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Remarks to Gravitation Theories

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Abstract: Gravitation is one of the most significant phenomena which attract the attention of humankind for ages. There are two most influential theories of the Gravitation at the current time being (summer 2019), namely, the Isaac Newton's Theory of Gravitation and Albert Einstein's General Theory of Relativity, which includes an explanation of the gravitation. However, both of them are incommensurate — so far — with plenty of quantum theories of the World. In this contribution, there is outlined a strategy for unifying the current approaches to the Gravitation. Namely, that the gravitation/gravity should be considered as a consequence of interaction — a "pinning effect" — of the Spacetime with the non-integral spin of the Fermions, to saturate/add/ the missing part of them. It might induce a deformation/curvature of the Spacetime and known effects on moving material objects, as well as electromagnetic radiation, including light, and other types of radiation, and properties/parameters of transformations of fields, described in the General Theory of Relativity and another. It is Gravitation which modifies/creates Spacetime curvature and its features and not vice versa.

Keywords: Gravitation, theories of gravitation, quantum theories, general theory of relativity, unified theory of gravitation.

Nomenclature

M:	mass.
F_G:	the gravitational force
R:	the radius/distance
$\varkappa$:	the Newton gravitational constant 6.67430×10^{-11} m^3 kg^{-1} s^{-2} [1]

1. Introduction

Isaac Newton revealed and described a phenomenon of Gravitation and related phenomena, like gravitational force, gravitational field, gravitational potential, the motion of objects in the gravitational field, and formulated and verified his utmost famous gravitational law [4-7]:

$$F_G = \varkappa \times M_1 \times M_2 / R^2 \quad (1)$$

The General Theory of Relativity understands Gravitation as a consequence of the curvature of the Spacetime due to/caused by the uneven distribution of mass and energy. Albert Einstein in cooperation with many other physicists and mathematicians formulated the following relation [6, 8-11]:

$$R_{\mu\nu} - \tfrac{1}{2} R g_{\mu\nu} + \Lambda g_{\mu\nu} = (8\pi G/c^4) T_{\mu\nu} \quad (2)$$

where

$R_{\mu\nu}$ is the Ricci curvature tensor,

R is the scalar curvature,

$g_{\mu\nu}$ is the metric tensor,

Λ is the cosmological constant,

G is Newtonian's gravitational constant,

c is the speed of light in vacuum,

$T_{\mu\nu}$ is the stress-energy tensor.

It is noticeable that the General Theory of Relativity [12] does not explain what specifically causes that the unevenly distributed mass makes the Spacetime curved.

For quantum physics, Gravitation/Gravity is supposed to be the weakest of the four fundamental forces of physics [13, 14]. That is why it does not influence significantly atomic and subatomic particle behavior.

On the contrary, it is the dominant force at the macroscopic scale, which governs movements of mass objects — like man-made spacecraft objects, planets, comets, galaxies, and other objects — in space/Universe [15].

Thinking about Gravitation, one should take into account the notion of the Standard Model of particle

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physics which classifies all the particles into two basic groups: Bosons and Fermions [13].

The Fermions are the particles which exhibit properties attributed to matter — all of them the weight in presence of other mass (in the Newtonian understanding) objects [16]. Fermions can be elementary particles, such as an electron, or it can be composite particles, such as the proton and neutrons [16]. They are the key building blocks of everyday matter. They include all quarks and leptons, as well as all the composite particles made of an odd number of these, such as all baryons and many atoms and nuclei [17-19]. Fermions follow the Fermi-Dirac statistics [20], on the contrary of bosons, which obey the Bose-Einstein statistics [16, 17]. Fermions have a half-integer spin differing from bosons, which have an integer spin [16, 21]. In addition to the spin characteristic, fermions have another specific property: they possess conserved baryon or lepton quantum numbers [16, 22]. Therefore, what is usually referred to as the spin-statistics relation is, in fact, a spin statistics-quantum number relation [22].

Fermions obey the Pauli exclusion principle [16, 23]. As a consequence of this fact, only one fermion can occupy a particular quantum state at any given time [16, 20].

While Fermions are usually associated with matter, bosons are generally force carrier particles, although in the current state of particle physics the distinction between the two concepts is unclear [24].

In this article, there is outlined a strategy for unifying the current approaches to the Gravitation, based on a compilation of some facts, which were found and verified in physics and related branches, and which are pertinent in the gravitational phenomena.

2. Methodology

The below-described deliberation is based on these — by myself formulated — fundamental axioms:

§1 Spacetime [25] is a dynamically developing "scene/stage/playhouse/base/matrix", which all the Universe objects, fields, processes, and phenomena have been created, are developing, acting, and existing in.

