



HAL
open science

The GeometroDynamic Model (GDM) of Reality in 80 THESES

Shlomo Barak

► **To cite this version:**

Shlomo Barak. The GeometroDynamic Model (GDM) of Reality in 80 THESES: A Realization of Einstein's Vision. 2018. hal-01524357v2

HAL Id: hal-01524357

<https://hal.science/hal-01524357v2>

Preprint submitted on 21 Sep 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

The GeometroDynamic Model (GDM) of Reality in 80 THESES

A Realization of Einstein's Vision

Shlomo Barak

Taga Innovations 16 Beit Hillel St. Tel Aviv 670017 Israel

Corresponding author: shlomo@tagapro.com

ABSTRACT

In this document we summarize, in 80 THESES, the ideas and results of the GDM that realizes Einstein's vision. The GDM appears in the HAL journal as 18 separate papers, submitted from Nov 2016 to Nov 2018.

THE CURRENT PARADIGM

The current paradigm, despite its excellent theories, faces many obstacles. Many principles remain unproven, attributes of elementary particles cannot be derived and calculated, and mysteries are un-resolved. This situation results from the lack of a deeper theoretical layer.

THE GDM

The missing theoretical layer is the GeometroDynamic Model of Reality (GDM). The GDM provides answers as to what are: **charge, elementary particles, inertia (mass), gravitation**, and relates to additional fundamental subjects. The GDM does not, at large, contradict the paradigm; it simply serves as a realistic and tangible deeper theoretical layer.

GDM RESULTS

Some results, published in the Barak papers, are presented here. The current foundations of physics, including the Standard Model and String Theory **fail** to provide such results.

MASSES OF THE ELEMENTARY PARTICLES

Electron/Positron Mass

$$M_e = \frac{s^2 \sqrt{2}}{\pi(1 + \pi \alpha)} \cdot \sqrt{G^{-1} \alpha \hbar c^{-3}}$$

For the electron/positron charge, which is a white/black hole, $s = 1$ ($[s^2] = L^2 T^{-2}$) is light velocity at the event horizon, as the far-away observer measures [2].

$$M_e (\text{calculated}) = 0.91036 \cdot 10^{-27} \text{ gr}$$

$$M_e (\text{measured}) = 0.910938356(11) \cdot 10^{-27} \text{ gr}$$

A dimensionality check: $[G^{-1}] = ML^{-3}T^2$ $[\alpha] = 1$ $[\hbar] = ML^2T^{-1}$ $[c^{-3}] = L^{-3}T^3$ Thus:

$$M = [s^2 \sqrt{G^{-1} \alpha \hbar c^{-3}}] = L^2 T^{-2} (ML^{-3} T^2 \cdot ML^2 T^{-1} \cdot L^{-3} T^3)^{1/2} = L^2 T^{-2} (M^2 L^{-4} T^4)^{1/2} = L^2 T^{-2} ML^{-2} T^2 = M$$

Muon/Anti-Muon Mass

$$M_\mu (\text{calculated}) = 112.5 \text{ Mev}/c^2$$

$$M_\mu (\text{experimental}) = 105.8 \text{ Mev}/c^2$$

Quarks/Anti- quarks Masses

$$M_d (\text{calculated}) = 9M_e = 4.5 M_e V/c^2$$

$$M_d (\text{measured}) = 4.8 \pm 0.5 M_e V/c^2$$

$$M_{\bar{u}} (\text{calculated}) = 4.5M_e = 2.25 M_e V/c^2$$

$$M_{\bar{u}} (\text{measured}) = 2.3 \pm 0.8 M_e V/c^2$$

Proton/Anti-Proton Charge Radius

$$r_p (\text{calculated}) = 0.8774 \cdot 10^{-13} \text{ cm}$$

$$r_p (\text{measured}) = 0.8768(69) \cdot 10^{-13} \text{ cm}$$

THE EXTENDED GR EQUATION

By defining charge as nothing but curved space and using the Lorentz Transformation we derive the entire Maxwellian Electromagnetic theory, without any phenomenology. This result enables us [4] to extend Einstein's equation of General Relativity (GR) to become an equation that incorporates not only the energy/momentum tensor ($T_m^{\mu\nu}$), but also the charge/current tensor ($T_q^{\mu\nu}$).

$$\mathbf{R}^{\mu\nu} - \mathbf{1}/2\mathbf{R}\mathbf{g}^{\mu\nu} = 8\pi\mathbf{G}/\mathbf{c}^4 \cdot \mathbf{T}_m^{\mu\nu} + 4\pi\mathbf{G}^{1/2}/\mathbf{S}^2 \cdot \mathbf{T}_q^{\mu\nu} \quad (\text{cgs units})$$

where $S = 1$ and $[S] = LT^{-1}$

This equation becomes a macroscopic/microscopic equation of the entire physical reality. Charge and angular momentum are quantized and thus we predict that the curvature of spacetime is also quantized.

