and as a trans-conductance $Y_{21}e^{-j\omega\tau}$ with the same delay. The delay value is a (new) fundamental physical constant and can be shown to be the origin of the 'inertial mass of any particle [8]. These definitions also apply to mass and gravity as a result of the common definitions: Energy, $E = mc^2 =$ Potential, $\Phi \times$ Substance, Ψ.

This 'dark matter model of gravitation' is based on the observation of 'process capture' where the fields from two sources overlap. When applied to either EM or gravitational fields, the process capture RSS (Root-Sum-of-the-Squares) rule in general causes a reduction in total field energy, and in total mass when two particles (having mass) are brought together. It is this diminution of energy that is the root cause of gravitational attraction. This concept can be extended to further cases, such as small particles in a large (gravitational) field, self-attraction of dark matter, and black holes.

2. PARTICLES IN NORMAL MATTER COMPARED WITH DARK MATTER

Normal (ordinary) matter exists in solid, liquid and gaseous forms. All these are assemblies of particles, atoms and molecules. Figure 1, taken from Figure 2 of [8], shows why any matter made up of particles has inertial mass equal to gravitational mass. Whereas dark matter has no dense particle cores and as a consequence has much lower inertial mass but the same gravitational mass for the same energy. On the basis that electromagnetic self-coupling is $1/2\pi$ dark matter inertial mass cannot be higher than $1/(2\pi)^2 =\sim 1/40$ of its gravitational mass in the case of a dominant spectrum line type particle [8]. For heat energy with a wideband 'white-noise' spectrum the inertial mass can be expected to be less with a guessed limit of $1/(2\pi)^4 =\sim 1/1600$ of its gravitational mass.

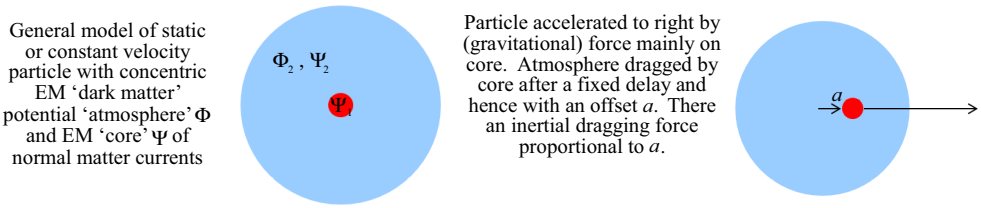

Figure 1: General model of a particle with an explanation for the inertia of normal matter.

In summary, 'dark matter' is any energy that is diffuse and continuous with 'soft' boundaries and contains no dense particles. It inertial mass is much lower than its gravitational mass. The energy of all potentials and fields qualifies as 'dark matter'.

3. PARTICLE GRAVITATIONAL FIELD TERMINATED AT ZERO POINT ENERGY LEVEL BY PROCESS CAPTURE

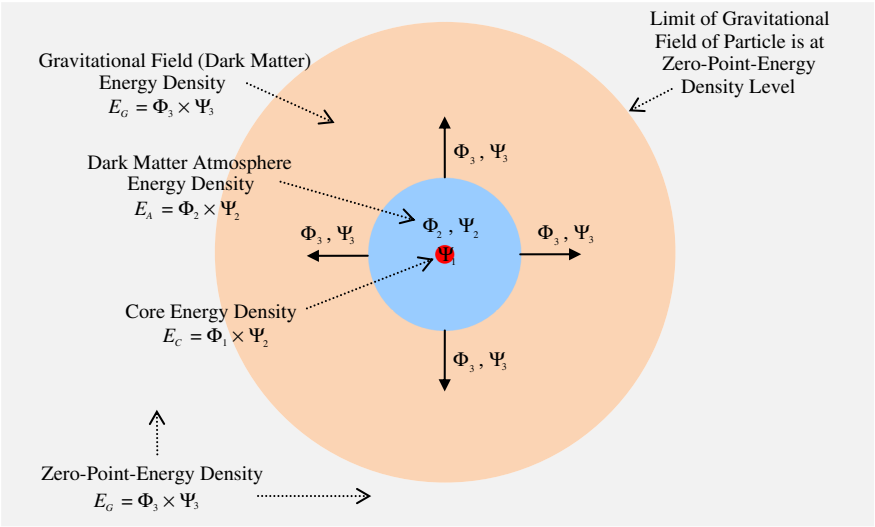

Figure 2: Isolated particle consisting of dense core with finite diffuse atmosphere and surrounded by its own gravitational field energy, extending in density as the inverse square law. The field terminates when it drops below the Zero-Point-Energy (ZPE) level. Both the Atmosphere and the Gravitational Field are Dark Matter. The diagram is not to scale — the radial scale is approximately logarithmic. Ψ is 'substance' density. Φ is potential. E is energy density.

4. PROCESS CAPTURE FOR OVERLAPPING GRAVITATIONAL POTENTIALS

Process capture is a fundamental effect that exists throughout all physics. It was first discovered in measurements of the radiation and loss resistances of the multiple radiation modes of small tuned loop antennas [11] are thereafter exploited in [1–9] and [12–15]. The key feature is that coupled processes overlapping and occupying the same space combine according to the Root-Sum-of-the-Squares (RSS) energy conserving law. It is a 'combination and capture' law where the

stronger process 'captures' and suppresses the weaker process. In some cases the energy conservation requirement may involve the conversion of energy to a different type or form [14].

