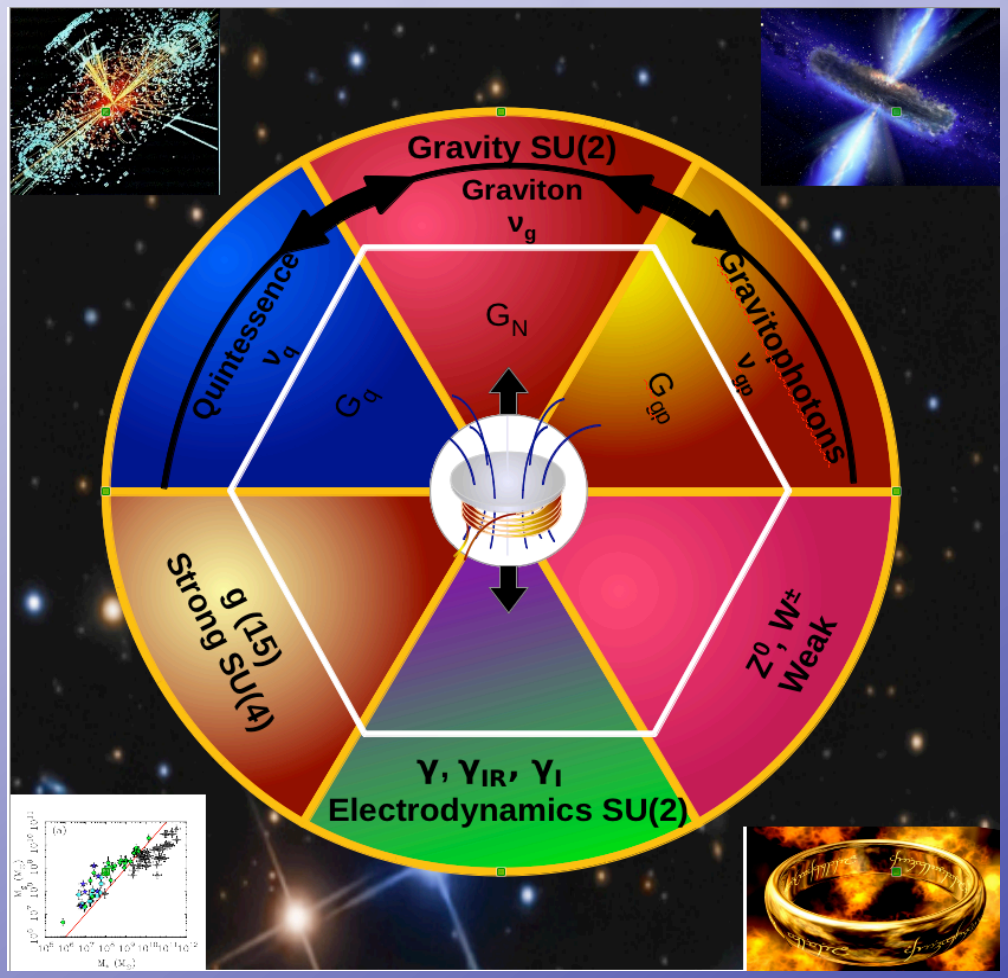
Emerging Physics of

Space Propulsion and Energy Generation



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Meaning of the title picture