In the past, efforts were made to incorporate the energy/momentum tensor of the electromagnetic field in the GR equation. The common denominator of all these efforts to unify gravitation and electromagnetism was the idea that only energy/momentum curves spacetime. In contrast, we show that the right-hand-side of the GR equation expresses curving by angular momentum and charge. Curving by angular momentum is related to frame dragging, whereas charge is simply curved space. Charge and angular momentum are quantized and thus we predict that curvature of spacetime is also quantized. Thus, the creation or annihilation of pairs is supposed to result a double quantum change in curvature.

THE GDM METHOD OF UNIFICATION

The GDM **approach** to the issue of unification, see [17], is as follows: **Instead** of adding spatial dimensions, which we consider a formal, even artificial, way of unification, we have explored the possibility that **all phenomena** have a common denominator. This common denominator is the **geometrodynamics of space**, since in the GDM **space is all there is**. Thus, Riemannian geometry, applied to deformed spaces rather than to bent manifolds [6], becomes our mathematical tool to explore the reality.

THE GDM IDEA

The elastic and vibrating three-dimensional Space Lattice is all there is.

Elementary particles are Transversal or Longitudinal wavepackets of this vibrating space.

THE GDM GOALS

The GDM is a model of the physical reality, in which space is all there is.

This expresses the drive to reductionism.

The GDM explains known, but currently unexplained, phenomena.

This expresses the drive to understand.

The GDM predicts new phenomena that can be confirmed experimentally.

This is the requirement for specificity and falsifiability.

The GDM logically infers laws of physics.

No phenomenology and hence no need to ask where the laws come from.

THE UNITS OF THE GDM

In the GDM **all** units are expressed by the unit of length L (**cm**) and the unit of time T (**sec**) only. A conversion from the **egs system** of units to the **GDM system** enables calculations of known phenomena and of new, GDM-predicted, phenomena.

THE CONSTANTS OF NATURE

$c_T = c$	Velocity of transversal Space vibrations (EM waves)	$[c_T] = LT^{-1}$
$[c_L]$	Velocity of longitudinal Space vibrations ($c_L > c_T$)	$[c_L] = LT^{-1}$
\hbar	Planck Constant	$[\hbar] = L^5 T^{-1}$
G	Gravitational Constant	$[G] = T^{-2}$
α	Fine Structure Constant	$[\alpha] = 1$

Since $c_L/c = \pi/2 \cdot (1 + \pi \alpha)$, see (25) in [2], we exclude c_L from the list and choose α instead.

In the GDM the elastic space vibrates both transversely and longitudinally.

Longitudinal electromagnetic waves have recently been detected [15].

A Constant of Nature is a physical quantity that, measured locally by observers anywhere in space, and with any relative velocity with respect to each other and to space, results in the same value (invariance).

Note, however, that a Constant of Nature is not necessarily regarded as a constant for an observer that observes other regions of space rather than his own. Our discussions on light velocity, both in SR and GR, will clarify this statement.

DIMENSIONALITY IN THE GDM SEE [1], [2], [3], AND [4]

esu	GDM
$[M] = M$	$[M] = L^3$
$[Q] = Q$	$[Q] = L^3$
$[H] = 1$	$[H] = T^{-2}$
$[G] = M^{-1}L^3T^{-2}$	$[G] = T^{-2}$
$[V] = LT^{-1}$	$[V] = LT^{-1}$
$[a] = LT^{-2}$	$[a] = LT^{-2}$
$[F] = MLT^{-2}$	$[F] = L^4T^{-2}$
$[\varphi_E] = QL^{-1}$	$[\varphi_E] = L^2$
$[\varphi_G] = L^2T^{-2}$	$[\varphi_G] = L^2$
$[E_E] = QL^{-2}$	$[E_E] = LT^{-2}$
$[E_G] = LT^{-2}$	$[E_G] = LT^{-2}$
$[U_M] = ML^2T^{-2}$	$[U_M] = L^5T^{-2}$
$[U_E] = Q^2L^{-1}$	$[U_E] = L^5T^{-2}$
	$[\epsilon] = L^2 T^{-2}$

THE GDM 80 THESES

GDM Basics

1. The sole GDM **postulate** is:

The three-dimensional elastic space is all there is.

Necessarily:

The deformation of space is described by a metric.

Space vibrates longitudinally and transversally with only two corresponding velocities.

There is no rest - only motion at the waves' velocities.

Elementary particles at "rest" are circularly rotating wavepackets. Their virtual geometric centers are at rest. When they move the wavepackets describe spirals.

The only one field in the GDM is the tension in space, due to a gradient in space density, see 7.