§2 Spacetime is inherent/participating in all the Universe objects, processes, and phenomena [25].

§3 The Gravitation/Gravity is one of a natural phenomenon which occurs in the Spacetime while/where a mass — in the form of a matter object/objects (which consist of Fermions) are present.

§4 Any mass/matter objects which consists of Fermions interact with other forms and entities ("elastic, electromagnetic, dielectric, magnetic, elastic, etc. fields and other" in Spacetime phenomena/objects") of the Spacetime, resulting in their deformation, curvature, polarization, and other properties modifications and transformations.

§5 The deformation of the Spacetime influences the motion of other mass/matter objects as well as the light [6, 7], or electromagnetic radiation in general, of nuclear particles, and presumably it influences also features of fields, physical, and other objects and phenomena in the Spacetime.

§6 Specifically, the Gravitation exhibits force field attracting the other mass/matter objects in the vicinity of the mass/matter objects (which obtain Fermions, too).

§7 The Spacetime as a seat/residency of all kind of force fields and objects might in principle moderate (e.g., via gauge bosons mediation [26]) the mutual attraction forces among the mass/matter objects.

§8 Some of the composite Fermion particles, like nuclei and atoms, show a space and energy release, while they are undergone to fission [27], and loos a part of their "Newtonian" weight.

These fundamental axioms were used in the following cogitation and outlets.

3. Discussion/Deliberation

In my understanding, Gravitation is a natural phenomenon, which occurs in the presence of mass objects as a mutual attractive interaction among them

mediated by Spacetime. It is Gravitation which modifies/creates Spacetime curvature and its features and not vice versa.

In my previous papers, I have defined and calculated the Gravitational Force Quantum and its Value [2], and the Elementary Gravitational Charge and its Value [3].

In this article, I specify the medium, in which the Gravitation occurs and acts, i.e., Spacetime, and fundamental axioms, which can be refined by following additional remarks:

Remark #1

The legitimacy of the first of the axioms (§1) is based on the (generally accepted) knowledge, that those are Fermions which cause the Newtonian features — namely weight, volume, and related characteristics and behavior - of the matter objects in the Spacetime [16].

In my opinion, there might exist a (so far unknown) interaction of the Spacetime — or one its specific forms — with the non-integral spin of the Fermions to saturate/add/the missing part of them, for example via a kind of gauge boson mediation. It might cause a "pinning effect" of the Spacetime to the Fermions and its deformation.

The broad elasticity, modifiability, and variability of the Spacetime might also mediate the interaction between "Fermion matter" objects, i.e. their mutual ("gravitational") attraction.

These statements inherent a presumption that the Spacetime is actively involved in the processes (interactions, fields, transformations, modifications, changes, etc.) which it is hosting.

When accepting this idea, it could lead us to the interconnection of the traditional gravitational theories with the quantum physics notion [28, 29], which is supposed to be a significant enigma of contemporary physics.

Remark #2

The axiom of the §2 copies the gist of the General Theory of Relativity [12].

In my opinion, there might be added, that it is a Gravitation and its physical manifestations, which can derive/describe/evaluate the stiffness, and related mechanical, and other properties of the Spacetime from its observable curvature.

Remark #3

The axioms of the §3 -§8 extend the presumptions given in the preceding two remarks 1, and 2.

In my opinion, the Gravitational Force Quantum and the Elementary Gravitational Charge mentioned above [2, 3] characterize and quantify the principles of the force field mentioned in §6.

Remark #4

The suggested explanation might serve as a base for the Unified Theory of Gravitation, i.e., as a bridge between the classical theories of gravitation and the Quantum Mechanics.

4. Conclusions

From this my outline of a new theory of the Gravitation/Gravity, I conclude, that:

The gravitation/gravity should be considered as a consequence of an interaction — presumably via gauge boson kind of mediation — of the Spacetime with the non-integral spin of the Fermions, which saturates/adds/saturates the missing part of them.

It might be caused by a "pinning effect" of the Spacetime to the Fermions, and a deformation /curvature of the Spacetime.

It is Gravitation which modifies/creates Spacetime curvature and its features and not vice versa.

The resulting deformation/curvature of the Spacetime might represent/cause/host/spread/mediate the gravitational field around the Newtonian objects (which consist of Fermions).

The resulting deformation/curvature of the Spacetime might also cause the known effects on moving material objects, as well as electromagnetic radiation, including light, and other types of radiation, and properties/parameters transformations of fields, which can be described by Albert Einstein in cooperation with many other physicists and

mathematicians in General Theory of Relativity [12].

The suggested explanation can be understood as a base for the Unified Theory of Gravitation.

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