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Gravity-Like Fields New Paradigm for Propulsion Science

Jochem Hauser[1], Walter Dröscher[2]

Abstract – *All space transportation systems are based on the principle of momentum conservation of classical physics. Therefore, all space vehicles need fuel for their operation. The physics governing this propulsion principle severely limits the specific impulse and/or available thrust. Only with novel physical principles, providing the proper engineering principles for propellantless propulsion, can these limits be overcome. The concept of gravity-like field propulsion represents such a novel principle. These fields would not be generated by the movement of extremely large masses (e.g., planets or stars). Instead, devices working similar to electromagnetism would be producing gravitational acceleration fields. The novel physical principle behind these devices stems from their direct interaction with the surrounding spacetime field. Current theoretical and experimental concepts pertaining to the physics of gravity-like fields are discussed together with recent experiments of producing extreme gravitomagnetic fields, performed at the Austrian Institute of Technology (AIT). The fundamental theoretical concepts of the Poly-Metric Tensor approach, PMT, are presented in a non-mathematical way, and, by further applying its physical concepts, it is argued that, in contrast to the circumferential gravity-like field observed in the experiments at AIT, axial gravity-like fields parallel to the axis of rotation of the cryogenic disk might be producible, strong enough for general propulsion purposes.* ***Copyright © 2011 Praise Worthy Prize S.r.l. - All rights reserved.***

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Nomenclature

ν_{gp}^0	Two types of neutral gravitophotons (gravitational gauge boson)
$\nu_{gp}^+ + \nu_{gp}^-$	Positive (attractive) and negative (repulsive) gravitophotons (gravitational gauge bosons)
ν_D	Dark matter neutrino, 3.23 eV
ν_g	Graviton (gravitational gauge boson, attractive)
ν_q	Quintessence particle (gravitational gauge boson, repulsive)
ω_I	Angular velocity of imaginary electrons
a_0	Acceleration parameter of Milgrom 10^{-10} m/s^{-2}
$\mathbf{B}_G$	Gravitomagnetic field vector from real moving masses
$\mathbf{B}_{gp}$	Observed gravitomagnetic field vector
$\mathbf{E}_G$	Gravitoelectric field vector from stationary masses
$\mathbf{E}_{gp}$	Gravitoelectric field vector from gravitophotons
G	Gravitational constant comprising three parts, G_N,G_{gp},G_q
G_N	Newtonian gravitational constant, (mediated by graviton, attractive force)
G_{gp}	Gravitational constant for gravitophoton interaction = $1/67^2 G_N$, this type of ravitation is both attractive and repulsive
G_q	Gravitational constant of quintessence interaction, repulsive, $10^{-18}\times G_N$
$g_{\mu\nu}$	Component of metric tensor as in GR, m;n = 0;1;2;3
$g_{\mu\nu}(H_\ell)$	Metric tensor of Hermetry form H_ℓ, ℓ = 1;…16
g_{gp}	Gravitophoton acceleration (in contrast to gravitational acceleration by gravitons)
H^8	Heim space, eight-dimensional internal space attached to each point of spacetime
H_ℓ	Hermetry form (metric subtensor from double coordinate transformation), ℓ = 1; ...16
m_D	Dark matter particle, 80.77 GeV
m_e, m_p	Electron and proton mass, respectively

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$O(8,q)$	Group structure of all 28 messenger bosons where q denotes the set of quaternions
$O(8,q)$	Group structure of all 28 elementary fermions where q denotes the set of quaternions
$O(8,q)$	Symmetry group structure of 15 Hermetry forms that describe the physically possible particle families and fields
R	Distance of a star from the galactic center
R^3, T^1, S^2, I^2	Subspaces of internal space H^8
v	Speed of star about center of galaxy
v	Circumferential velocity of disk in axial field experiment

I. Introduction

If any anti-gravity device is ever to be developed, the first thing needed is a new discovery in fundamental physics - a new principle, not a new invention or application of known principles, is required.

A.V. Cleaver: Electro-Gravity: What it is or might be Journal of the British Interplanetary Society, Vol. 16, 1957 [1] .

