

Project GREENGLOW

1

Its origin & further work

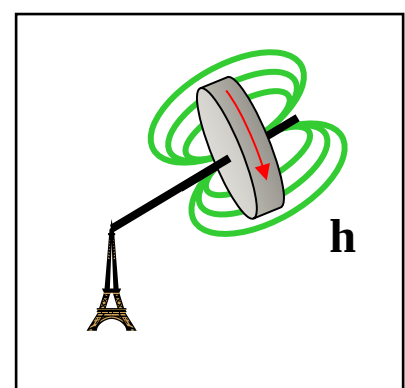
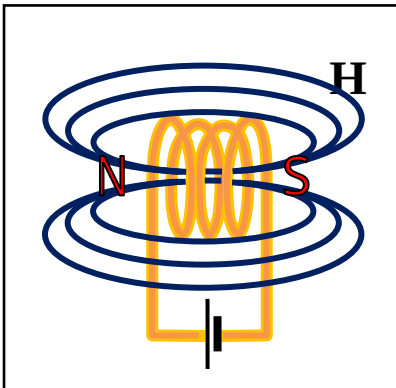
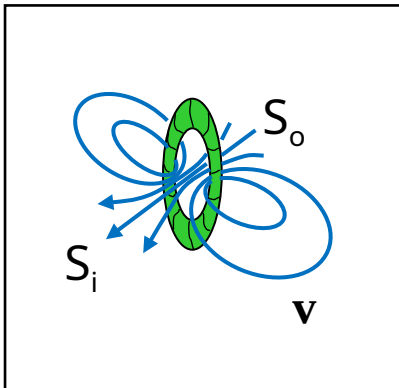
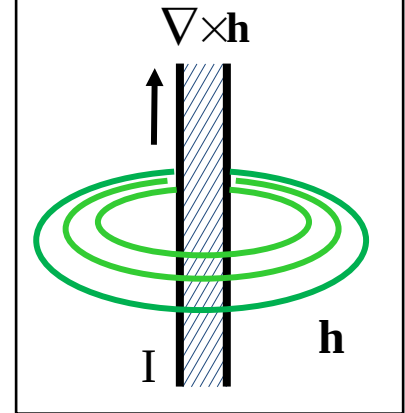
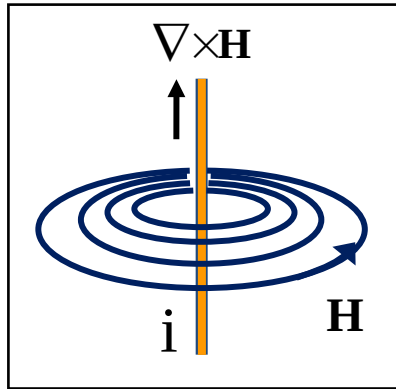
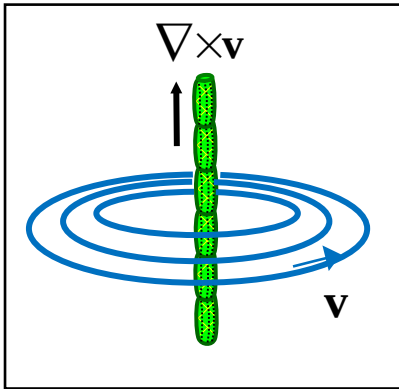
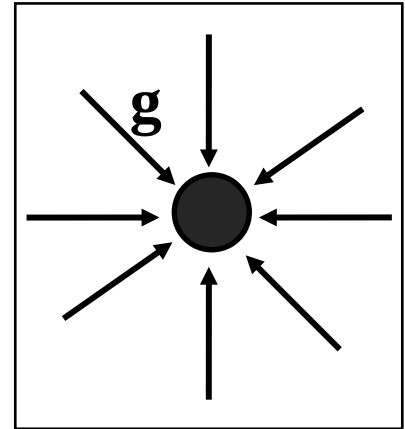
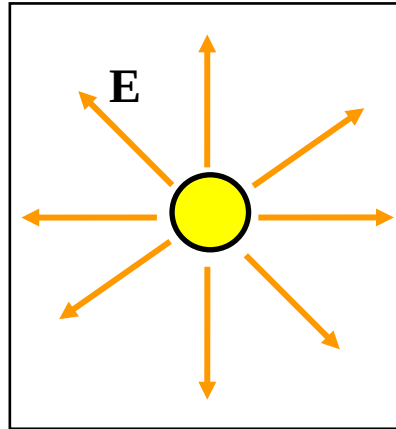
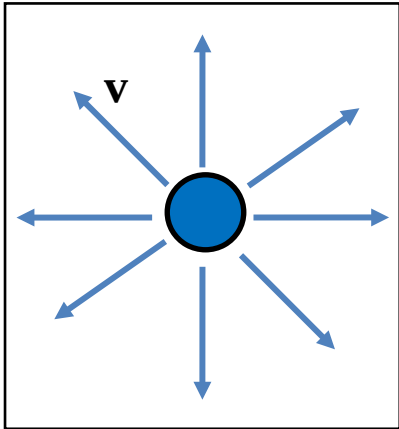
Saturday 16th January 2021



www.davewindett.com

Ron Evans Mathematical Engineer
BSc(Maths) London, MSc(Applied Maths) Leeds, PhD(Mech Eng) Leeds
(Specialised in Fluid Mechanics)
1978 – 2005 BAe/BAE Systems
Previous employment
Physics Laboratory Technician
Teacher Training College Maths lecturer
University Research Fellow

Analogies in Physics



British Aerospace Military Aircraft Division Warton Airfield, England, UK

Aerodynamics Office

1978 I joined BAe as a Senior Aerodynamicist
in the Performance & Propulsion Group

Analysing wind tunnel data
Listing excrescencies
Estimating drag (Hoerner)



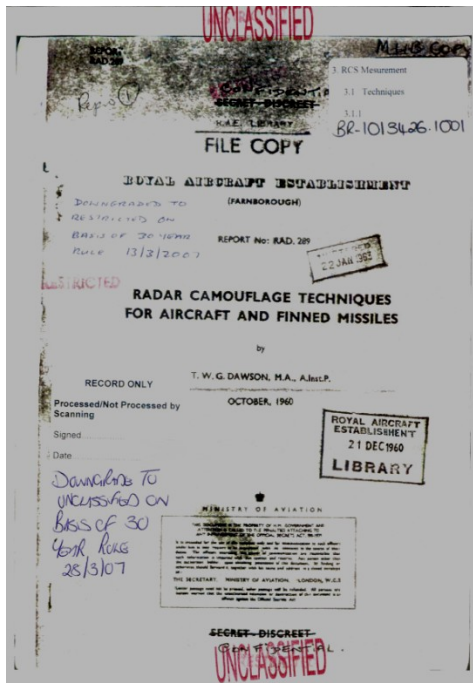
Aerodynamics Office

1979 UFO photographed over North York Moors – sent to BAe Publicity Dept.

1980 Chief Aerodynamicist attended briefing on F117 at RAE Farnborough

1980 I was tasked with forming a Stealth research programme

1960 RCS Measurement



Courtesy UK National Archive

EMI Scale model Radar range



Courtesy Thales UK Ltd/Dr Dudley Bird

RAM



December 1986 Visited Eric Laithwaite
Professor of Electrical Engineering, Imperial College