2. In contrast to the conventional scientific **inductive method** the GDM is a *freely invented* (Einstein's expression) idea. With this idea alone, we can infer logically the laws of physics and construct a physical theory isomorphic to the entire physical reality. The GDM is thus a non-phenomenological theory.

The GDM specificity is also expressed by new suggested experiments and observations, which enable its "validation" or falsification.

3. In the past, space was considered a reference frame, which is meaningless without the presence of material bodies. Today, space is considered a kind of elastic foam or elastic fluid with nonlinear properties.

4. In the GDM **nothing is alien to space**. Space, not yet clearly modeled is, however, the **one and only one** basic physical entity that is needed to construct known physics and beyond.

5. The goal in physics is much humbler than finding the truth - what is truth? In physics we just build tentative models for different aspects of the Reality or for the entire Reality.

6. A model is: A collection of mathematical equations and a geometrical, or other, description that relates to variables and constants.

7. In the GDM there is **only one variable**, which is **space density ρ** . And only two dimensions: L length (cm) and T time (sec).

This space density ρ , of the foamy space lattice, is the number of space cells per unit volume,

$$[\rho] = L^{-3}.$$

The un-deformed (not contracted or dilated) space density is notated ρ_0 .

Examples are:

Electric Charge density is: $q = 1/4\pi \cdot (\rho - \rho_0)/\rho$ $[q] = 1$.

Charge bivalency is clearly noticed.

Curvature of a deformed space, analogous to a bent manifold, is:

$$K = \frac{4\pi}{45} \left(\frac{\nabla \rho}{\rho} \right)^2 \quad [K] = L^{-2}$$

8. The purpose of a model is:

To create a compact language to describe phenomena – Reductionism

To describe causal relationships - Understanding

To predict phenomena that have not yet been observed – Specificity and Test of “Validity”

The GDM is the Ultimate Reductionism.

9. English is our language. Tensor analysis and Riemannian geometry are our mathematical tools. Limitations of language and mathematics are also the limitations of a model, the GDM included.

10. Physical models are **tentative**. Even a single fact that does not comply with the model falsifies it.

Riemannian Geometry

11. Riemannian geometry is the geometry of a n-dimensional **bent manifold**, in a hyperspace with additional dimensions. According to the GDM, it is also the geometry of a n-dimensional **deformed space**.

Hence, the metric of a 3D space zone can be regarded as the metric of a deformed elastic space that occupies this zone. This duality - bent versus deformed - enables us to understand General Relativity (GR) intuitively, and inspires our imagination.

12. Space in GR is considered a continuous manifold, bent (curved) by energy/momentum. Both Einstein (1933) and Feynman (1963), however, considered the option of space being a deformed (curved) continuum rather than a bent (curved) continuous manifold. In the GDM space is a 3D **deformable entity** rather than a bent continuous manifold.

On Space and Time in SR

13. In the theory of Special Relativity (SR) space is considered a **subjective** entity. An observer in an inertial frame observes space and bodies in another inertial frame moving relative to the first frame to be contracted a Lorentz-contraction. In the GDM space is objective and Lorentz-contraction is real (Lorentz).

14. In SR time is also considered a **subjective** entity. An observer in an inertial frame observes “time” and clock rates in another inertial frame moving relative to the first frame to be dilated; a Larmor-dilation. In the GDM, clock rates are objective and Larmor-dilation, which relates to clock rates, is real (Lorentz).

Spacetime in the Paradigm

15. If we do not relate to space and time as independent entities, but as a combined (united) entity termed **spacetime**, the reality returns to be **objective and absolute**. This is a result of the **Interval** being invariant to Lorentz transformation.

The idea of spacetime is beautiful but it is merely a useful mathematical concept, since time, according to the GDM, is not a fundamental attribute of nature.

Time in the GDM

16. Distance and time are considered fundamental attributes of the reality and the result of their division is velocity. We consider, in contrast, distance and velocity as fundamental and **time as merely a practicality.**

17. We do not know what time is, we only know what motion is.

We can build devices called clocks; whose hand movement (or whatever is analogous to the hand movement) describes to us the “passing of time”. Each cycle of the clock’s rhythm, or frequency of its motions, represents a unit of time. As a result, we consider spacetime to be merely a mathematical tool.

The Constant Light Velocity and the Fluid Space

18. Measurements, using different techniques, of **one-way** light velocity, along a given distance, and in different directions in space, yield the same result.

19. Electromagnetic waves, like gravitational waves, are according to GDM, space waves. In the paradigm, however, they have their own “media”, which according to General Relativity (GR) follows the topology of space. The isotropy obtained (**18**) is explained by the measurement instruments being stationary relative to space, and hence the “media”. This is possible if space is confined locally by the Earth and carried along by its linear and rotational motions. This should also be the case for other planets and stars. Thus, to maintain continuity, space must be an elastic fluid.