A gravitational potential or field is a 'process' that fills space with energy usually with an inverse square law of distance from its source. For two spaced sources there is an overlap boundary at which the gravitational energy densities A and B are equal. Either side of this boundary the stronger energy density suppresses the weaker according to the Root-Sum-of-the-Squares (RSS) 'process combination and capture rule'. Essentially it is a power/energy conserving process. Two unequal ($A > B$) energy densities coupling in a finite volume are combined by the Root-Sum-of-the-Squares (RSS) rule as shown in (1) and where RSS combination is indicated by the symbol $\oplus$:

$$A \oplus B = \sqrt{\left(A^2 + B^2\right)} \approx A + B^2/A \to A \tag{1}$$

Thus 'process capture' causes the weaker component to be 'suppressed' by the ratio of the weaker component to the stronger. On the other side of the boundary A and B in (1) are interchanged. The excluded energy E_X is

$$E_X = A + B - \sqrt{\left(A^2 + B^2\right)} \tag{2}$$

At the boundary $A = B$ and E_X has a maximum value of $A(2 - \sqrt{2})$ or a 29.3% exclusion of energy.

At a short distance either side of the boundary either A or B is substantially suppressed and energy of the weaker component becomes almost totally excluded. For large masses this exclusion of energy process becomes the classical gravitational force law. This analysis was originally used for the energy coupling of the spurious components that can appear in an oscillator spectrum [15].

5. ATTRACTION BY EXCLUSION OF GRAVITATIONAL ENERGY AND ZERO-POINT-ENERGY LIMIT

Figure 3 shows four examples where two particles are attracted to each other whenever some of their overlapping gravitational energy becomes 'excluded'. The amount of excluded energy is

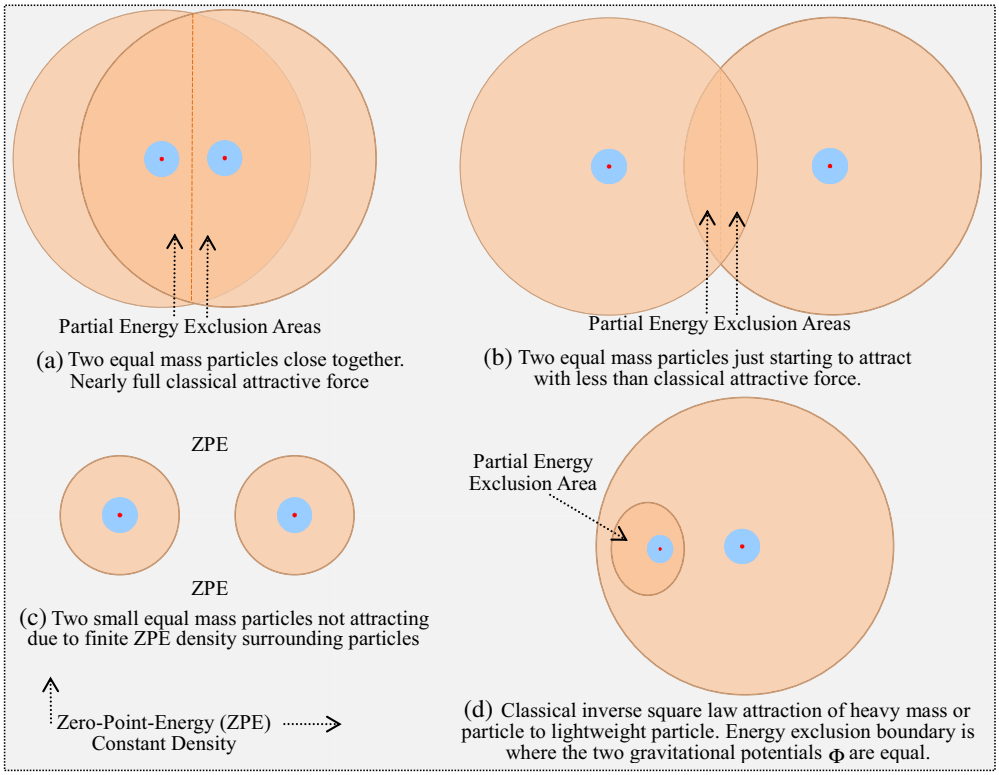

Figure 3: Four cases of gravitational attraction. The attractive force is from energy exclusion where two gravitational potentials/fields try to occupy the same volume in space. The reduced energy is translated into a force. 'Process capture' causes energy exclusion. The weaker energy is suppressed according to the RSS rule.

proportional to a force between the two particles of a pair. The classical 'work done by a force' principle can be used to calculate the force. The amount of energy 'excluded' can also be estimated by integrating the RSS combination Equation (2) to a sufficient distance either side of the 'equal energy boundary' line. Because the RSS process capture and suppresses the weaker component, the required integration distance is not excessive. In many cases exact analytic solution is feasible. This is always much faster than a Finite Element numerical solution [16].

Of particular note in Figure 3 is the use of the novel proposition that the Zero-Point-Energy (ZPE) of (the ether of) free space is a lower limit of the gravitational potential and field and therefore to the gravitational attraction of particles. See for example (c) in Figure 3. It would be a nice experiment to try to measure and confirm this directly.

6. CONCLUSIONS

Fields and potentials in space have energy. This energy is in the form and nature of 'dark matter'. Gravity and Electromagnetics (EM) both comply with these two propositions/assertions. In this way gravity and EM may be 'joined up'.

Energy exclusion where gravitational potentials from different sources overlap is what creates gravitational attraction. The magnitude of the excluded energy at any point can be calculated from suppression/reduction of total energy in accordance with the RSS (Root-Sum-of-the-Squares) process combining rule.

The existence of the Zero-Point-Energy (ZPE) of (the ether of) free space provides a distance limit to gravitational attraction (of small particles).

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