The Wostok mission fifty years ago, on 12 April 1961 with *Juri Gagarin*, changed the course of both space science and space flight in the U.S. It became painfully clear that the U.S. had fallen behind the Soviet Union. The space program initiated by President Kennedy brought the U.S. back on track. Within a decade, as promised by *Wernher von Braun*, the U.S. landed a man on the Moon. Since that event, the U.S. space program is gradually fading away. The 40th anniversary of the Moon landings has come and gone, but the future of humans going back to the Moon looks grim, not even considering a Mars mission, which seems next to impossible. In combination with the ***high risk aversion of U.S. and European space agencies***, these programs will remain paper studies for an indefinite period of time.

The ***technical problem*** is inadequate propulsion. Space propulsion is stuck with the technologies developed in the 50s and 60s of the last century[1], and the vision portrayed by von Braun in his famous article in Collier's magazine, entitled *Man on the Moon* [2], did not become a reality. Furthermore, the space shuttle era came to an end with Altantis STS-135 landing on 21 July 2011, and NASA should have been preparing its next generation space vehicle. Instead, the foreseen successor *Ares I-X*, a two stage rocket, was canceled. To some extent, it looked like a modernized version of the Saturn V rocket from the Apollo moon program, developed by von Braun in the 1960s. The recent article by T. Jones [3] described clearly the enormous development efforts, the vast infrastructure, and the sophisticated technology required for eventually delivering 25 metric tons of payload into LEO (low earth orbit), which is somewhat less than the 29 metric tons of the retired shuttle. Despite all the engineering ingenuity, undoubtedly displayed in the design of *Ares I-X*, it was a sobering lesson to learn that these extreme technological efforts would have resulted in a space transportation system of relatively modest capability, but of high technological complexity. Due to engineering difficulties and the accompanying high cost, the program was abandoned. The fundamental problem can be **linked to the underlying propulsion principle** that remains unchanged since the days of ancient Chinese rockets. It is the *physical principle of classical momentum conservation* which stands in the way of producing an efficient and effective propulsion system. It is the **basic physics** itself that prevents progress. Therefore, *only novel physics* can overcome this barrier. It can be safely concluded that with present technology and the approved NASA budget, the vision of returning astronauts to the Moon by 2020 clearly is not feasible. Neither will the efforts from private industry change this bleak picture. For spaceflight to mature the only option is to **focus on alternative physical concepts** and start research in this direction. This insight is *not* a new one, as can be seen from the history of industrial activities that took place five decades ago.

More than fifty years ago, an article was written by A.V. Cleaver, Rolls Royce entitled *Electro-Gravity: What it is or Might Be* [1]. In it, a completely novel approach to space propulsion is discussed, based on so called *interaction field propulsion*. Furthermore, it is stated that the Martin Co. (now Lockheed-Martin) actually ran advertisements appealing for scientific researchers interested in gravity. It is further reported that extramural contracts were placed, through their Research Institute for Advanced Study (RIAS), with Dr. Pascual Jordan and Burkhard Heim, at the German Universities of Hamburg and Göttingen. A recent comprehensive and well written biography on the life and scientific work of Burkhard Heim was published by von Ludwiger (in German) [4] . A few years later, the need for advanced space propulsion methods based on field propulsion was discussed again in the books by Seifert, 1959 [5] and Corliss, 1960 [6] as well as by Samaras [7]. In the fifties and sixties of the last century, field propulsion, i.e. space propulsion without propellant, was a domain of intense investigations, but, as is well known, this once active field did not produce any space propulsion technology, and in the following decades research in this area completely subsided. At that time there existed an active scientific program aimed beyond the ever attractive force of Newtonian gravity.

The field saw a revival with the NASA breakthrough physics propulsion program (1996-2001) [8] , which ended without having generated usable practical or theoretical consequences concerning novel space propulsion methods. It became clear from this project that engineering refinement of existing technology as well as known physical laws were not suitable in providing breakthrough propulsion. A review of the state of the art

[1] Since the high risk aversion of these agencies also extends to technological progress, space propulsion most likely will remain in that state. Without embracing risk, ***game changing*** cannot be obtained.

as of 2003 was then given by J. E. Allen [9]. In his final critique, Sec. 5, Allen concludes that the necessary breakthrough has not been achieved.

In order to achieve the goal of propulsion breakthrough and/or green energy generation, *novel physical laws in the form of additional long range forces will be needed*, based on new, additional fundamental scientific principles by extending, but not overthrowing, experimentally verified physical theories. A recent nonmathematical introduction to extreme gravitomagnetic and gravity-like fields as well as their potential technical implications can be found in the well written book by *G. Daigle* [10].