20. Einstein in his paper (1939) on *stationary systems*, a term that appears in the second postulate of his Special Relativity (1905), identifies these systems as stars, and concludes that space must be a *compressible fluid*, carried by these stars.

This carrying of space by Earth is accompanied by both rotational and linear Frame Dragging, which has been confirmed experimentally.

It also creates local frames for each star, the Earth included. To the CMB (cosmological microwave background) frame we can relate as the global frame for the entire space.

21. Based on theses **18** to **20** the GDM modifies textbook's Special Relativity (SR). See theses **59** to **66**.

Transversal and Longitudinal Space Waves

22. The elastic space vibrates both transversely and longitudinally. Gravitational waves are transversal **space** waves that have been detected recently (2016). The known electromagnetic waves are also, according to the GDM, transversal **space** waves. There is also recent evidence, both theoretical and experimental, for the existence of longitudinal electromagnetic space waves.

23. The GDM, reveals the relation between:

$c_T = c$ Velocity of transversal Space vibrations (EM waves), and the

$c_L = \pi/2 \cdot (1 + \pi \alpha) \cdot c$ Velocity of longitudinal Space vibrations ($c_L > c_T$)

$c_L = 1.6068 \cdot c$, where α is the Fine Structure Constant.

This relation is a key element in our model of the elementary particles, which enables derivation and calculation of their radii and masses.

Electric Charge and Electromagnetism

24. Charge is not alien to space but simply a drastically curved zone of it - contracted space is positive charge whereas dilated space is negative charge.

The current theories are unable to derive the attributes of electric charge, which are: bivalency, stability, quantization, equality of the absolute values of the bivalent charges, the electric field it creates and the radii of the bivalent charges. The GDM derives it all.

25. Electric charge density, is defined based on space density only. This definition alone, without any phenomenology, yields the theory of Electrostatics. Together with the Lorentz Transformation it yields, as an approximation, the entire Maxwell Electromagnetic theory. The non-approximated theory is non-linear, since the field is part of the charge that creates it - like in gravitation. This is the specificity of the theory that resembles QED.

The Masses of Elementary Particles

26. The GDM model of the electric charge and its field enables us, for the first time, to derive simple equations for the radii and masses of the electron/positron muon/anti-muon and quarks/anti-quarks. These equations contain only the constants G , c , \hbar and α (the fine structure constant). The calculated results based on these equations comply with the experimental data of CODATA 2014.

27. The Standard Model of elementary particles, despite its successes, fails to derive and calculate the radii and masses of the elementary particles, and fails to explain what charge is.

Gravitation

28. Masses of elementary particles curve space positively. They also sense (are affected by) curvature, created by other masses, and move accordingly. How, specifically, this occurs, is an open issue in the current understanding, as is the issue of inertia. The GDM elementary particle

model resolves these issues, shows **mass** to be merely a practicality, and proves Newton's First and Second Laws.

29. The contraction (curving) of space by a mass (GR's gravitation) creates a gradient in light velocity. A particle, retaining its angular momentum, senses this gradient, and is forced into **free fall**. This free fall is attributed to the currently unexplained attraction between masses. The GDM proves Newton's Law of Gravitation and the equivalence of gravitational and inertial masses.

30. The spin of an elementary particle causes space torsion. This torsion results in space contraction (positive curving), which is GR's gravitation. Knowing how spin and charge curve space, we extend Einstein's field equation to become an equation of both energy/momentum and charge/current. This equation becomes a macroscopic/microscopic equation of the physical reality. Charge and angular momentum are quantized and thus we expect curvature of spacetime, on the microscopic level, to be also quantized.

Quarks Strong Force and the Issue of Where is Anti Matter

31. The GDM shows that in the universe, the amount of matter exactly **equals** the amount of anti-matter. This suggests (see **32** to **36**) that creation started in a pair-production process.

32. We model a quark (anti-quark) as a topologically twisted positron (electron), which is a circulating longitudinal wavepacket of space contraction (dilation) namely positive charge (negative charge). This explains confinement, and enables us to derive and calculate the masses of the d and u quarks, and the radius of the proton charge. Our results comply well with the experimental data of CODATA 2014. It also enables to prove that the **strong force** is an electromagnetic force.

33. Mesons, baryons, protons and neutrons are made of quarks and hence are made of electrons and positrons. We prove our contention (**31**) by showing that **neutral atoms are constructed of an equal number of topologically twisted electrons and positrons.**

The Photon and the Photom

34. The GDM models the Photon as an oscillation of the space lattice, in a plane perpendicular to its line of propagation at the light velocity c . This plane is vertical or horizontal or rotating clockwise or anti-clockwise. The Photon oscillation occupies a finite volume of space with a defined shape, structure and size. The size is proportional to the photon's wavelength.