1974 Christmas Lecture at the Royal Institution , London
 Speculation: Does a precessing gyro lose weight?
<https://www.youtube.com/watch?v-JRPc7a-AcQo>

Demonstration of an Inertial Thrust Machine

Maxwell's Equations of Electromagnetism

$$\begin{aligned} \nabla \times \mathbf{E} &= -\mu \frac{\partial \mathbf{H}}{\partial t} & \nabla \cdot \mathbf{E} &= \frac{\rho}{\epsilon} \\ \nabla \times \mathbf{H} &= \rho \mathbf{v} - \epsilon \frac{\partial \mathbf{E}}{\partial t} & \nabla \cdot \mathbf{H} &= 0 & \mathbf{B} &= \mu \mathbf{H} \end{aligned}$$

GEM equations with the missing curls

$$\begin{aligned} \nabla \times \mathbf{g} &= \eta \frac{\partial \mathbf{h}}{\partial t} & \nabla \cdot \mathbf{g} &= -\frac{\rho}{\gamma} \\ \nabla \times \mathbf{h} &= \rho \mathbf{v} - \gamma \frac{\partial \mathbf{g}}{\partial t} & \nabla \cdot \mathbf{h} &= 0 & \mathbf{b} &= \eta \mathbf{h} \end{aligned}$$

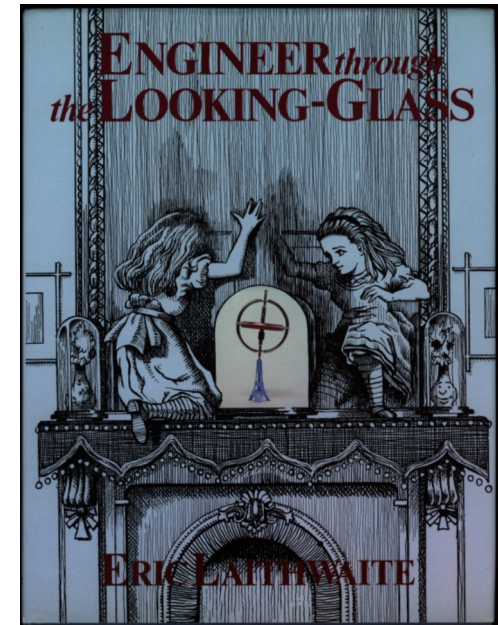
$$c^2 = \frac{1}{\epsilon \mu}$$

$$c^2 = \frac{1}{\gamma \eta} \quad \gamma = \frac{1}{4\pi G}$$

Equivalences - Vector properties but not field properties.

Gravity **g** is equivalent to acceleration **a**.

Induced gravitomagnetism **b** is equivalent to angular velocity **Ω**.



Sandy Kidd's Inertial Thrust Machine.

