The Ambient Gravimagnetic Field

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BACKGROUND

The objective here is to compute the ambient gravimagnetic field in the vicinity of the Earth and compare it to the gravimagnetic field of the earth. The term gravimagnetic and the associated gravimagnetic values used here are developed and defined in:

<http://mtaonline.net/~hheffner/Gravimagnetism.pdf>
<http://mtaonline.net/~hheffner/GR-and-QM.pdf>

Only an object which is solid can sustain torque free precession. Therefor the earth, and even the earth-moon system, can not sustain torque free precession.

(See: http://en.wikipedia.org/wiki/Precession)

If we assume the precession of the earth is due to torque on the earth by the ambient gravimagnetic field, then, using the precession rate, we can compute the field strength of that ambient field.

GYROS

Let:

a = angular acceleration (a vector)
I = moment of inertia
L = angular momentum (a vector)
omega = angular velocity of precession (a vector)
t = time
Tp = period for one precession rotation
Ts = period for one gyro spin rotation
Q = torque (a vector)
Q_earth = torque on earth from gravimagnetism
w = angular velocity of gyro (a vector)

So:

Q = dL/dt = d(I w)/dt = I a

Q = omega x L

(See: http://en.wikipedia.org/wiki/Gyroscope)

PRECESSION TIME

Tp = (4 Pi^2 I)/(Q Ts)

(See: http://en.wikipedia.org/wiki/Precession)

EARTH

Precession Period: Tp = 25,800 years = 8.142x10^11 sec.
Precession Angular radius: 23 degrees 27 minutes
Mass: 5.985x10^24 kg
Radius: 6378 m.
Rotation period: Ts = 86164 sec.

BASIC GRAVIMAGNETIC VARIABLES

Electric	Gravitational
q	m * i
E	g
B	K
J	J_g
epsilon_0	epsilon_g_0 = 1.192602x10^9 kg s^2/m^3
mu_0	mu_g_0 = 9.329597x10^-27 m/kg
c	c_g = c

Table 1: Gravity-electromagnetism Isomorphism Correspondence Table

The mass of the earth is m_t_earth = 5.985x10^24 kg. The radius of earth is 6371 km. The moment of inertia for a sphere of radius r and mass M is (2/5) M r^2.

For estimating purposes, considering the iron core out to 3500 m, we might assume, by weighed value, the mass is located in a ring of radius 1780 km, rotating once every day, i.e. at 2*Pi*1780 km/day = 129 m/s. The moment of inertia of the earth I is then I = m r^2 = (5.985x10^24 kg)(1780 km)^2, so:

I = 1.90x10^37 kg m^2.

EARTH'S GRAVICURRENT

The gravicurrent is:

$$i\_g\_earth = (5.985 \times 10^{24}\ i\ kg)/day$$

$$i\_g\_earth = 6.927 \times 10^{19}\ i\ kg/s.$$

Note that i in the units here is the imaginary number $(-1)^{(1/2)}$.

GRAVIMAGNETIC DIPOLE MOMENT OF EARTH

The magnetic dipole moment is given by:

$$mu = i\_amps * A$$

The gravimagnetic dipole moment mu_g of the earth's gravicurrent is thus the gravicurrent times the area of the current loop, or $(6.927 \times 10^{19}\ i\ kg/s)(Pi*(1780\ km)^2)$ gives:

$$mu\_g\_earth = 6.90 \times 10^{32}\ i\ kg\ m^2/s$$

TORQUE ON GRAVIMAGNET IN UNIFORM GRAVIMAGNETIC FIELD

Torque on current loop in uniform magnetic field:

A = area of current loop
$mu = i\_amp\ A$ = magnetic moment
$Q = mu \times B$ = torque

The gravitational equivalent:

A = area of gravicurrent loop
i_g = gravicurrent
$mu\_g = i\_g\ A$ = gravimagnetic moment
$Q\_g = mu\_g\ X\ K$ = torque

TORQUE FROM PRECESSION TIME

Given Q the precession (for 90 deg. torque):

$$Tp = (4\ Pi^2\ I)/(Q\ Ts)$$

so solving for Q we have:

$$Q = (4\ Pi^2\ I)/(Tp\ Ts)$$

Where, from above:

Tp = 8.142x10^11 sec.