35. In the GDM contracted space is positive charge and dilated space is negative charge. The photon oscillation is space contraction and dilation on opposite sides of the line of propagation. Thus, **the photon is a confined oscillating dipole with its resultant field.**

36. This dipole is an oscillation of the **bivalent elementary charges**, which in the pair production process are converted into the stable bivalent elementary charges of the electron and positron (as it is for other elementary particles).

The photon in the GDM holds all the basic features that appear in all the other elementary particles.

37. QED attributes to a photon in its ground state half of the photon energy, half of its linear momentum, and half of its spin. To distinguish a photon from a ground state photon, we name it a **Photom**, which is a photon at the bottom.

In the GDM the “oscillating dipole” photon splits into two types of photoms:

The Positive Photom: An oscillating contraction of space (positive charge), close to the line of propagation. This oscillation is in a plane or in a rotating plane, around the line of propagation.

The Negative Photom: An oscillating dilation of space (negative charge) close to the line of propagation. This oscillation is in a plane or in a rotating plane, around the line of propagation.

38. The GDM considers these photoms as the pair of an “electron” and “positron” of the **Dirac Sea**. Vacuum polarization is due to this Dirac Sea. This way we dispel the need for separate ground states (vacuum states) for the electromagnetic field and for the electron and positron field (Dirac sea). And since all the forces in the GDM are one force, all the ground states are the one, and only one, **Dirac Sea**.

The Photon Quantum Enigma

39. Photons and photoms, condense when they are in phase and disperse when in anti-phase.

Ensembles of closely packed photons or photoms, which oscillate in phase, are the classical EM waves.

Photons of intersecting anti-phased beams are not destroyed - they are **displaced**.

This feature explains the double-slit experiment, for an **ensemble** of photons or photoms (classical EM waves).

40. Spontaneous emission of a photon is **induced emission** by a photom. The density of photoms (the number of space vibrational modes per unit volume) is so high that they condense to create classical waves. This explains the double-slit experiment for **single** photons. Thus, the GDM dispels the need for attributing a dualistic nature to single photons that arrive at the screen one at a time.

The Graviton

41. Gravitational waves have recently been detected. These space waves are predicted by General Relativity. As of today, there is no theoretical proof, or observational evidence, for the existence of quanta of these waves.

42. The GDM models the, as yet hypothetical, Graviton. The argument in support of its existence is that gravitation is quantized, **30**.

The Electron (Positron)

43. In the GDM every space disturbance - a transversal or longitudinal wavepacket - must move at the velocity c_T or c_L , respectively. “Rest” is the case in which a wavepacket moves in a closed loop.

44. The **electron (positron)** at “rest” is a circulating longitudinal dilational (contractional) wavepacket (its charge) with radius r_0 . Its tangential velocity of propagation is c and its radius of circulation is R_0 . This circulation (which is not just a simple circle) is the **origin of spin**. Thus, from a distance, the electron (positron) is observed as if at rest, and from close, as a volumetric dilation (contraction), which is its negative (positive) charge that moves in a circle. This circulation creates the electron magnetic moment, which the GDM calculates classically.

45. In linear motion, at velocity v , the circle of revolution becomes a spiral. If the length of the wavepacket is retained the spiral radius $R < R_0$ (in analogy to a stretched spring) and $r < r_0$. Thus: $R = 1/\gamma R_0$ and also $r = 1/\gamma r_0$. The GDM shows that $r/R = \alpha$ the fine structure constant.

From this alone we derive the **results** of the **Lorentzian Special of Relativity**.

46. The **resultant** electron motion, however, is **always** at the wave velocity c . Thus, a translatory motion at constant velocity v , does not involve any exertion of force. It is also obvious that necessarily $v < c$. **Newton's first law**, and the **second postulate of the theory of relativity**, which implies that no particle or signal can move at a speed that exceeds the light/wave velocity c , are thus a natural result of the GDM.

47. The force to accelerate an electron is needed to curve space more strongly by reducing r (hence increasing the energy). **Newton's Second Law** and **Inertia** are thus explained.

48. The literature distinguishes between the **kinetic energy** $\frac{1}{2} M_0 v^2$, which a particle possesses by virtue of its motion, and its **internal energy** $M_0 c^2$. But in the GDM, the kinetic energy is also an internal energy of deformation (the reduction in size of r and R) that cannot be distinguished from the rest energy. Thus, **mass** is only a **practical term**.

The Electron Quantum Enigma

49. The wavefunction with the electron's linear momentum P and kinetic energy U_k , gives the **probability amplitude** of the electron to be in a specific location at a specific time. This wavefunction borrows its features from those of the electron wavepacket. The wavefunction is associated with a real electromagnetic wave, generated by the electron, which creates a space permittivity wave of photoms. This permittivity wave, which moves ahead at the speed of light, guides the electron and gives the wavefunction its predictive probabilistic nature.