THE LAWS OF PHYSICS
REVOLUTIONISED

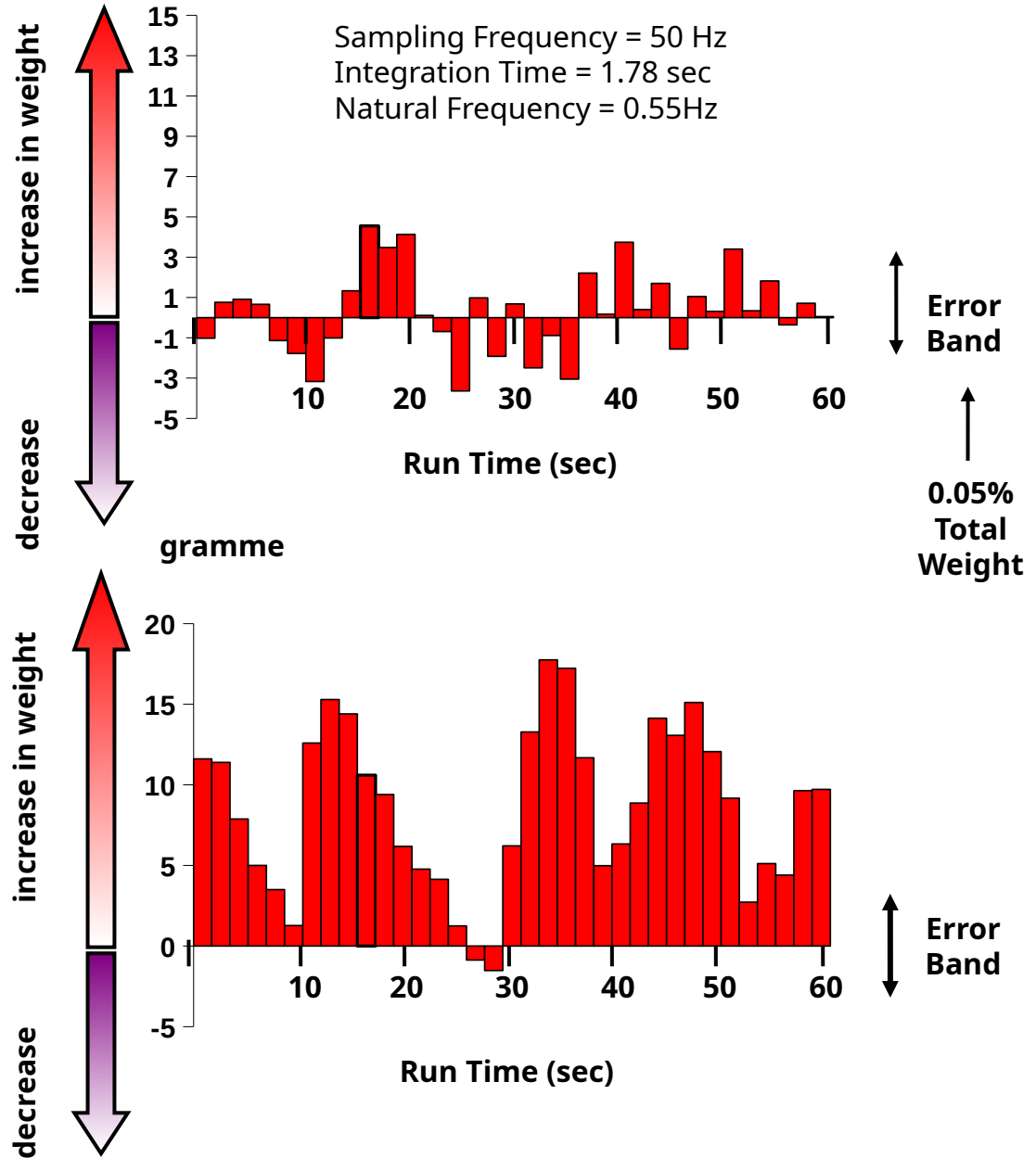


July 1991

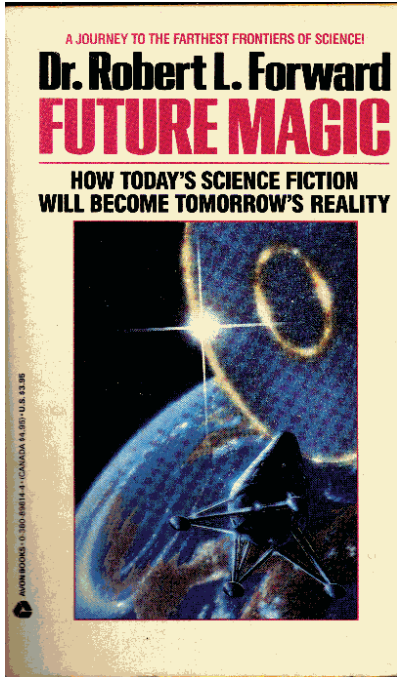
Weight 5.4 kg



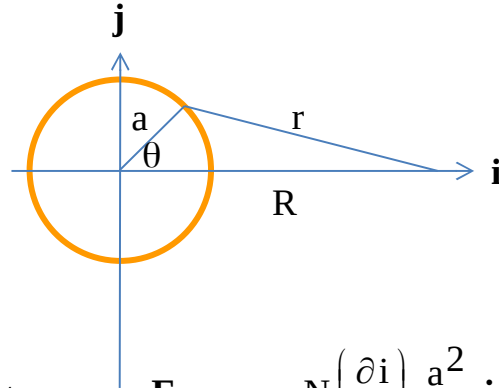
Courtesy of BAE Systems/Wind Tunnel Dept.



Gravity research pioneer - Dr Robert Forward



Antigravity



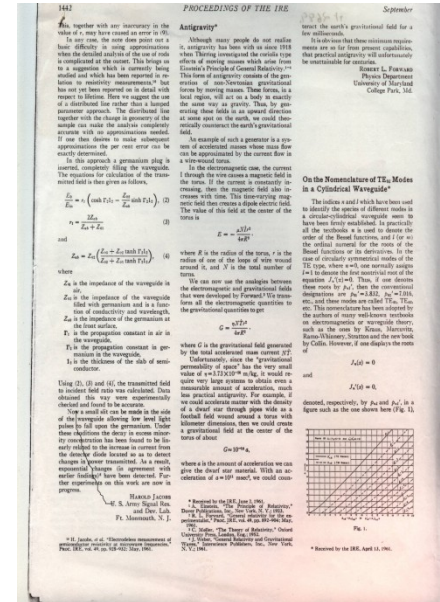
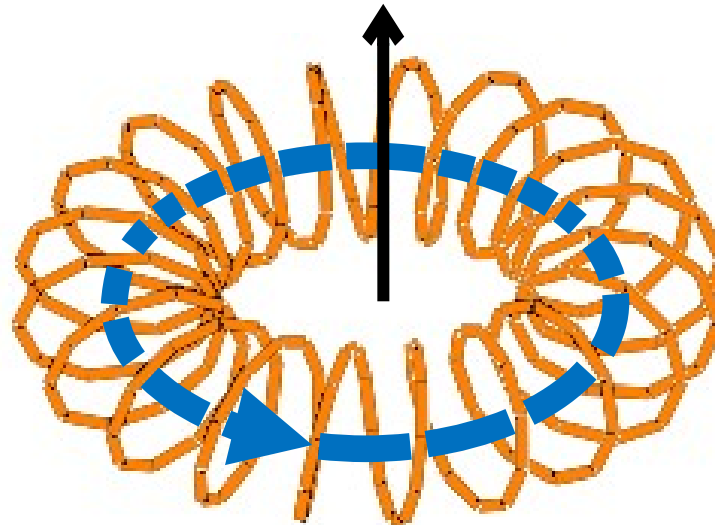
$$\mu_0 = 1.2566 \times 10^{-6} \text{ H/m}$$

$$\eta_0 = 0.9314 \times 10^{-26} \text{ m/kg}$$

$$\mathbf{E} = \mu_0 \mu_r N \left(\frac{\partial \mathbf{i}}{\partial t} \right) \frac{a^2}{R^2} \mathbf{j}$$

$$\mathbf{g} = \eta_0 \eta_r N \left(\frac{\partial \mathbf{i}}{\partial t} \right) \left(\frac{m e}{e} \right) \frac{a^2}{R^2} \mathbf{j}$$

August 1989
Visited Bob Forward



Proceedings of the IRE,
September 1961, page 1442

Pre-Greenglow Gravitational Study

9

FBS 007
BRITISH AEROSPACE (MILITARY AIRCRAFT) LIMITED
WARTON AERODROME
PRESTON, LANCOS
PR4 1AX

REPORT No. _____
COPY No. 13
DATE November 1990

The objective of this meeting was to learn, to identify any potential areas of breakthrough that could have a significant effect on BAe's future business and single out any business opportunities.

The first day was spent discussing current research projects, including Gravitational Wave Astronomy, Gradiometry and 9th Force experiments.

The second day dealt with specific ideas about gravitation, including microgravity research, the electron, a relativistic wave model of the electron and an experiment to determine the gravitational constant G , the permittivity ϵ_0 and the permeability μ_0 .

The Round Table Meeting was judged as a success by BAe's engineering interest in gravitational research and given as first-hand information about the project.

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TITLE B Ae - University Round Table
on Gravitational Research

PREPARED ON BEHALF OF
BRITISH AEROSPACE BY: Ron Evans
Dr. R.A. Evans

APPROVED _____

AUTHORISATION T.R. King
Mr. T.R. King
(Head of Future Business Strategy)

BRITISH AEROSPACE

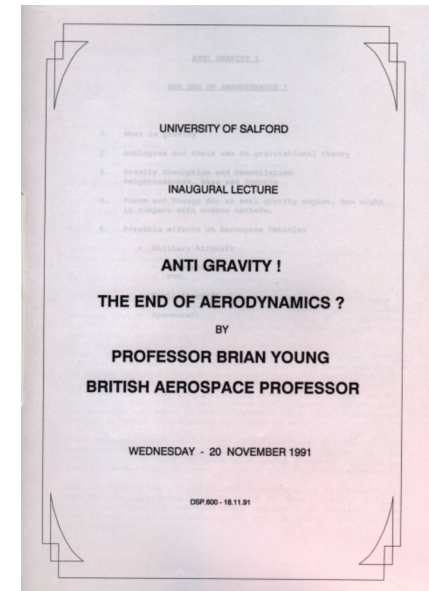
Report on Meeting held at the NOVOTEL Conference Centre,
Preston on Mon/Tues 26/27 March 1990.
The Meeting was unclassified and completely open.