It was much of a surprise when in 2006 [41], credible experimental results were published -compared to those published in the preceding decade - on laboratory produced extreme gravitomagnetic and gravity-like fields. One of the hopeful aspects of these experiments is that until recently gravitation could only be observed, but not experimented on in any controlled fashion. It seems now that, with the advent of these new gravitomagnetic experiments, gravitational-like fields might be producible in the laboratory. In other words, there seems to be experimental evidence that long-range force fields other than Newtonian gravitation and electromagnetic fields might exist.

In this article theoretical concepts describing the physical background of these novel gravitomagnetic phenomena, which would be outside General Relativity (*GR*), are presented. In particular, their repercussions regarding the number and nature of physical interactions as well as hitherto unknown physical phenomena and their relationship to these gravitomagnetic experiments are discussed.

The physical model outlined in this article will be employed to explaining the observed gravitomagnetic phenomena both qualitatively and quantitatively. In addition, their application to establishing an advanced technology based on these novel interaction fields is described. It will be argued that these fields might have the potential of leading to radically different technologies that is, to both propellantless space propulsion and novel forms of earthbound transportation as well as new ways of direct energy generation and also fusion, which might profit from these gravity-like fields.

Scientists and engineers are well aware of conservation laws as well as the second law of thermodynamics. Even if a process obeys conservation laws, the entropy principle (causality) must allow this process to happen. Current space transportation systems are based on the principle of momentum conservation of classical physics. Therefore, all space vehicles need some kind of fuel for their operation. Launch capabilities from the surface of the *Earth* require huge amounts of fuel. Only *novel physical principles*, providing the proper *engineering principles for propellantless propulsion*, can overcome these limits.

The concept of *gravity-like field propulsion* represents such a novel principle, not being based on the movement of extremely large masses, but on the capability of building devices for the generation of gravity-like (i.e. acceleration) fields, in a way similar to electromagnetism. In other words, gravity-like fields should be technically controllable. Since a propulsion system based on these fields has to function in empty space, it must interact with the spacetime field itself. There is no alternative, since spacecraft-fuel interaction is *not* an option.

At present, physicists *believe* [15] that there are four fundamental interactions: strong (nuclei, short range), weak (radioactive decay, short range), electromagnetic (long range), and gravitational (long range). As experience has shown over the last six decades, **none** of these physical interactions is suitable as a basis for novel space propulsion. Furthermore, none of the advanced physical theories (if they represent physical reality at all), like string theory or quantum gravity, go beyond these four known interactions. On the contrary, recent results from causal dynamical triangulation simulations [12], [13], [14] indicate that wormholes in spacetime do not seem to exist, and thus, even this type of exotic space travel appears to be impossible.

However, there seems to be genuine evidence of novel physical phenomena, based on both new theoretical concepts as well as recent experiments that may have the potential for leading to propellantless space propulsion technology, utilizing two novel fundamental long range gravity-like fields that should be both attractive and repulsive. These fields may be the result from the interaction between electromagnetism and gravity.

Gravity-like field experiments at AIT indicated that at very low temperature, a phase transition might occur, generating both extreme gravitomagnetic fields as well as gravity-like fields. Theoretically, the existence of these fields is explained through the generation of novel non-ordinary matter (i.e. virtual particles of imaginary mass), causing an interaction between electromagnetism and gravitation. Gravity-like fields might exist that are both attractive and repulsive. The current theoretical and experimental concepts pertaining to the physics of gravity-like fields are discussed below together with recent experiments of producing extreme gravitomagnetic fields, performed at the Austrian Institute of Technology (AIT). The fundamental theoretical concept termed *Poly-Metric Tensor PMT* approach, was devised by B. Heim in simplified form already in the early 1950s [29]. By applying the physical ideas of *PMT* further, it is argued that, in contrast to the circumferential gravity-like fields possibly observed in the experiments at AIT [42], [45], gravity-like fields acting *parallel to the axis of rotation of the cryogenic disk* may be producible, which should be strong enough for propulsion purposes. The basic experimental setup along with respective technical requirements as well as the resulting acceleration are discussed in the subsequent sections.

II. Novel Concepts for Field Propulsion

II.1. Current Status of Space Propulsion

The current status of space propulsion is characterized by two contradicting scenarios. The first one, chemical