The PMT (poly-metric tensor) approach in a nutshell

The *mandala* of the title page shows six fundamental physical interactions, three of them are of gravitational nature. Newtonian gravitation is supposed to be mediated by the graviton and was formulated in 1687. Two novel gravitational bosons are introduced, termed gravitophoton and quintessence particle. The latter represents the dark energy field that, when expressed by Einstein's cosmological parameter $\Lambda(t)$, is written as $\Lambda = \Lambda^+ + \Lambda^-$, where the + sign indicates a contraction (attractive), and the – sign stands for an expansion (repulsive) field with respect to the 4D spacetime manifold. In the present expansion phase of the Universe, $\Lambda > 0$, i.e. the magnitude of the repulsive field Λ^- should be marginally larger than the magnitude of Λ^+. In a later time period of the cosmic evolution, it might well be that the trend reverses, and the Universe starts contracting. In particle terminology the graviton is characterized by ν_g, and the quintessence particle by ν_q for Λ^- as while the antiparticle ν_q is for Λ^+. Furthermore at cryogenic temperatures, a phase change might take place, leading to the generation of gravitophotons, ν_{gp}, signaling the onset on an interaction between electromagnetism and gravitation, leading to completely novel gravitational phenomena in the form of laboratory generated gravity-like fields whose origin is not by the movement of extremely large masses. Thus gravitational engineering might become possible, resulting in a breakthrough for propulsion without fuel and direct energy generation. When an interaction between electromagnetism and gravitation is triggered, the surrounding spacetime field is also involved in the interaction with regard to the momentum and energy balance, i.e. the physical system to be considered does include the spacetime field as well, and conservation principles must be applied to this physical system. Gravity therefore seems to exhibit a much more complex behavior, being both a vector (gravitophoton) and tensor theory (graviton, quintessence). Laboratory generated gravity fields exhibit vector character (spin 1) and are represented by a type of Maxwell like equations, while cosmological fields have tensor character (spin 2), and their potentials propagate almost instantaneously at 2.5×10^{10} c. A total of six gravitational bosons is obtained from the construction of a poly-metric tensor, represented by two SU(2) groups. There should be three different types of matter with positive (Newtonian), negative (dark) and imaginary (transient) signs. Consequently electromagnetism comprises three bosons, the photon γ, γ_{IR}, γ_I representing the EM interaction between real masses, imaginary and real masses as well as between imaginary masses. The strong interaction is characterized by 15 gluons i.e. by group SU(4). Beside the eight real gluons, there exist six additional gluons termed g_{IR}, and one imaginary gluon g_I. The weak interaction is given by group SU(2). However, it should be noted that the total group structure of PMT comprises three O(8,q) groups (q is a quaternion), where $O_H(8,q)$ describes the 8D internal gauge space, termed Heim space, H^8, and the groups $O_F(8,q)$ and $O_B(8,q)$ are describing the fermions and bosons. Each O(8,q) group possesses the subgroup structure O(3,q), O(2,q), O(2,q), U(1,q). Moreover, the eight internal coordinates ξ^a are associated with corresponding physical fields φ^a through the so called non-linear σ–model (Kaku, Jost, Zeidler, see references). Hence, each metric subtensor (termed *Hermetry* form) constructed from the PMT approach can be directly associated with its proper *Lagrange* function. In this way, the *action function S* can be constructed fro each Hermetry form and, in principle, the *Feynman path integral* can be evaluated. With regard to spacetime manifold M^4 with coordinates $(x^\mu) = (ct, x, y, z)$ there should exist a dual spacetime M^{*4} with an imaginary time coordinate, i.e. $(x^\mu) = (ict, x, y, z)$ where the negative mass, i.e. dark matter resides. There is a gravitational interaction between M^4 and M^{*4}.

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A few words about the presenting author

Yesterday

Thinking Big – Can Do

Motto of Los Alamos in the 1940s

Today

Risk Averse Large Organizations

21 st century: withdrawal to paper studies (US and Europe)

For genuine progress in space propulsion ➔➔ *Yesterday*

What types of Gravity?