- Gravitational wave research
Glasgow University
- Fifth force experiments
Newcastle University
- Superconducting gravity gradiometer
Strathclyde University
- Faraday's gravity experiments
BAe Warton
- Quantum effects in microgravity
Commercial Space Technologies
- Heaviside's linearized gravity GEM
BAe Warton
- New model of the electron
(A quantum view of Newton's 2nd law)
Kent University
- An interaction between gravitational
and electromagnetic waves
Birmingham University

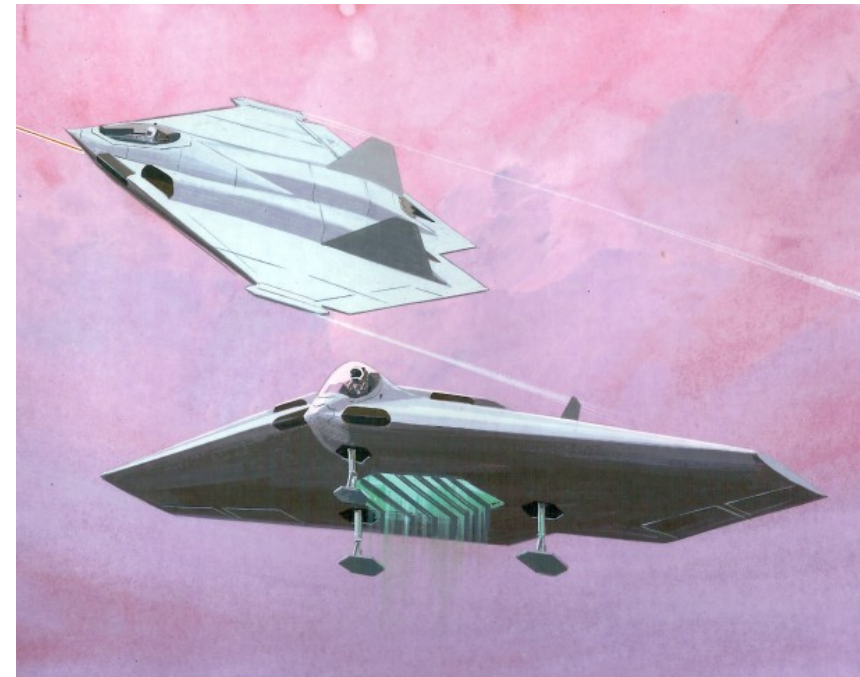
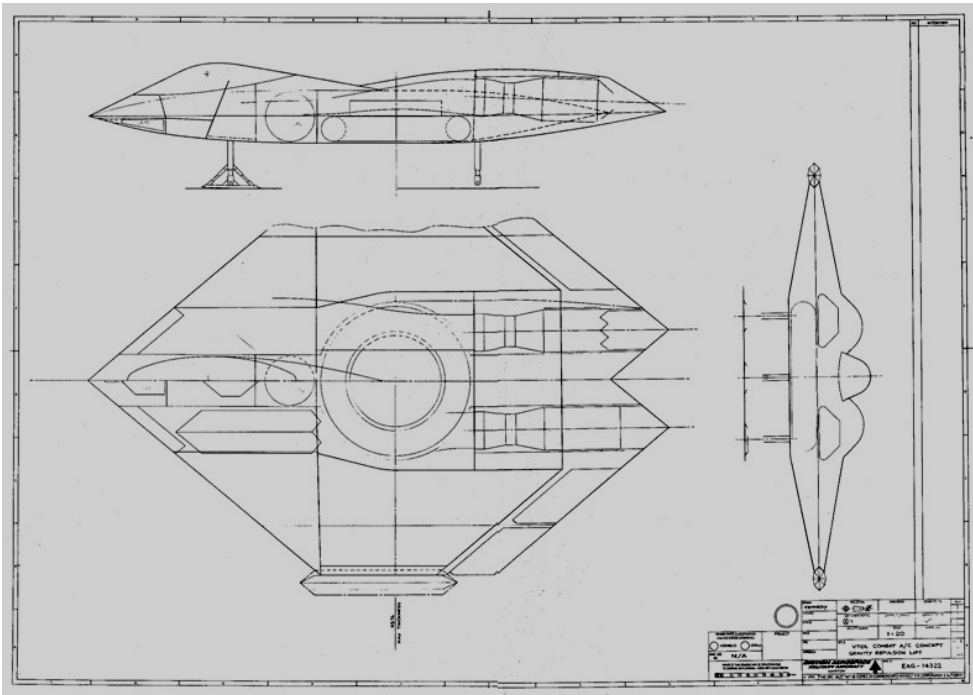
The Technical Director's request

November 1991

- Salford University Professor
- I MECH E HQ Lecture
- BBC Radio 4 Interview
- Press Headlines
- Jane's Defence Weekly article



Hybrid anti-gravity stealth fighter



Site closures

BAe Kingston (Harrier & Hawk)

Sell-off of non-core businesses

50% reduction of workforce (1991)

Write-off of £1b assets

BAe still UK's biggest exporter

Merger talks with DASA (1998)

BAe Purchase of Marconi from GEC

BAE Systems (30 November 1999)

1990 Warton Advanced Technology Department

1990 Exploratory Studies Group

1992 Strategic Liaison Office

1993 Shared time between Stealth Group & the EW & TF

1995 Formation of the Technologist Career Branch

Chief Technologist, Fellow, Consultant, Adviser

The branch had a small Research Budget

Technologist Adviser for the Warton Demonstration Centre

The start of Project Greenglow

March 1997

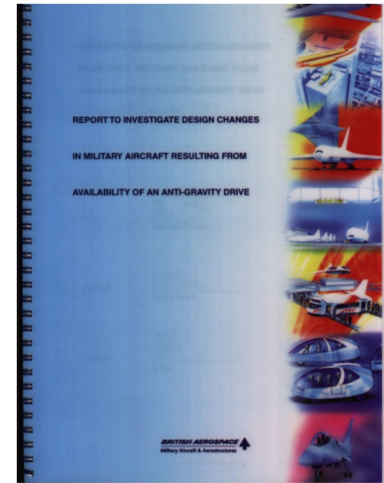
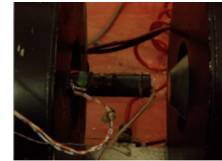
The long term future of Aerospace

Lecture to Future Concept Engineers at BAe Warton
 Given by Professor John Allen
 (formerly Chief Future Projects Engineer BAe Kingston)



June 1997

Heat transfer experiment under magnetic field gradient
 Professor Phil Bissell University of Central Lancashire

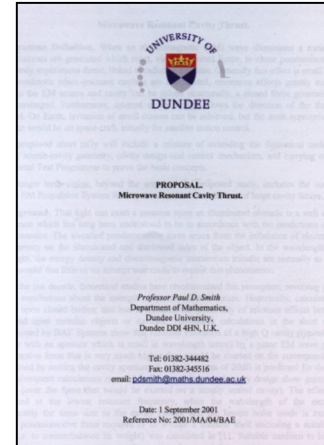


July 1997

Meeting with *gravitational physicists at Lancaster University*
 Led by Professor Robin Tucker