50. In the double-slit experiment, this electromagnetic wave creates the interference pattern that spatially modulates the permittivity of space. We assume that this pattern is retained for some time, determined by a relaxation time not known to us. This time interval should be at least the time for the electron to move from the slit to the screen.

“Dark Matter”

51. Based on General Relativity, we derive theoretically, the Milgrom phenomenological MOND equation that explains Rotation Curves in galaxies. This is made possible by considering the inhomogeneous space expansion - Hubble flow, in and around, galaxies. Our derivation dispels the need for Dark Matter, or modifications of accepted physics.

Foundations of Physics:

52. Physical phenomena and their relevant theories are categorized as Foundations of Physics:

- A.** Electromagnetism (EM) and Quantum Electrodynamics (QED) deal with the bivalent electric charges, photons and their interactions – the Electromagnetic force.
- B.** Gravitomagnetism and General Relativity (GR) deal with masses, gravitons and their interactions – the Gravitational force.
- C.** The Standard Model of Elementary Particles (EPs) and Quantum Chromodynamics (QCD) deal with the EPs interactions – Strong force (The Weak force is electromagnetic).
- D.** Quantum Mechanics (QM) deals with interactions on the microscopic level.
- E.** A Unifying Foundation, that unifies the above four foundations, attempts to present the electromagnetic, gravitational, and strong three forces of nature as one (the weak force is electromagnetic).

The GDM is a unifying foundation.

GDM versus String Theory and Unification

53. String Theory (ST) is considered a Unifying Foundation. This mathematical theory, however, is not isomorphic to reality. It fails to derive and calculate attributes of EPs, leaves important issues open, and does not suggest experiments to “verify” or falsify its contentions.

54. The GDM is also a Unifying Foundation. But, in contrast to String Theory, the GDM derives and calculates attributes of EPs, shows all the forces to be manifestations of density and tension within space, solves important long-standing issues, and suggests experiments to “verify” or falsify its contentions.

55. The GDM serves as an underlying theory to the four basic foundations and does not require any new mathematics or **extra dimensions**.

The elastic **3D space** is all there is; this GDM single postulate gives it all.

GDM Equations

56. The “hidden” variable of the **Navier, Maxwell, Einstein and Ricci Flow equations** is ρ - the space lattice density. In the GDM sources are merely highly deformed zones of space (highly contracted or dilated) whereas their fields are continuations of these deformations, reduced by orders of magnitudes, with only a small deviation from the normal (standard) space density. Thus, the equations of physics express different aspects of the same reality - the geometrodynamics of space.

57. The electron wavefunction, which is the solution of **Schrodinger Equation**, is associated with a real space permittivity wave of photoms generated by the electron. With this idea the GDM proves the de Broglie conjecture.

Note that permittivity is also ρ dependent and so is the Schrodinger Equation.

58. This space permittivity wave of photoms, created by the electron and moving ahead of it, guides the electron to create the interference pattern in the double slit experiment.

Modified Special Relativity (MSR)

59. In the GDM Modified SR – the MSR - the first SR postulate is turned into a definition of the term: A **Law of Nature**.

Definition: A physical law is a **law of nature** if it appears the same in all inertial systems.

60. Instead of SR **postulates** MSR presents **laws**:

First Law: Rays of light move in a “stationary” system with velocity c , relative to this system, whether the rays are emitted by a stationary or by a moving body.

Note that all stars are “stationary” systems. But **it is not clear** how small a material system can be and still serve as a “stationary” system.

61. Second Law: Real velocity of an inertial system (velocity relative to the “stationary” system in which the inertial system resides) is accompanied by a real Lorentz contraction of material bodies and a real Larmor slowing-down of clocks in this system.

62. Two inertial material systems, moving at the same \mathbf{v} , cannot be considered as one combined inertial system, as argued by J. Bell, since space between them is not affected.

63. Space between galaxies is subjected to the Hubble flow whereas the space inside galaxies is not (no cosmological redshift). The CMB resides in the **global** space in and around galaxies and its frame defines real velocity relative to the **global** space.

A **local** “stationary” space is that of any star, the Earth included.

On Relative and Real Velocities

64. Relative velocity is the velocity between any two inertial systems.

Real velocity is the velocity of an inertial system relative to a “stationary” system - global or local.

Real velocity is accompanied by real length contraction and time dilation (the slowing of clocks).

If we only consider relative velocities, length contraction and time dilation are **not real**, as argued by Born.

Lorentz Contraction and Larmor Time Dilation

65. Lorentz contraction is related to material bodies, and **might** also relate to local confined spaces. It is determined by real velocity as suggested by Lorentz (1904), and the GDM.