Gravity in the form of Newtonian gravity is the weakest of the four known fundamental forces, though there is no proof for the existence of exactly four fundamental interactions. In 2006 Tajmar et al. reported on the measurements of extreme gravitomagnetic fields from small Nb rings at cryogenic temperatures that are about 18 orders of magnitude larger than gravitomagnetic fields obtained from GR (general relativity). Cifuolini in 2006 and the NASA-Stanford Gravity Probe-B experiment in Dec 2008 confirmed the Lense-Thirring effect as predicted by GR (gravitomagnetic fields generated by a rotating massive body, i.e. Earth) within some 10%-15%. In 2007 gravitomagnetic fields generated by a rotating cryogenic lead disk were measured by Graham et al. 2007. Though these measurements were not conclusive (the accuracy of the laser gyroscope was not sufficient to produce a standard deviation small enough) their experiment seems to have seen the same phenomenon reported earlier by Tajmar et al., termed parity violation. This means that gravitomagnetic fields produced by the cryogenic rotating ring or disk vary substantially and change sign for clockwise and counter-clockwise directions of rotation. The experimental situation therefore occurs to be contradictory. On the one hand GR has been confirmed while at the same time, there seems to be experimental evidence for the existence of extreme gravitomagnetic fields that cannot be generated by the movement of large masses. Moreover McGaugh Feb 2011 has experiments that clearly contradict GR. If these experiments can be confirmed, they give a clear indication for the existence of additional gravitational fields of non-Newtonian nature. As was shown by the GP-B experiment, measuring gravitomagnetic fields from GR poses extreme difficulties. In GP-B overall measuring time was about 10 months and the mass of the Earth acted as a test body. In contrast, Tajmar et al. measure for a few seconds only and the mass of the ring is some 400 g. Their gravitomagnetic field generated is equivalent to that of a white dwarf. Therefore a novel physical mechanism should exist for the generation of gravity-like fields, which might also provide the key to gravitational engineering similar to electromagnetic technology. Furthermore, gravity-like fields may be the long sought enabling technology for space propulsion without fuel. In addition, a combination of axial gravity-like fields and magnetic induction field might stabilize the plasma of a magnetic mirror.

Six Fundamntal Forces : Three Gravitatioanl Forces

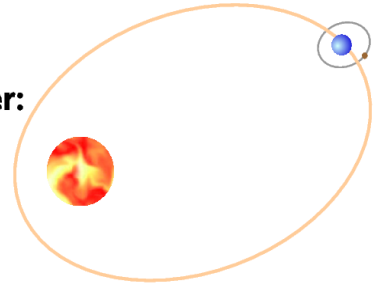
Gravitation

Graviton $H_1(S^2)$: ν_g
attractive +

$G_g = 6.671 \times 10^{-11}\ Nm^2/kg^2$

Ordinary matter:

Solar System
Galaxies
Black holes



Gravitation

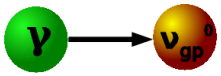
Gravitophoton $H_9(S^2 \times I^2)$: $\nu_{gp}{}^0$
attractive +, repulsive -

$G_{gp} = 1/67^2\ G_g$

Coupling of
Electromagnetism - Gravitation

Non-Ordinary Matter

Dark Matter

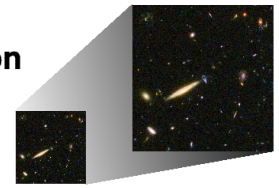


Gravitation

Quintessence $H_{10}(I^2)$: ν_q
repulsive -

$G_q = 4.3565 \times 10^{-18}\ G_g$

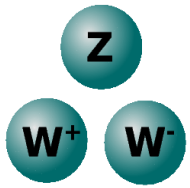
Dark energy
Cosmic acceleration



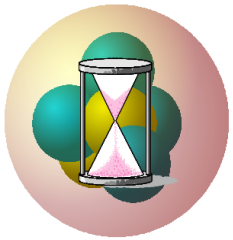
Weak

Bosons
$H_3(R^3 \times S^2 \times I^2)$:

$H_4(R^3 \times T^1 \times S^2 \times I^2)$:

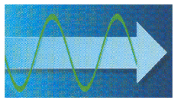


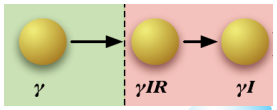
Neutron decay
Beta decay
Neutrino interaction
Stellar fusion

