# Gravity-Superconductors Interactions: Theory and Experiment

**Volume 1**
**eISBN: 978-1-60805-399-5**

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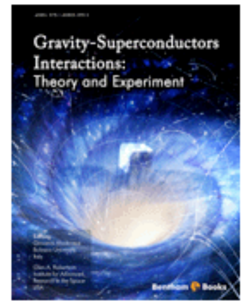


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**Foreword** F
pp.i-iii (1) **Authors:** *Jean-Marie Muylaert, Jochem H. Hauser*
doi: 10.2174/97816080539951120101000i
**Bentham Science Publishers, July 2012**

It is our pleasure to write the foreword for *Gravity-Superconductors Interactions*, the first book to further its goal of presenting to the scientific community the state of theoretical and experimental research concerning the latest results in the emerging field of *physics for novel gravity-like fields* that might represent a new paradigm shift regarding the very nature of gravitation.

We were privileged working together for several years at the European Space Agency (ESA), experiencing first-hand the immense technical difficulties and extreme cost to place relatively small payloads into low earth orbit. Space propulsion is still dealing with the technologies developed in the 50s and 60s of the last century, and the vision portrayed by Werner von Braun in his famous article in Collier's magazine in 1952, entitled *Man on the Moon*, did not become a reality.

The shuttle era is coming to an end soon, and thus NASA is preparing to fly, as soon as possible, its next generation space vehicle, *Ares I-X*, a two stage rocket, which, to some extent, is looking like a modernized version of the Saturn V rocket from the Apollo moon program developed by von Braun in the 1960s. In his recent article T. Jones in Aerospace America, May 2009, is describing clearly the enormous development efforts, the vast infrastructure, and the sophisticated technology required to eventually delivering 25 metric tons of payload into low earth orbit, which is somewhat less than the 29 metric tons of the soon to be retired space shuttle. Despite all the engineering ingenuity, undoubtedly displayed in the design of *Ares I-X*, it is a sobering lesson to learn that these extreme technological efforts will result in a space transportation system of relatively modest capability, but being of highest technological complexity.

The problem is not with the engineering, which even goes beyond the present state of the art. It is linked to the underlying propulsion physics that remains unchanged since the days of ancient Chinese rockets. It is the physical principle of classical momentum conservation that stands in the way of producing an efficient and effective propulsion system. It is the *basic physics* itself that prevents progress. The same holds true in the field of energy generation, especially fusion may be out of reach as was discussed in the recent article by M. Moyer entitled *Fusion's False Dawn* in Scientific American, March 2010. As it seems, only *novel physics* can overcome this barrier.

Therefore, the motivation to further exploring the mysterious nature of gravitation is understandable, aiming beyond Newtonian (Einsteinian) gravity. Gravitation has maintained the interest of researchers at every stage in the history of physics, and it became Einstein's quest to unify gravitation with the other forces since 1916, the year he published his general relativity theory. The still unfinished manuscript on his desk, found after he passed away, clearly showed that he was still elaborating on his lifelong dream, namely to extend the description of the force of gravity as geometry, which had worked so marvellously well in the case of gravitation, to the other physical interactions. The *geometrization of physics*, i.e. associating a metric tensor with each physical interaction, still is an open question, and it remains to be understood, if and how this beautiful principle can be extended to encompass all the other forces.

Hence, it should be no surprise that *new theoretical attempts along with experimental work* are presented in this book to continue where Einstein was forced to leave off. The quantization of the gravitational field has been unsuccessful, despite great efforts in this direction. The problem may be that the number of fundamental forces is not known, in other words, there is a *belief that only four forces exist* (strong, weak, electromagnetic, and gravitational force). Perhaps gravity is of more subtle nature than Newtonian gravity, and an interaction between gravity and electromagnetism might exist? At least, the Maxwell equations of electrodynamics and the linearized Einstein field equations, termed Einstein-Maxwell equations, show surprising structural similarity.

New gravitational experiments have been published since 2006, and geometrical theories from the 1950s (for instance by Finzi, Heim, Wheeler) were extended and combined with concepts of modern physics (symmetry, symmetry breaking, London equations, Ginzburg-Landau theory, spacetime as a physical field etc.) and have gained some prominence, trying to explain novel experimental results for extreme gravitomagnetic and gravity-like fields. In his monograph on *Quantum Field Theory*, M. Kaku presents a calculation of the Coleman-Weinberg potential that might be employed to calculate the coupling strength for the extreme gravitomagnetic fields. Most recently, as pointed out by A. Zee in *Quantum Field Theory in a Nutshell*, gravity might be the square of two spin 1 fields (it should be noted that particles of spin 1 can be described by Yang-Mills fields), an idea that also might be applicable in the explanation of the experiments on extreme gravitomagnetic fields that are 18 orders of magnitude larger than those predicted by general relativity, and, if confirmed, are outside general relativity. These and other exciting ideas are presented here to the reader, and might shed new light on the nature of gravity as well as the number and type of fundamental forces that exist in Nature.

