APEC Meeting 12th March 2022 Ron Evans.

SLIDE 1.

Front cover of my latest book. It's a bit of wishful thinking, showing a flying saucer, powered by gravitational means, having landed on the Moon. The scene was drawn by Dave Windett. He also drew the pictures of the scientists, mathematicians and engineers in the book.

The first third of the book deals with the development of gravitational theory, from Newton's potential theory through to Einstein's general relativity.

Because gravity is so weak (when compared with electromagnetism), experiments to investigate gravitational effects have depended on the sensitivity of the measuring apparatus.

The second third of the book deals with the importance of analogues. The development of fluid & aerodynamics, electromagnetism and thermodynamics showed that in theoretical terms they all had very similar mathematical structure, even though the physical quantities were different. This allowed for read-across between subjects, where an effect in one subject, apparently missing in another, could be looked for.

The last third of the book is mostly about the extension of the model of gravity using the analogue from electromagnetism and examining Faraday's gravity experiments. With the help of gravitomagnetism Faraday's experiments can be viewed in a new way and new versions of his experiments considered

In this presentation I want to concentrate on how gravitational propulsion might be achieved. I have the outline of an experiment to test the idea, but I'm a mathematician, not an experimenter. Also, I have no funding. I'm looking for advice, help and support from those of you who are experimenters.

SLIDE 2.

Francis Bacon was a 17th century high-up British politician whose career was wrecked by a scandal. Bacon left politics and turned his attention, instead, to writing about science.

Bacon proposed the foundation of a scientific academy in England, which he called the House of Solomon. The academy was to be a teaching and research institute with laboratories and a library. Thirty years later, this idea led to the formation of the Royal Society of London.

In his book Novum Organum Scientiarum, which means the Advancement of Learning, Bacon stressed the importance of analogues in the search for making breakthroughs in understanding.

SLIDE 3.

James Clerk Maxwell also recognised the importance of analogues. Having developed Electromagnetic theory he investigated the gravitational analogy.

The first term involving $\nabla \bullet \mathbf{g}$ comes from Newton's static theory of gravity. The other equations reflect unknown aspects of gravity associated with moving mass. Moving mass is the analogue of moving electrical charge. Clearly the field **h** is the gravitational analogue of the magnetic field **H**, hence it is called the gravitomagnetic field. But such a field had never been detected by a stationary observer as the mass moved by.

We now know that Einstein's equations for gravity reduce to the Maxwell analogue for low mass speeds.

SLIDE 4.

Oliver Heaviside, was a self-taught mathematician well-versed in Maxwell's equations. He believed in the existence of the gravitomagnetic field **h** but assumed that it was so weak externally that its existence might only be detected with moving astronomical bodies. The weakness comes from η (pronounced "eta"), the gravitomagnetic permeability.

We know the value of γ (gamma), which comes from Newton's inverse square law, and we know the value of c, the speed of light in free space. Since $c = 1/\sqrt{\gamma\eta}$, we can evaluate η and it is very very small, but non-zero.

Special relativity plays a part. If you move with the mass at a steady speed there is no relative motion and so the **h**-field doesn't arise.

SLIDE 5.

Suppose an observer is sat astride a column of mass moving with uniform speed **v**. Since mass responds to gravity, the observer will be very weakly attracted to the column.

If the combined mass of the column and the observer accelerate, the observer must hang on or he/she will be left behind. This back reaction, or inertia, is usually explained as the result of Newton's 3rd law of motion.

The gravitational analogue gives us a different view of inertia. The observer's mass responds to gravity. Therefore the changing gravitomagnetic field within the mass must have created an induced gravity field to which the observer's mass is subjected.

If we could create a changing gravitomagnetic field within a mass we could cancel inertia. Or we could create a propulsion system.

SLIDE 6.

When a mass is free to fall in a gravity field $\mathbf{g}_0$ it accelerates downwards with acceleration equal to $\mathbf{g}_0$.

From our extended set of equations for gravity, we know that an induced gravity is created in the vertical direction. But the induced gravity field $\mathbf{g}_0$ cancels with the Earth's gravity $\mathbf{g}_0$, so the falling mass has no inertia.

Suppose a person holds a spring balance to weigh an object of mass m. It has weight $m\mathbf{g}_0$. In free fall the spring balance registers zero weight.

SLIDE 7.

In 1998 I video-taped a UK Channel 5 TV programme, entitled *Aliens among us*. Timothy Good was the executive producer. The story featured Bob Lazar, who claimed to have worked on a flying saucer at a secret US base called Area 51. The programme contained very little technical information but was sensational in that Lazar said that the saucer was of alien origin and was propelled by gravitational means. In the programme Stanton Friedman said that Lazar was a capable hands-on engineer but that he had no scientific qualifications. Consequently, his layman's explanations of what he had seen and worked on should be treated with caution.

In my search for technical information concerning Lazar's story, the best books that I have found are Timothy Good's *Alien Liaison* and Paul LaViolette's *Antigravity Propulsion*. Even so, the technical content about the gravitational propulsion of a flying saucer is limited.