Larmor time dilation is the slowing rate of clocks, and is determined by real velocity (Note that we do **not** consider time to be fundamental).

Simultaneity

66. We can infer real velocities of inertial frames, by measuring our own real velocity, and our relative velocities to the other frames. Thus, internal observers of all frames will agree whether events occur at the same time or not, despite the fact that their clock rates might differ. Simultaneity is thus absolute, in contrast to textbook SR in which it is relative.

General Relativity (GR) Unification and Quantization

67. Riemannian geometry, the mathematical basis of GR, is the geometry of a n-dimensional **bent manifold**, in a hyperspace with additional dimensions. According to the GDM, it is also the geometry of a n-dimensional **deformed space** (see **11**).

Hence the metric of a 3D space zone can be regarded as the metric of a deformed elastic space that occupies this zone.

68. Consider the linear dimension of a space cell as the local observer's yardstick. Hence, in a space lattice the distance between two points is simply the number of space cells on the straight line between the two points for a Euclidian space and on the geodesic for a Riemannian (deformed) space.

69. We consider a **standard unit of length** as a yardstick with **the same number** of space cells along its length, anywhere in space. A one-centimeter yardstick, for example, contains the same number of space cells anywhere. The linear dimensions of these cells, however, might vary in different zones of space. Hence, the length of the yardstick, as seen by observers in different zones of space, may also vary.

70. We consider a **standard unit of time** as the time that it takes for a light beam to cross a standard unit of length. If the yardstick moves with respect to space we relate as a unit of time to the time it takes for the beam to move back and forth (divided by two). This device is our **standard clock**.

71. Observers in all zones of space, regardless of their space densities, will claim to get the same result measuring light velocity with their standard yardsticks and clocks. Hence, we relate to light velocity as a **constant of nature**.

72. However, each and every far-away observer finds that, according to his measurements and understanding, light velocity elsewhere, where local-observers reside, might vary according to space density in their locality. This is the result of light velocity dependence on the permittivity and permeability of space, which is dependent on space density.

73. The permittivity and permeability of space depend on the density of space. Hence, we should **not** consider light velocity as a constant. We, thus, relate to the “**coordinate speed of light**” of GR as a real speed.

74. A longitudinal wavepacket applies pressure on the space lattice and bends its sides perpendicular to the wavepacket circular or linear propagation direction. This bending is the “Frame Dragging” and it causes the contraction of space around a circulation track. As a result, particles have a minute positive curvature (in addition to their much larger charge curvature) that depends on their Angular Momentum.

75. An elementary particle, beside its direct contraction or dilation of space related to its charge, has an additional mechanism by which it contracts space around itself (creates positive curvature). This contraction, is due to the torsion in space created by the spin of the elementary particle. The additional global contraction of a body is, thus, related to its **inertial mass**.

76. All this proves that **gravitational mass is inertial mass**; a stronger statement than the equivalence principle.

77. By defining charge as curved space and using LT we are able to derive the entire Maxwellian Electromagnetic theory, without any phenomenology. This result enables us to extend Einstein’s equation of General Relativity (GR) to become an equation that incorporates not only the energy/momentum tensor ($T_m^{\mu\nu}$), but also the charge/current tensor ($T_q^{\mu\nu}$).

$$\mathbf{R}^{\mu\nu} - \frac{1}{2}\mathbf{R}g^{\mu\nu} = \frac{8\pi G}{c^4} \cdot \mathbf{T}_m^{\mu\nu} + \frac{4\pi G^{1/2}}{s^2} \cdot \mathbf{T}_q^{\mu\nu}$$

where $S = 1$ and $[S] = LT^{-1}$

78. Charge and angular momentum are quantized and thus we predict that the curvature of space is also quantized.

79. This extended equation (77) becomes a macroscopic/microscopic equation of the **entire physical reality**.

S. Hawking (1987)

80. *However, if we do discover a complete theory... Then we shall ... take part in the discussion of the question of **why it is that we and the universe exist**. If we find the answer to that, it would be the ultimate triumph of human reason.*

תושלב"ע

BARAK PAPERS ON PHYSICS

The papers can be found by inserting Shlomo Barak in the HAL Search:

HAL (<https://hal.archives-ouvertes.fr/>)

RECOMMENDED ORDER OF READING

The essence of electric charge

- [1] S. Barak: On the Essence of Electric Charge, Part 1: Charge as Deformed Space
hal-01401332 (Nov 2016) <https://hal.archives-ouvertes.fr/hal-01401332>

A derivation and calculation of the elementary particles masses:

- [2] S. Barak: On the Essence of Electric Charge, Part 2: How Charge Curves Space
hal-01402667v2 (Nov 2016) <https://hal.archives-ouvertes.fr/hal-01402667>