Novel theories on the geometrization of physics should provide new statements and propositions that unmistakably should lead to recognizable facts, which should, for instance, occur from the existence of extreme gravitomagnetic and gravity-like fields observed at cryogenic temperatures, rather than by speculation or chance. As Einstein felt, the most important objective of any theory is to comprise as few and basic elements as possible without contradicting physical experience in conjunction with practical applications. For example, as presented in this text, a relationship between the different phenomena of electromagnetism and gravitation might have been discovered. Any novel theory must be verifiable by laboratory experiments or astronomical observations. In order to verify a theory, it must provide a procedure how measurable information can be extracted. Since experiments do not produce physical principles, any novel theory must produce meaningful forecasts and also be falsifiable.

According to *Dirac's dictum*: a special regulator of a theory that reflects quality is its beauty. Einstein's theory of general relativity is an example of such a theory. The successful geometrization of physics combined with proper symmetries (group theory) would fit this picture as would the experimental generation of gravity-like fields at cryogenic temperatures by symmetry breaking.

In this book, these two important topics are addressed and discussed from various points of view. Needless to say, beauty cannot be the sole yardstick for the correctness of a theory or physical phenomenon, and there is always the danger that, for instance physical models are invented to fit an experimental situation. An example to be remembered are the (non-existing?!) gravitational waves measured by Weber. It is of utmost importance that other laboratories verify any discovery before it can be claimed as valid. Verifying gravitational experiments is not an easy endeavour since highly sensitive devices have to be produced and utilized at cryogenic temperatures, often at liquid Helium temperature. Even if experimental findings or theories eventually cannot be verified, one should not denounce the serious experimenter or theorist for failure, since the history of science has shown that every step forward is a complicated venture. Needless to say that all programs for novel theoretical models initially contain many unclear points, to say the least. But this is true even for established theories. The theory of general relativity has unified gravity with inertia. The equation of motion is for material points moving along geodesics. General relativity interprets gravitation in terms of curvature of spacetime that is, the homogeneity and isotropy of spacetime are violated. Energy and momentum conservation are valid only in flat spacetime. Since gravitational waves require the full nonlinear Einstein field equations, the superposition principle does not seem to hold, in contrast to electromagnetic waves. This would be true only in the weak field limit.

Recently a number of important and interesting experimental results on gravitomagnetic and gravity-like fields, *generated in the laboratory*, have been obtained. Gravitational experiments are notoriously difficult as can be seen from the fact that the physics of gravitational wave astronomy, despite the early efforts of J. Weber starting out in 1969, is still not an established fact.

As was pointed out by the well-known theoretical physicist Richard P. Feynman in his now famous lecture *There's Plenty of Room at the Bottom*, given already in 1960, and published in the journal *Engineering and Science* (February 1960), there occur numerous strange phenomena in the complex situations of solid-state physics. He prophetically foresaw an enormous number of technical applications that could arise from such physics. He also mentioned Kammerling Onnes, the pioneer of low temperature physics and superconductivity. Why should it not be possible that a combination of low temperature and solid state physics could lead to strange phenomena and, this is the most important point, to a large number of technical applications, but this time in the field of gravitational engineering? This is what this book is all about.

Finally, in order for science to progress, both theorists and experimenters have to be willing to take a certain scientific risk that is, *getting off the trodden path*. If a blind alley is met, the courage to reverse one's direction of research is required. If, however, ideas of novel gravitational fields at cryogenic temperatures turn out to be true, the new scientific age of gravitational engineering might have begun. It also would mean that famous string theory is not the answer or, at least, not the complete answer, and thus will not reveal the secret of the Universe.

Whether or not this book is telling the final scientific truth, or even stands for a paradigm shift cannot be decided at this moment. Nevertheless, we are convinced that substantial benefit for the reader does come from it.

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# Chapter 11
# Emerging Physics for Gravity-Like Fields

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Based on theoretical ideas under development since 2002, termed Extended Heim Theory (EHT), as well as experiments performed at AIT Seibersdorf, Austria since 2006, it is argued that there is evidence for the *existence of novel gravity-like fields* and thus also *different types of matter*. These gravity-like fields are not described by conventional Newtonian (Einsteinian) gravitation, *i.e.*, by the accumulation of mass. Instead, under certain conditions, they should be producible in the laboratory by small ring or disk shaped masses rotating at cryogenic temperatures. *EHT*, in describing these novel fields, postulates six fundamental physical interactions, three of them of gravitational nature. The two additional gravity-like fields may be both attractive and repulsive. It is further argued, based on both *EHT* and experiments that these gravity-like fields are outside the known four physical fundamental forces, and may result from the conversion of electromagnetic into gravitational fields. The gravitomagnetic effect of these fields is found to be some 18 orders of magnitude larger than classical frame dragging of General Relativity. This fact seems to be in accordance with recent experiments performed at AIT Seibersdorf. A non relativistic semiclassical model will be presented as an attempt to explain the physical nature of the novel gravity-like fields. There seems to be a special phase transition, triggered at cryogenic temperatures, responsible for the conversion of electromagnetic into gravitational fields. The features of the six fundamental physical interactions are utilized to investigate the potential of the novel gravity-like fields for propulsion purposes as well as energy generation.