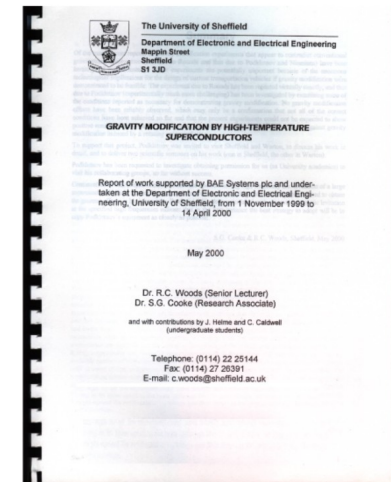
November 1997

Funding request submitted for *Project Greenglow* to the Warton Technologists' Research Panel was agreed
 Professor Tucker to be Academic Adviser
 Professor Allen to be Design Consultant



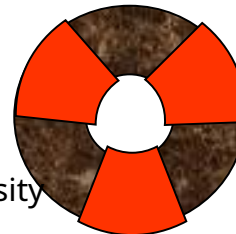
November 1997

Start of *Project Greenglow*
 Lecture Series begins
 Small support from Rolls Royce
 Verbal support from MoD (Fear of seen funding UFO study)



January 1999

Study of a *Photon Drive* at Dundee University
 Dr Paul Smith and Professor Sergei Vinogradov



YBCO annulus
 Biggest weight change during change in solenoid current

November 1999

Part examination of the *Podkletnov effect* at Sheffield University
 Led by Dr Clive Woods

Advanced Technology Centres responsible for Company research

- Sowerby Research Centre, Bristol (Formerly the BAe Dynamics Research Centre)
- Great Baddow Research Centre (Formerly the Marconi Research Centre)

2000 Project Greenglow university funding on hold.

January 2001 Glasgow University Goals & Metric Study advised more emphasis on Quantum aspects relating to gravity, particularly Zero Point Energy.

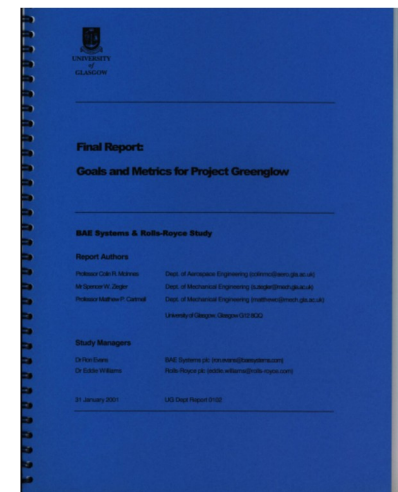
ATC agreed to support Project Greenglow for 3 years

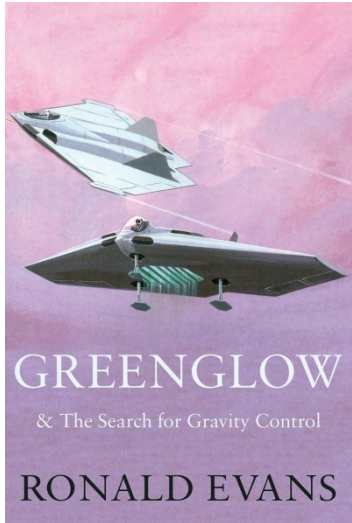
- Birmingham University - Casimir Study
- Lancaster University - Earth's Gravitomagnetic field

2000 NASA BPP Program meeting at Warton

2001 Graham Ennis' Field Propulsion Conference at Sussex University

2004 End of Project Greenglow.





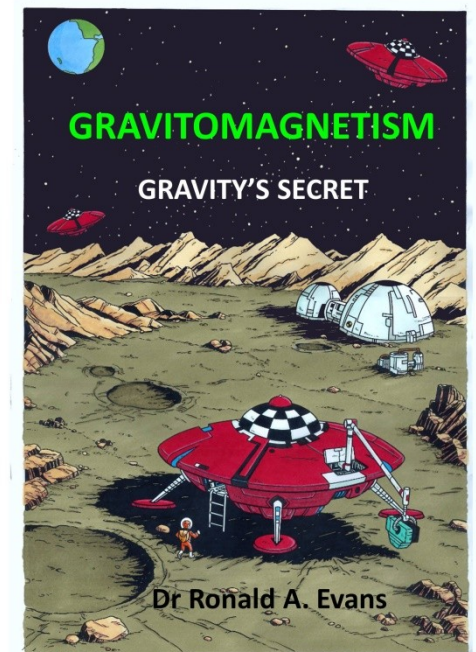
Publisher Matador (2015)
ISBN 9781784620233
eISBN 9781784627065

BBC *HORIZON* Project Greenglow Programme transmitted 23 March 2016

Gravitation is what holds our feet to the ground,
so if we could defeat it, or even just disturb it,
then it could send us to the stars.

Editor Steve Crabtree
Producer Nic Young
Voice-over Peter Capaldi

- BAE Systems Project Greenglow
- NASA BPP Program
- Laithwaite & gyro at the RI
- Podkletnov and gravity effect
- Anti-gravity & propulsion
- Anti-matter at CERN
- Shawyer EM Drive
- MoD Quantum accelerometer
- EU BPP studies at Dresden Un



Publisher Matador
Expected publication date
Summer 2021

Methods of detection

Induced magnetism $\mathbf{B} = \mu\mathbf{H}$

Lodestone (Magnetite)

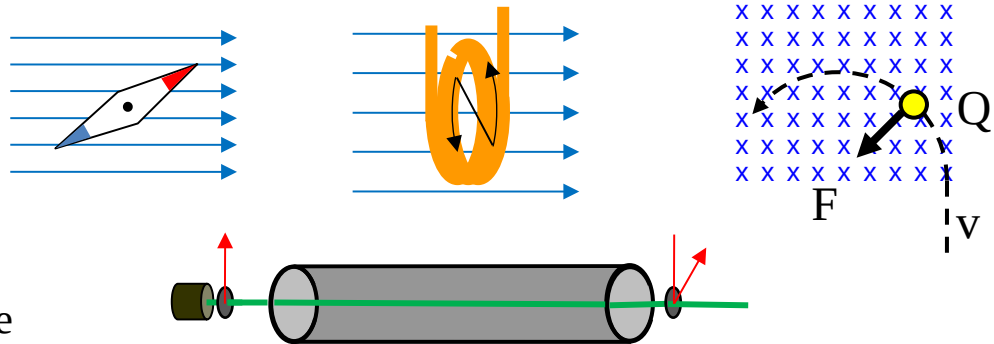
Compass

Suspended search coil

Faraday rotation

Moving charge $\mathbf{F} = Q(\mathbf{v} \times \mu\mathbf{H})$

SQUID – Quantum magnetic flux = $h/2e$

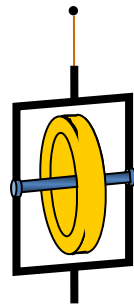


Enforced rotation

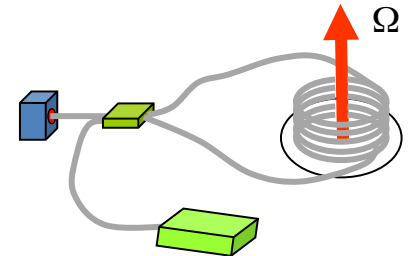
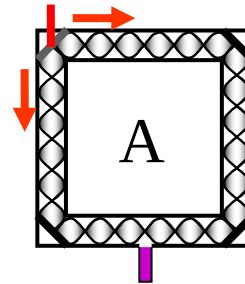
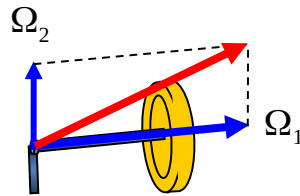
Spinning flywheel