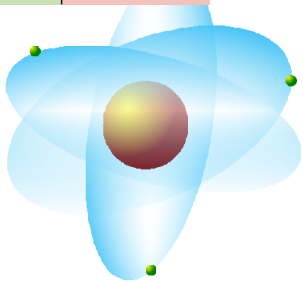


Electromagnetic

Photon $H_2(T^1 \times S^2 \times I^2)$: γ



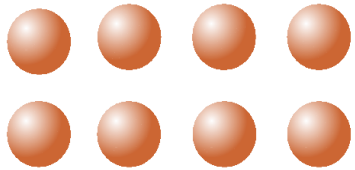




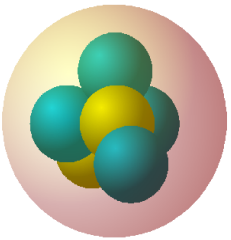
Atoms
Light
Chemistry
Electronics

Strong

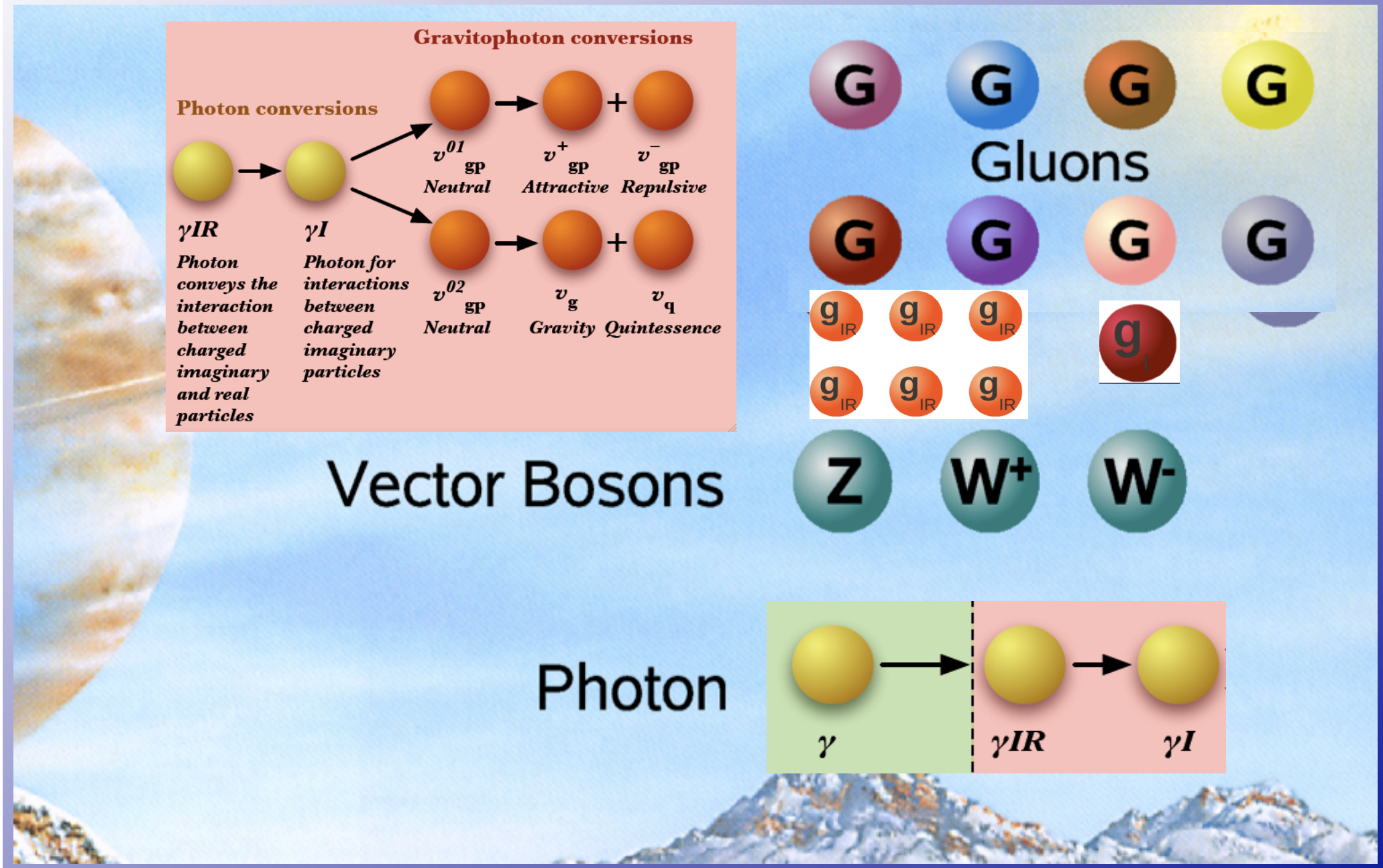
Gluons $H_5(R^3 \times I^2)$: g



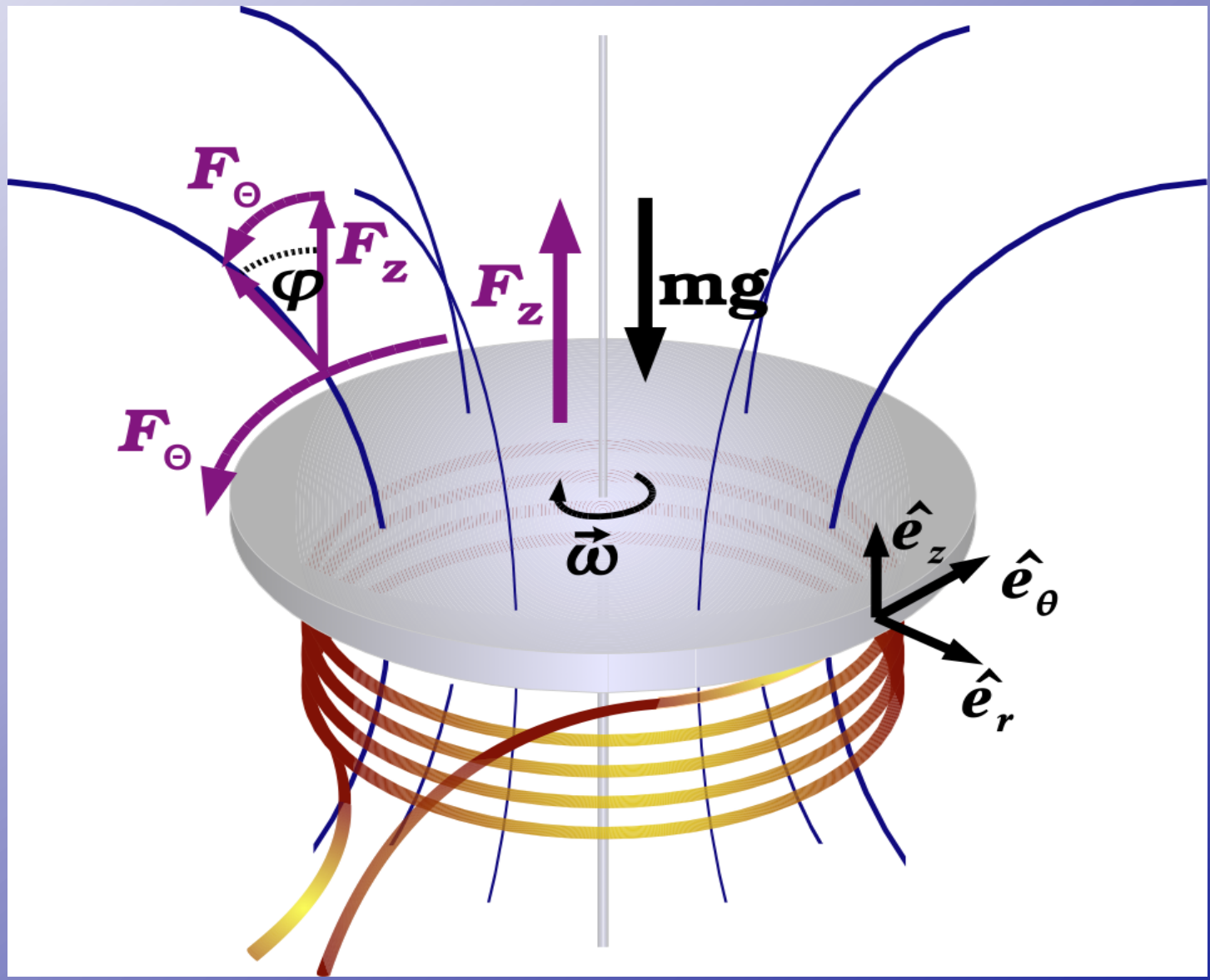
Quarks
Baryons
Mesons
Nuclei



Gauge Particles in EHT



Novel Experiment to Generate Vertical Gravity-Like Force Field



Moyer, M: *Fusion's False Dawn*, Scientific American, March 2010

Direct Energy Generation

Fusion of hydrogen isotopes :
Deuterium -Tritium: started out in the 1950s, T = 150 million degrees
1 gallon of deuterium infused water = 1 supertanker of oil
He is the end product

However, a is reactor needed, *NOT* an ignition facility

Engineering problems: Plasma instability, materials need to withstand high T, high-energy particles, breeding of tritium fuel neeeded, constant operation (years)

Most likely these problems cannot be solved with magnetic fields only

NIF: National Ignition Facility is an enormous laser, $ 4-billion (U.S.)

ITER: fusion from magnetic fields : Tokamak (donut shaped geometry), $ 14-billion (under construction, Cadarache, France)

misleading figure: 500 MW does not mean anything: for how long? this is power, not energy

Consequences for Physics and Technology

- **Recent experiments by Tajmar et al. *dramatic change*: perhaps for the first time *artificial gravitational fields* were generated in the laboratory.**
  However, there is a caveat: G-L Field is in plane of ring only.
  Vertical gravity-like field is needed (Heim experiment).

- **Novel physical theory predicts *six fundamental interactions*, gravitation can be both attractive and repulsive. *EHT was used to anlayze the Tajmar, Graham and Gravity-Probe B experiments and seems to confirm the experimental results.***