Ts = 86164 sec.

I = 1.90x10^37 kg m^2.

Q_90 = (4 Pi^2 I)/(Tp Ts)

Q_90 = (4 Pi^2 (1.90x10^37 kg m^2))/
((8.142x10^11 s) (86164 s))

Q_90 = 1.069x10^22 N m

However, the above assumes a 90 deg. angle of precession. Knowing

Q = I * (w x omega)

and that the angle between w and omega is the precession angular radius: 23 degrees 27 minutes, we get

Q_earth = Q_90 * sin(23.45 deg..) = Q_90 * 0.398

Q_earth = (1.069x10^22 N m) * 0.398

Q_earth = 4.26x10^21 N m

AMBIENT GRAVIMAGNETIC FIELD

Given:

mu_g = mu_g_earth = 6.90x10^32 i kg m^2/s

Q_g = Q_earth = 4.26x10^21 N m

and knowing the angle between mu_g and gravimagnetic field K is the precession angular radius: 23 degrees 27 minutes:

Q_g = mu_g X K

we have scalar quantities:

Q_g = mu_g * K * sin(23.45 deg..)

so solving for K:

$K\_ambient = Q\_g /(mu\_g\_earth * 0.398)$

$K\_ambient = (4.26x10^{21} N m) /((6.90x10^{32} i kg m^2/s) * 0.398)$

$K\_ambient = 1.551 x 10^{-11} (i Hz)$

AMBIENT GRAVITATIONAL LORENTZ FORCE ON ORBITAL SPEED OBJECT

Given EM Lorentz:

$F = q (v x B)$

We have the gK equivalent:

$F\_g = m (v x K)$

Given:

$m = 1 kg$

$v = 8050 m/s$ (18,000 mi/hr)

Then:

$F\_g = (1 kg i) ((8050 m/s) x (1.55 x 10^{-11} (i Hz)))$

$F\_g = -1.248x10^{-7} N = 1.272x10^{-8} kgf$

So the lateral acceleration due to moving at orbital speed through the ambient gravimagnetic field is:

$a\_amb = 1.272x10^{-8}$ g's.

Note that this is merely a net value. The translational speed of the earth with respect to the ambient gravimagnetic field has not been established. This value is concealed by the fact the earth and moon system are laterally accelerated at the same rate as any other near bodies moving in realtion to the ambient gravimagnetic field. The ambient magnetic field values are useful for calculating effects on circular motion, however.

EARTH GRAVIMAGNETIC FLUX (K) IN CENTER OF EARTH

The magnetic field in the center a conducting ring radius R and current i_ring is

$$B = mu\_0 * i\_ring / (2 R)$$

Using earth simulating ring radius 1780 km, and gravicurrent

$$i\_g\_earth = 6.927 \times 10^{19}\ i\ kg/s$$

We have the field

$$K\_g\_earth = (9.33 \times 10^{-27}\ m/kg)(6.927 \times 10^{19}\ i\ kg/s) / (2 * 1780\ km)$$

$$= 1.815 \times 10^{-13}\ (i\ Hz)$$

which is only 2 orders of magnitude less than the ambient gravimagnetic field 1.551×10^{-11} (i Hz)!

GRAVIMAGNETIC INTENSITY (H_g) IN CENTER OF EARTH

$$H\_g\_earth = K\_g\_earth / mu\_g\_0$$

$$H\_g\_earth = (1.815 \times 10^{-13}\ (i\ Hz))/(9.33 \times 10^{-27}\ m/kg)$$

$$H\_g\_earth = 1.945 \times 10^{13}\ i\ kg/(m\ s)$$

The gravimagnetic intensity at orbital altitudes at the equator is within an order of magnitude of this value, but reduced.

EARTH GRAVITATIONAL LORENTZ FORCE ON ORBITAL SPEED OBJECT

Given:

$$m = 1\ kg$$

$$v = 8050\ m/s \quad (18{,}000\ mi/hr)$$

Then:

$$F\_g = m\ (v \times K)$$

$$F\_g = (1\ kg\ i)\ (8050\ m/s) \times (1.815 \times 10^{-13}\ (i\ Hz))$$

$$F\_g = -1.461 \times 10^{-9}\ N = -1.49 \times 10^{-10}\ kgf$$

So the lateral acceleration due to moving at orbital speed through Earth's gravimagnetic field is

    a_earth = 1.49x10^-10 g,

or less depending on location. Note, however, the Earth's gravimagnetic field rotates with the earth. It thus has no influence on geosynchronous satellites, for example. The Earth's rotation speed must be subtracted from satellite velocities going west to east, but added to satellite velocities going east to west. This is somewhat irrelevant since the ambient gravimagnetic field dwarfs the Earth's.