Ring Laser Gyro

Fibre Optic Gyro



Free suspension



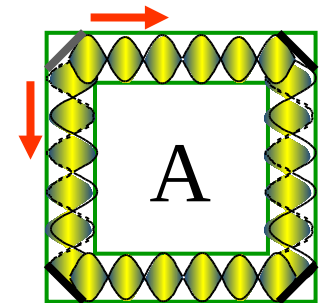
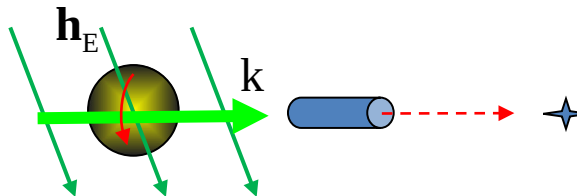
Induced gravitomagnetism $\mathbf{b} = \eta\mathbf{h}$

Spinning flywheel or sphere

Large Ring Laser Gyro

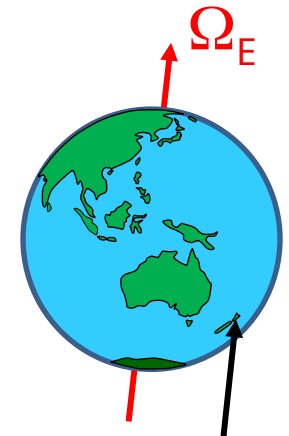
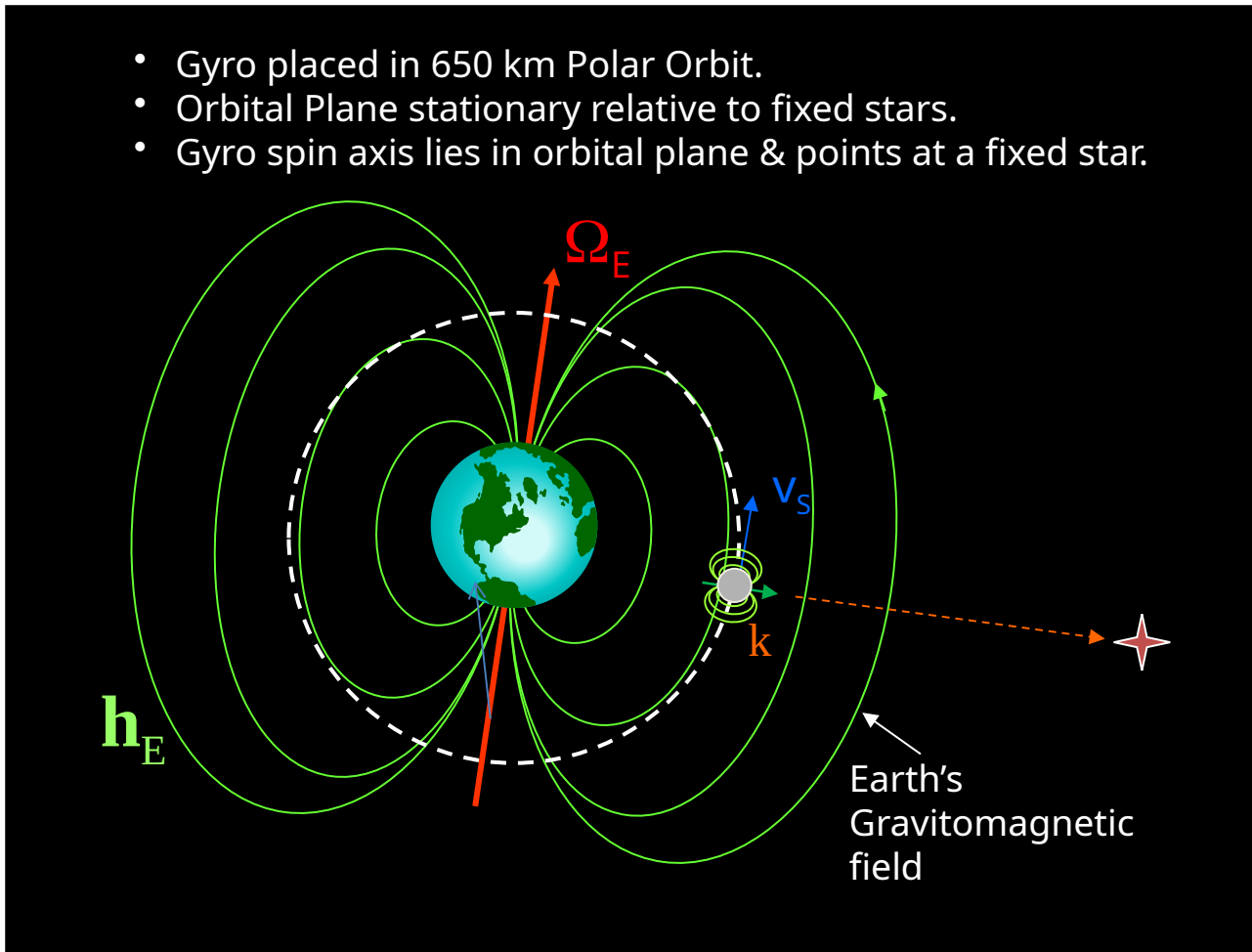
Faraday rotation

Moving mass $\mathbf{F} = m(\mathbf{v} \times \eta\mathbf{h})$



The NASA GP-B satellite experiment.

- Gyro placed in 650 km Polar Orbit.
- Orbital Plane stationary relative to fixed stars.
- Gyro spin axis lies in orbital plane & points at a fixed star.



UG 1 RLG

$$\mathbf{h}_E = \frac{1}{4\pi} \left[\frac{I_E \boldsymbol{\Omega}_E}{r^3} - \frac{3I_E (\boldsymbol{\Omega}_E \cdot \mathbf{r})\mathbf{r}}{r^5} \right]$$

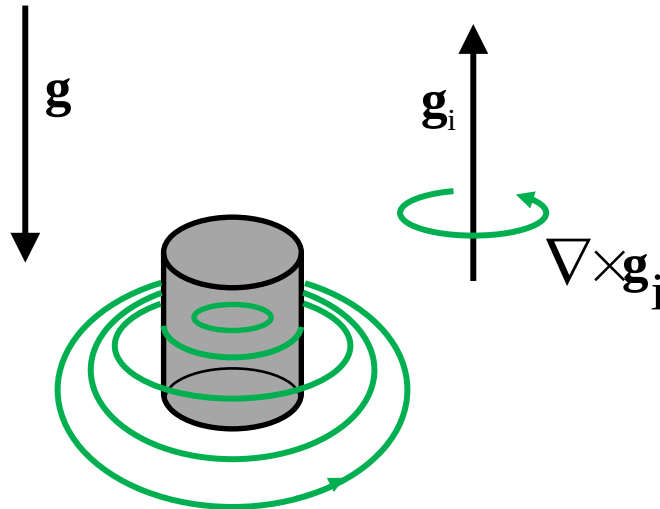
Over a year the gyro angular velocity vector twisted by a very small amount.