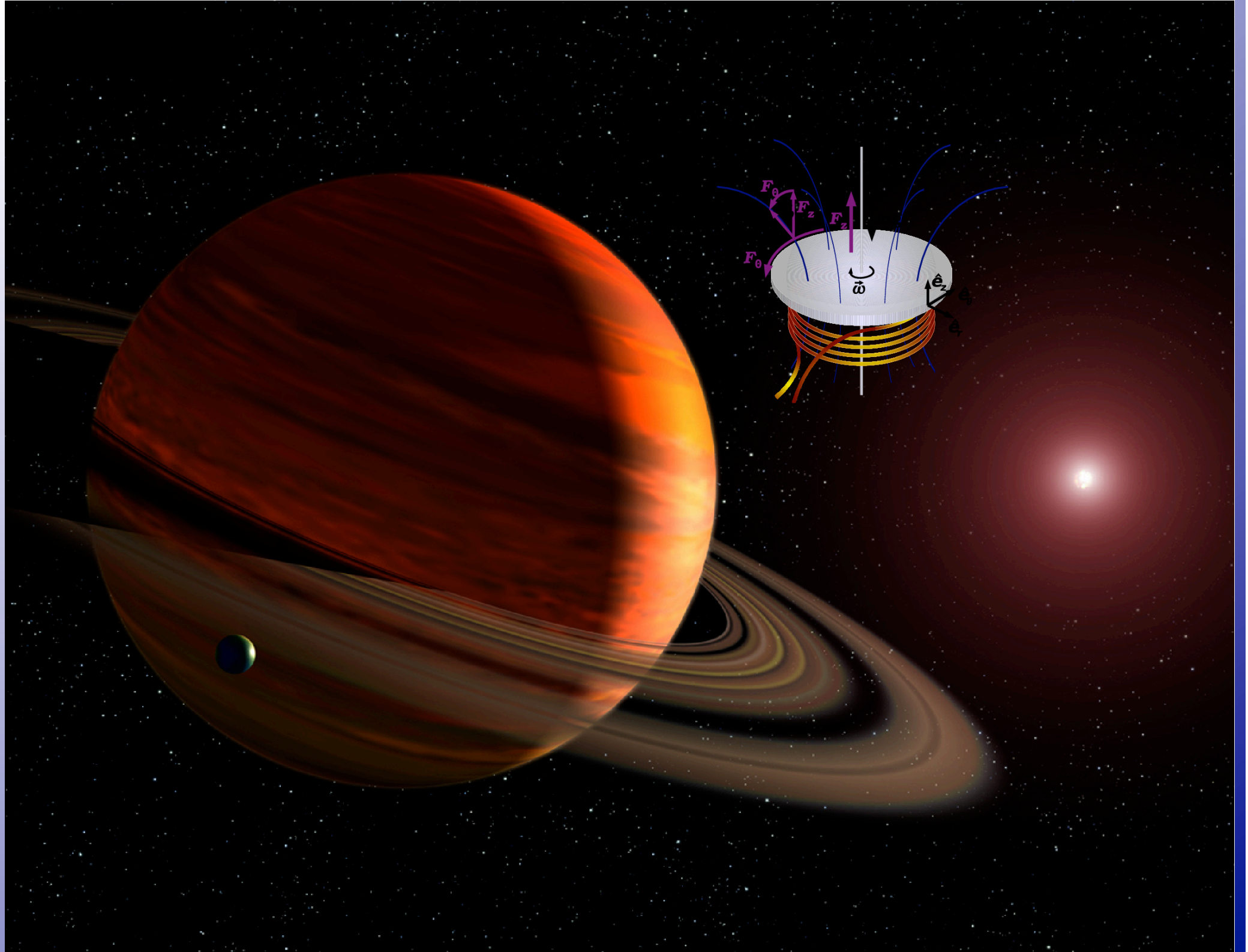
- ***Physics: The group of the standard model* SU(3) x SU(2) x SU(1*) may have to be replaced by* O(8,q) = O(3,q) x O(2,q) x O(2,q) x O(1,q*) with q denoting the field of quaternions and 15, 6, 6, 1 generators. Internal Heim space* $H^8 = R^3 \times T^1 \times S^2 \times I^2$ *subspace structure. Interaction between electromagnetism and gravitation.***

- ***EHT proposes an experiment to generate an G-L Field for propellantless propulsion*. It should be possible to lift a spacecraft for the surface of the earth with gravito-magnetic propulsion. This experiment is not more difficult than Tajmar's experiments.**

- **Can we break the *Light Barrier*? Not in our spacetime, but possibly in hyperspace.**

Future Research and Technology Activities

1. *GM and G-L Fs (Gravity-Like Fields) might have been generated in the lab with relatively low technical effort (2006, 2007, 2008, 2009 Tajmar et al.)*
   - **Independent confirmation (?) of Tajmar's experiments (Graham, July 2007)**
   - **Comprehensive program of G-L F experimental work on larger scales, improved accuracy etc., Gravity-Probe B might have been impacted by large gravitomagnetic fields**
2. *Theoretical analysis (EHT) seems to qualitatively confirm Tajmar's and Graham's experimental findings on GM and G-L Fs*
   - **Research program on the *Physics of Extreme Gravity-Like Fields***
   - **Feasibility study for vertical gravity-like field demonstrator experiment**
   - **Research program for gravity-like field technology (propulsion, transportation)**
   - **Research Program for green energy generation by gravity-like fields**
   - **Materials science research for gravity-like fields**
   - **Many open questions remain: scalability, materials, spacetime fields, origin of matter, existence of hyperspace ?**
3. *Theoretical-Experimental Program*
   - **Joint research program to devise experiment for vertical force**
   - **Joint research feasibility study how to construct and build propellantless propulsion device**
   - **Investigate gravity-like force for energy production purposes (generators, fusion)**


F_θ
F_z
F_z
F_θ
$\vec{\omega}$
$\hat{e}_z$
$\hat{e}_r$
$\hat{e}_\theta$

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