I have no comment to make about Lazar's claim that the power source was an anti-matter reactor. What interested me was the mention that gravity waves feeding the propulsion system could be channelled.

SLIDE 8.

We are used to the idea of wave/particle duality. So we can interchange electromagnetic waves with photon beams. Although photons are a figment of our imagination, they allow us to picture what is going on and to put numbers into a model.

Associated with a photon are a frequency f and a wavelength λ. From Einstein's $E = mc^2$ we conclude that a photon has an effective mass. On passing close to the Sun's surface, the path of a photon emitted from a star will be slightly deflected, owing to the photon's effective mass and the gravitational attraction of the Sun.

Black Body radiation curves are available for a range of temperatures. A body of fixed temperature θ emits an infinite number of photons with different frequencies. Suppose at this temperature we select the photon with the maximum energy E_{MAX} and its wavelength λ_{MAX}.

From Wien's law we have

wavelength $\lambda_{MAX} \times$ temperature θ = constant.

Since $c = f\lambda$, we see that frequency f is linked to temperature θ.

SLIDE 9.

A photon has effective mass. Therefore as it moves upward in a gravity field **g** its energy changes. But the energy of a photon is hf. So, if it changes its energy it must change its frequency. This leads to Einstein's change in frequency Δf in moving upwards a distance Δs.

Since the frequency reduces it is a red-shift.

Another way of looking at it is that by changing frequency the force on the photon is cancelled. Thus the photon continues to move at speed c.

Our gravitomagnetic model gives us another view. A mass moving at constant speed develops a constant gravitomagnetic field **h**. But, since the photon's effective mass changes with frequency, the **h**-field associated with a photon must change. In doing so, it creates a **g**-field (within the photon beam), which cancels the Earth's gravity field.

So we have a photon beam with changing frequency. This implies a linear change in temperature within the beam which is not cancelled.

SLIDE 10.

Professor Allen Hynek founded CUFOS, the Center for UFO Studies, in 1973. According to Hynek’s data the distinguishing characteristics of a UFO approaching landing are

- Electrical interference
- A heating effect
- Gravitational interference

Apart from these there is local damage to trees and plants, and ground indentations if the UFO lands.

SLIDE 11.

In my latest book I mentioned the idea that there was more to be squeezed out of Einstein's gravitational red-shift (see page 87). It involves a coherent beam of photons , a thermal field and the creation of a gravity field. But please take note, the idea is very speculative.

We start by creating a temperature gradient, or thermal field **T**. The material supporting the thermal field must be transparent to photons. So, depending of the frequency, we might use a dielectric (for radar) or glass (for light and IR). The material is contained in a waveguide.

Then, using the thermodynamic analogue we derive the shift in frequency Δf as a photon moves a distance Δs along the thermal field. Analogous to the Einstein case, the change in photon frequency results in the cancelation of the thermal **T** field within the photon beam. Thus the photons move with speed c (different from the speed of light in free space) through the material. We are left with a photon beam with a linear change in frequency which creates a gravity field **g**. The field **g** acts on the mass contained within the waveguide, producing a thrust. An important factor is the photon density. Even so, the induced **g**-field might be weak, so an amplifying method needs to be considered.

The gravity field created is reminiscent of LaViolette's electromagnetic wave with a gravity effect. Hynek's three characteristics of a UFO's presence are all present.

Whether the **g**-field extends outside the waveguide (End effect) is unknown. Probably not! But the waveguide can be bent, with a bent thermal field. So, the gravity field can be channelled.

Roger Shawyer's EM-Drive is conical cavity, within which a microwave signal resonates. At the narrow end the signal must suffer cut-off. The loss of wave energy will lead to the narrow end getting hot. So the EM-Drive thrust might result from the same effect.

SLIDE 12.

According to Wicki, from the mid 1950s through to the mid 1970s, many US aerospace companies conducted gravity research studies. As Paul LaViolette shows in his book, these studies often involved the use of radars.

The crux of an experiment to test my idea is to shine an electromagnetic wave along a medium. That can't be so difficult. I have no access to a microwave or a millimetre wave source, but I do have a laser pointer. So, I wondered whether I could start by shining a laser beam through a glass rod. Heating one end of the rod, to create a thermal field along it, could come later.

I am not an experimenter, but I tried shining a laser through a glass rod. It was not a success. Perhaps, at the very least, experts in fibre optics could advise me on how to get this part of the experiment to work.

The diagram shows my basic idea. A glass rod, with a laser source attached, is balanced horizontally and suspended (in Earth's gravity field g_0) from a vertical string. The presence of an induced gravity field g_i along the glass rod is detected if the string moves out of the vertical.

I am unable to do the experiment. Perhaps some of you experimenters can make it work, or can suggest an improved experiment.

If the idea is sound, this could be the start of a new form of propulsion for vehicles operating under the sea and into space. I am left wondering. Who can help?