- (6.6 arcsecs/year) Space-time curvature detected. (April 2007)
- (0.042 arcsecs/year) Gravitomagnetic field detected. (April 2011)

We know that a mass falling in Earth's gravity field \mathbf{g} is weightless

But only an equal and opposite gravity field \mathbf{g}_i can cancel a gravity field

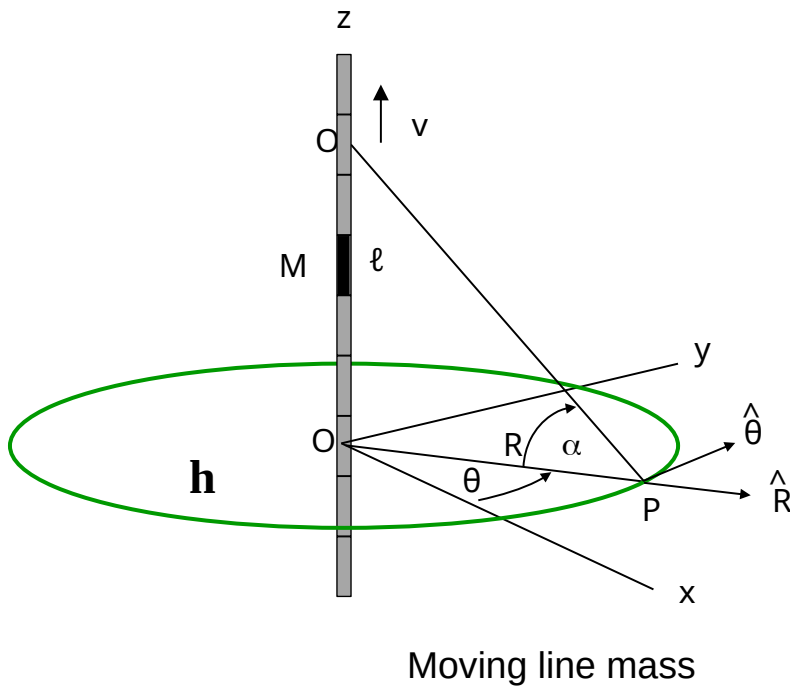
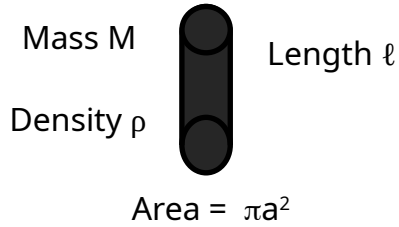
$$\nabla \times \mathbf{g}_i = \eta \frac{\partial \mathbf{h}}{\partial t} = \eta_o \frac{\partial \mathbf{h}_o}{\partial t} + \eta_i \frac{\partial \mathbf{h}_i}{\partial t}$$



Control of gravitomagnetism means control of inertia and a means of propulsion

An infinite line mass - a model in progress

(Analogue of an infinite line charge)



A line mass moving with velocity \mathbf{v}

$$\text{The mass current } I = \frac{M \mathbf{v}}{\ell}$$

The gravitomagnetic field \mathbf{h} at a distance R from a mass M moving with velocity \mathbf{v} is related to angular momentum density

$$\mathbf{h} = -\frac{1}{2} \rho (\mathbf{R} \times \mathbf{v})$$

For steady velocity \mathbf{v} the field \mathbf{h} satisfies the GEM equation

$$\nabla \times \mathbf{h} = -\rho \mathbf{v}$$

$$\mathbf{h}_{\text{Ext}} = -\frac{I}{2\pi R} \hat{\boldsymbol{\theta}} \quad \text{and} \quad \mathbf{h}_{\text{Int}} = -\frac{IR}{2\pi a^2} \hat{\boldsymbol{\theta}} \quad \text{Analogue of Biot-Savart laws}$$

From the model the gravitomagnetic permeability $\eta = \left(\frac{2}{\rho R^2} \right)$

For free space $\eta_o = 0$ (space acts like solid body where $\rho = \infty$)

Within the moving mass $\eta_i = \frac{2\pi \ell}{M}$

For the induced fields

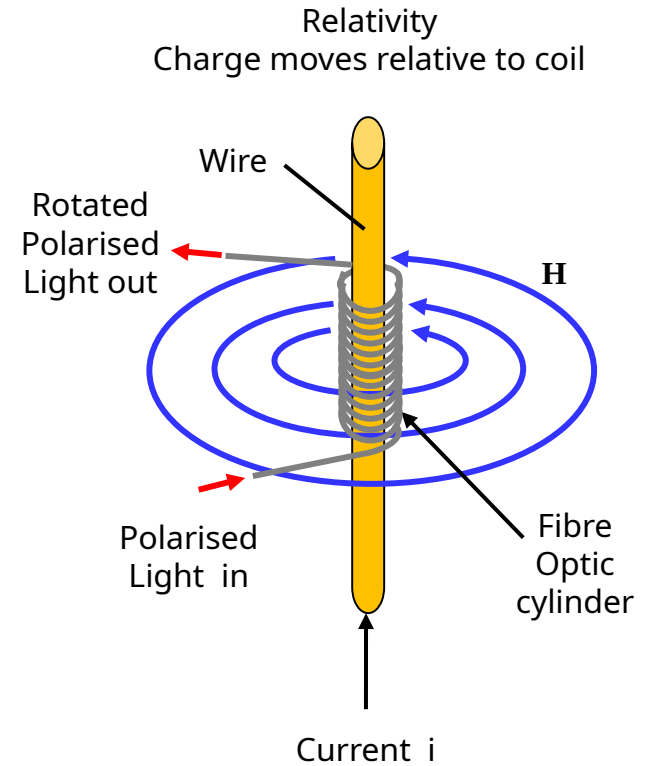
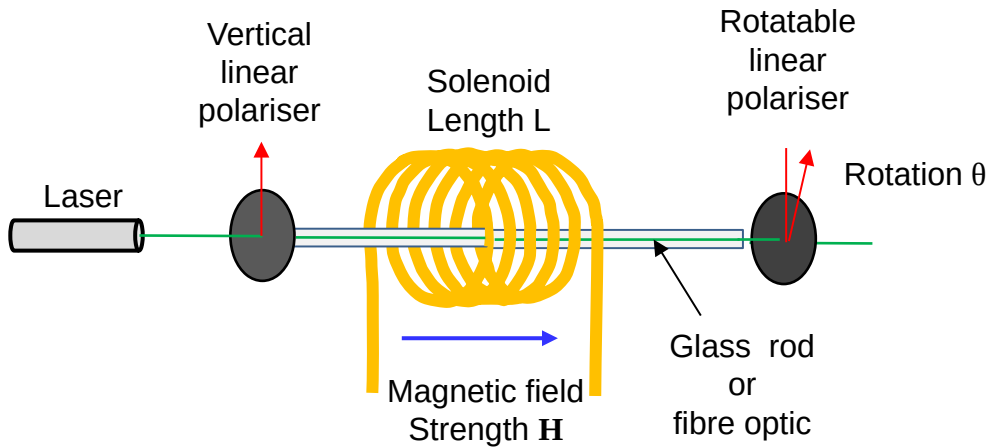
$$\mathbf{b}_{\text{Ext}} = \eta_o \mathbf{h}_{\text{Ext}} = 0 \quad \mathbf{b}_{\text{Int}} = \eta_i \mathbf{h}_{\text{Int}} = -\left(\frac{R^2}{a^2} \right) \Omega_R \hat{\boldsymbol{\theta}} \quad \text{where } \Omega_R = \frac{v}{R}$$