The nature of inertia – mass is merely a practicality:

- [3] S. Barak: On the Essence of Gravitation and Inertia, Part 1: Inertia and Free Fall
of an Elementary Particle hal-01404143v5 (Nov 2016)
<https://hal.archives-ouvertes.fr/hal-01404143v5>

The unification of gravitation and electromagnetism:

- [4] S. Barak: On the Essence of Gravitation and Inertia, Part 2: The Curving of Space
by an Elementary Particle hal-01405460 (Nov 2016)
<https://hal.archives-ouvertes.fr/hal-01405460>

The strong force is electromagnetic:

- [5] S. Barak: Where is Anti-Matter? hal-01423547 (Dec 2016)
<https://hal.archives-ouvertes.fr/hal-01423547>

Dark Matter as a misconception:

- [6] S. Barak: A Theoretical Derivation of the Milgrom MOND Equation
hal-01471151v3 (2017) <https://hal.archives-ouvertes.fr/hal-01471151v3>

The photon and the quantum enigma:

- [7] S. Barak: The Photon and the Quantum Enigma hal-01423548 (Dec 2016)
<https://hal.archives-ouvertes.fr/hal-01423548>

The electron and the quantum enigma:

- [8] S. Barak: The Electron and the Quantum Enigma hal-01631624 (2017)
<https://hal.archives-ouvertes.fr/hal-01631624>

Quantization of Gravitation:

[9] S. Barak: The Graviton hal-01524355 (2017)

<https://hal.archives-ouvertes.fr/hal-01524355>

The GDM geometry:

[10] S. Barak: On Curved Manifolds and Deformed Spaces hal-01498435 (2017)

<https://hal.archives-ouvertes.fr/hal-01498435>

On time (SR):

[11] S. Barak: Time is not Fundamental - unlike Distance and Velocity. hal-01502214

(2017) <https://hal.archives-ouvertes.fr/hal-01502214>

Space as a special frame (SR):

[12] S. Barak: Space as a Special Frame and Starlight Aberration hal-01498454

(2017) <https://hal.archives-ouvertes.fr/hal-01498454>

A Modification of SR.

[13] S. Barak : The Constancy of One-Way Light Velocity and the Possibility that Space is a Foamy Fluid hal-01625000v2 (2017)

<https://hal.archives-ouvertes.fr/hal-01625000v2>

Electromagnetism; a continuation of [1]:

[14] S. Barak: Electromagnetism as the Geometrodynamics of Space

hal-01498448 (2017) <https://hal.archives-ouvertes.fr/hal-01498448>

The GDM:

[15] S. Barak: A GeometroDynamic Model (GDM) of Reality

A Realization of Einstein's Vision hal-01435685v4 (2017)

<https://hal.archives-ouvertes.fr/hal-01435685v4>

On space density as the only one variable of equations of physics

[16] S. Barak: Equations of Physics and Space Density hal-01625004 (2017)

<https://hal.archives-ouvertes.fr/hal-01625004>

On methods of unification:

[17] S. Barak: The GeometroDynamic Model (GDM) Versus String Theory (ST) hal-01524356 (2017) <https://hal.archives-ouvertes.fr/hal-01524356>

The GDM THESES

[18] S. Barak: THIS PAPER

THE AUTHOR OF THESE PAPERS

Dr. Barak was born and lives in Israel.

He holds a Ph.D. in Physics from the Hebrew University of Jerusalem.

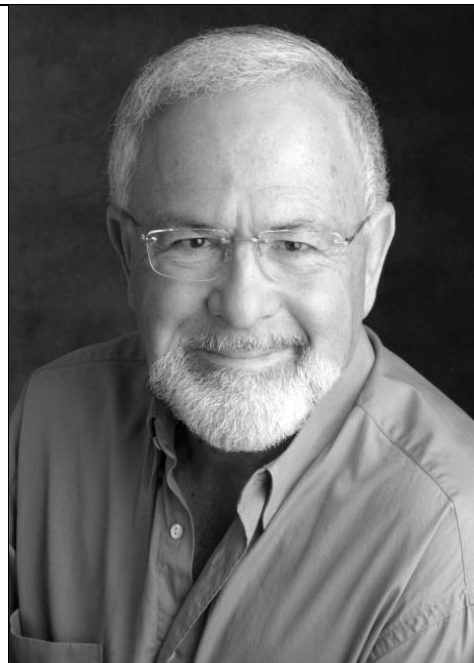
He contributed to the defense of his country.

He contributed to technology and to the economy of his country.

His contribution to science is this collection of papers.

Taga Innovations 16 Beit Hillel St. Tel Aviv
670017 Israel

Corresponding author: shlomo@tagapro.com



Dr. Shlomo Barak