## 1. PHYSICS OF GRAVITY-LIKE FIELDS

Physics, as we know it, is based on the belief of the existence of exactly four fundamental forces. There are two long range forces (interactions) electromagnetism and gravitation. Gravitation is believed to be always attractive, while electromagnetism can be both attractive and repulsive. The bosons that mediate the force between the charged particles that is, particles having mass and/or electric charge, are the hypothetical graviton and the photon, respectively. The other two interactions are the weak force ($\beta$ decay) and the strong force (atomic nuclei), which are of short range, *i.e.* their range is about $10^{-15}$ $m$. The two cornerstones of modern physics, general relativity and quantum theory, are predicting highly different magnitudes of the energy of the vacuum, whose ratio is about $10^{120}$, which means the error is in the exponent. This might be an indication that physics as it is understood at present is not complete and has to be complemented by novel concepts in the form of additional interactions.

Based on ideas, first proposed by Heim in the late 1950s, a so called poly-metric tensor has been constructed, the authors [25, 24, 9, 10, 20, 50, 26, 23]. In this article the main physical concepts

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leading to the proposed six fundamental forces are presented, the details can be found in. These theoretical concepts are termed *Extended Heim Theory* (*EHT*), though *EHT* does not have reached the status of a theory, but should be conceived as a *phenomenological model* to explain the existence of the six fundamental forces. These concepts demand two additional gravity-like fields that may be both attractive and repulsive originating from an interaction of electromagnetism and gravitation as well as new types of matter. Therefore, there should exist six fundamental interactions, three of them of gravitational type. It was quite unexpected when in 2006 experiments were published on the existence of gravity-like fields by Tajmar *et al.* [11-13] performed at AIT (Austrian Institute of Technology) and in 2007 by Graham *et al.* [14]. Also, the NASA-Stanford Gravity-Probe B experiment might have been subjected to these gravity-like fields, see below. These novel fields, *if confirmed*, may have the potential to serve as a basis for a completely different technology on transportation, as well as energy generation.

Hence, it is of great interest to obtain at least a heuristic understanding of the underlying physical phenomena and to establishing rules for the scaling of the gravitational effects that are of non Newtonian type. In this article we consider possible applications to propulsion, but the concepts can be directly employed to any type of transportation and might also aid in the stabilization of fusion plasmas. The physics of space flight is based on the century old rocket equation that is an embodiment of the conservation of linear momentum. As a consequence, chemical rockets, which are the most powerful propulsion systems of today, are flying fuel tanks. In the following paragraph, a brief discussion of the advanced concepts for space propulsion is presented. It should be noted, however, that all of the physical principles presented have been known since the 1950s, but no significant progress regarding their technical realization was made [1].

### 1.1 Recent History of Gravity-Like Field Experiments

During the last two decades, numerous experiments related to gravity shielding or gravitomagnetic interaction (coupling between electromagnetism and gravitation) were carried out. In the 1990s a Russian scientist claimed to have measured gravitational shielding. However, Woods et al. [6] have delivered experimental evidence that these two claims cannot be substantiated. This kind of gravitational shielding does not seem to exist. In 1997, a Japanese free fall experiment using an encapsulated spinning gyro [7] reported differences in free fall time depending on the direction of rotation. The authors concluded that an asymmetry (parity violation) caused the generation of anti-gravity. But the equations of motion for a free falling body in an atmosphere are highly complex, because of aerodynamic lift and drag (pressure drag, friction drag) that also may be time dependent. Although the spinning gyro was encapsulated, it might have transferred angular momentum, for instance, by friction effects, to the free falling body causing a rotation of the body. This rotation would have changed the free fall time. If the gyro had a small geometrical asymmetry, a rotation in one direction (18,000 rpm) might cause a transition from laminar to turbulent flow, and thus may lead to a different transfer in angular momentum, depending on the direction of rotation. Since the authors do not address these possible sources of error, it cannot be decided whether or not this set of experiments is reliable. The experiments were conducted at room temperature.

Hence, the conclusion concerning the above experiments is that they must be considered as incorrect or, at least, inconclusive, and therefore are not considered in our experimental analysis.