The gravimagnetic force is not very observable. Only precise measurements or long term measurements can detect it.

In the center of earth, by the right hand rule, the gravimagnetic field is directed at the North Pole, and the lines of force exit the earth's surface in the Northern Hemisphere. However, the Earth's gravimagnetic field is oriented Southwards in space above the equator, and due to the majority of mass being in the core, it is oriented that direction even under the surface of the earth at the equator. Since mass has positive charge, but both the gravimagnetic field and gravimagnetic charge have a factor of i, the force has a negative sign. This means, at the equator, the direction of the Earth based Lorentz gravimagnetic force is away from the earth for an object traveling west-to-east, but toward the earth for an object traveling east-to-west.

The orbital velocity, V = (G M/r)^0.5, is reduced when the apparent gravity field G M is reduced by the gravimagnetic Lorentz force.

For the same altitude satellites (r fixed), the west-to-east satellite will move slower than the east-to-west satellite, because its apparent value of G M is reduced. This implies that for circular orbits, for the same speed satellites (V fixed), the earth orbit radius will be lower for a west-to-east satellite than for an east-to-west satellite.

Space tethers oriented radially in space above the equator will experience seemingly inexplicable stretching tidal forces, while those oriented east-west will experience none.

Directly above the poles things are different. Space tethers experience a smaller tidal force, due principally to the Earths gravimagnetic field, when oriented horizontally and broadside to the direction of travel, but not much when oriented radially.

At the North Pole, the satellite is diverted to the left by the effects of the Earth's gravimagnetic field, as viewed feet down, contrary to the earth's spin. At the South Pole it is diverted to the right, the opposite direction, by effects of the Earth's gravimagnetic field. Between the poles the orientation of forces gradually shifts.

Note, however, that the poles of the *ambient* gravimagnetic field overwhelms the effects of the Earth's gravimagnetic field. They circumnavigate diurnally at +-66 degrees 33 minutes latitude. The ambient gravimagnetic field is oriented as coming from the North Ecliptic Pole in Draco, directed toward the South Ecliptic Pole, assuming it comes from bodies rotating and moving in the same directions as Earth.

The ambient gravimagnetic pole in the Northern hemisphere is a South pole. The field is oriented downward through the Earth. A satellite moving Northward through this field will be diverted to its *right*, to the East.

See the Summary of Computed Values below.

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SUMMARY OF COMPUTED VALUES

Moment of inertia of earth

I = 1.90x10^37 kg m^2

Gravicurrent of earth:

i_g_earth = 6.927x10^19 i kg/s

Gravimagnetic dipole moment mu_g_earth:

mu_g_earth = 6.90x10^32 i kg m^2/s

Torque on earth:

Q_earth = 4.26x10^21 N m

Ambient gravimagnetic field:

K_ambient = 1.551 x 10^-11 (i Hz)

K_ambient = 1.551 x 10^-11 (i N s/(kg m))

Gravimagnetic field (K=B_g) in Center of Earth

K_g_earth = 1.815x10^-13 (i Hz)

Gravimagnetic Field Intensity (H_g) in Center of Earth

H_g_earth = 1.945x10^13 i kg/(m s)

Lateral (Lorentz) acceleration due to moving at orbital speed through the ambient gravimagnetic field in normal (perpendicular) direction:

a_amb = 1.272x10^-8 g

Lateral acceleration due to moving at orbital speed through the polar ambient gravimagnetic field in normal (perpendicular) direction:

a_polar = 1.49x10^-10 g (dwarfed by ambient gK acceleration)

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SUMMARY OF FINDINGS

The surprising finding is that the ambient gravimagnetic field is about 2 orders of magnitude larger than the Earth's gravimagnetic field. If correct, this should have profound implications for the Gravity Probe B experiment.