On the cylinder wall $R = a$

$$\mathbf{b}_{\text{Wall}} = -\Omega_{\text{Wall}} \hat{\boldsymbol{\theta}} = -\frac{v}{a} \hat{\boldsymbol{\theta}}$$

Faraday rotation

$$\theta = V H L$$



Analogue: Can gravitomagnetism be detected within a fluid flow, using an internal fibre optic cylinder

Assumption:

H and h are twinned fields (electrons have charge $-e$ and mass m_e)

Query 1:

Can H and h fields be separated? (Use of mu-metal screen)

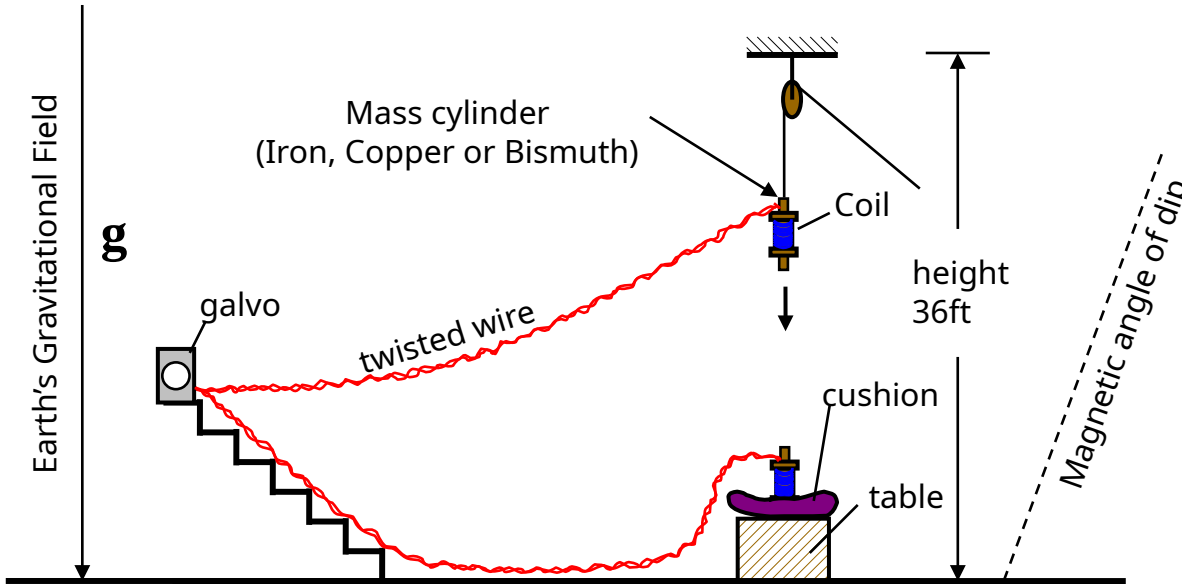
Query 2:

Does Faraday rotation occur with gravitomagnetism?

Query 3:

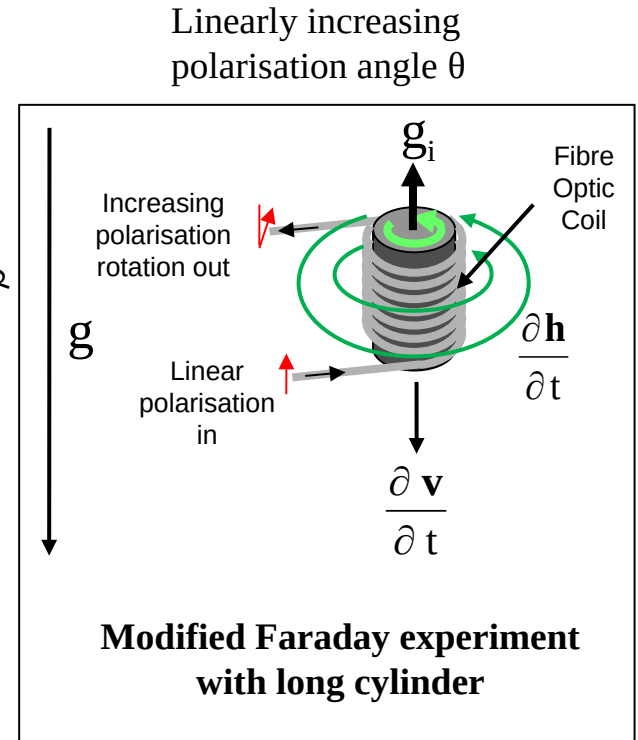
Is gravitomagnetism responsible for Faraday rotation?

Faraday's 1st Gravitational Experiment.



Floor of the Lecture Room at the Royal Institution

Adapted from 'Faraday's Diary Vol V', p. 167, G.Bell & Son



Experimental options

$$\left. \frac{\partial \mathbf{b}}{\partial t} \right|_{\text{Wall}} = \frac{g}{a} \hat{\boldsymbol{\theta}}$$

1. A large fibre optic coil, with its axis vertical, allowed to fall in a gravity field
2. A fibre optic cylinder attached to a long mass cylinder allowed to fall in a gravity field

Two hundred years ago, quite by chance, Hans Oersted discovered the link between moving charge (electric current) and magnetism. Both subjects had been known about for two thousand years, or more, but no one had realised that they were coupled together. Oersted's discovery set off a flurry of activity by scientists looking for further effects. It led to Joseph Henry's and Michael Faraday's near synchronous discovery of electromagnetic induction. And it led to James Maxwell's mathematical model of electromagnetism which predicted the existence of electromagnetic waves. There was no way that Oersted could have foreseen what his discovery would lead to.

The gravitational analogue of Oersted discovery, the link between moving mass (mass current) and gravitomagnetism, is waiting to be found. It seems likely that the effect being sought remains hidden from view within moving bodies. Revealing the presence of the gravitomagnetic field in a laboratory on Earth will allow further probing and learning how to manipulate gravitomagnetism. That is the key to gravity control. Like Oersted, we cannot see what the discovery will lead to. But, results are likely to be momentous. Just as control of electromagnetism has changed the way that we live, we can be absolutely certain that the changes in our life-style brought about by gravity control will be mind-blowing.