Title –
PIONEER ANOMALY MAY BE GRAVITATIONAL, NOT THERMAL

Author – Rodney Bartlett

Abstract –
The question and answer about spacecraft flybys (Astronomy magazine's "AskAstro" section - August 2014) got me thinking about the Pioneer anomaly - a slight slowdown in the predicted positions of the Pioneer 10 and Pioneer 11 spacecraft noticed when they entered the outer solar system. After their billions of miles of travel, the Pioneer spacecraft are some 3,000 miles short of their predicted locations. If they were now carrying an infinitesimal extra mass due to m=E/c^2, this could account for the shortfall. I propose electromagnetic energy from the RTG (radioisotope thermo-electric generator) powering each craft is insufficient to be relativistically converted into enough mass, and suggest energy in the form of gravitational waves that are diverted towards the Sun's mass would convert into the mass causing the Pioneer anomaly. As the end of this short article states, "Though it's possible that high-frequency electromagnetic waves like X-rays or gamma rays, as well as the subatomic particles in cosmic rays, might contribute to Pioneer's extra mass**;** a gravitational cause is not invalidated since both matter and electromagnetism have their origins in gravitation" (this is explained).

Content –
In a paper published on June 12, 2012 in Physical Review Letters ["Support for the Thermal Origin of the Pioneer Anomaly" - Phys. Rev. Lett. 108, 241101 (2012) [5 pages]; Slava G. Turyshev, Viktor T. Toth, Gary Kinsella, Siu-Chun Lee, Shing M. Lok, and Jordan Ellis write: "We investigate the possibility that the anomalous acceleration of the Pioneer 10 and 11 spacecraft is due to the recoil force associated with an anisotropic emission of thermal radiation off the vehicles" and "We therefore conclude that at the present level of our knowledge of the Pioneer 10 spacecraft and its trajectory, no statistically significant acceleration anomaly exists."

According to http://hypertextbook.com/facts/1997/PatricePean.shtml, the space probes Pioneer 10 and 11 are respectively travelling 2.39 and 2.22 Astronomical Units per year (1 astronomical unit is the average distance between the Earth and Sun - it equals 92,955,807.273 miles [from Wikipedia's "Astronomical unit"]). Therefore, Pioneer 10 travels 2.39 x 92,955,807.273 (approx. 222 million) miles per year and Pioneer 11 2.22 x 92,955 807.273 (approx. 206 million). These approximations can be averaged to 214 million miles per year. However, the probes are travelling some 3,100 miles (5,000 kilometres) less than expected each year ("The Pioneer anomaly - solved?" by Liz Kruesi in "Astronomy" magazine - Nov. 2012, p. 20). This reduction in distance travelled amounts to 214,000,000 / 3,100 (approx. 1 / 69,000).

The following paragraph is ***NOT*** intended to be an accurate method for calculating what the abstract calls “an infinitesimal extra mass” (accounting for) “the Pioneer spacecraft (being) some 3,000 miles short of their predicted locations”. Its ***ENTIRE PURPOSE*** is simply to use the ***EXAMPLE*** of a tiny mass of 0.00005 gram which - purely for convenience, and remembering that E=mc^2 can combine joules with kilograms and metres per second - is calculated by dividing 258 kg by 5,000,000 metres –

Pioneer 10 weighs 258 kilograms and was launched in 1972 while Pioneer 11 weighs 259 kg and was launched in 1973. If we divide 258 (kg) not by 5,000 (kilometres) but by 5,000,000 (metres - in order to keep the units consistent with the units used later), we get 0.00005 of a gram (0.000 000 05 of a kilogram, for consistency). This is the quantity of extra mass which has slowed the craft by some 5,000 kms**;** and also the amount of mass (weighing it on Earth gives us 0.00005 g) which Einstein’s Relativity says is produced from energy. We can conclude that this energy is in the form of gravitational waves from the following paragraphs –

When gravity waves (the warping of space-time) concentrate to form matter #, gravity travels from external to matter**:** pushes against matter (repels). Repulsive gravity is dark energy. Successive waves are re-radiated at unconcentrated strength from matter to external (opposite action to repelling wave) and attract – it must be remembered that attraction is merely a matter of perspective, since Einstein showed that attraction of two bodies of matter actually results from space-time’s curvature pushing bodies.

If space-time forms mass, there could be "currents" of space-time flowing in the "oceans" between the galaxies. Space-time would form the matter in the galaxies, and it would form the Earth/objects on this planet. How? By some of the currents of space-time or gravity which pass the solar system's outer boundary being diverted towards the massive Sun's centre (just as some of the waves passing an island are refracted toward the shore by the island’s mass – see **Enceladus and Gravitation**). Along their course, the refracted gravitational waves are concentrated 10^24 times in the intense warping we call matter.

Enceladus and Gravity

If space-time (whose warping is gravity) forms mass, there could be "currents" of space-time flowing in the "oceans" between the galaxies. Space-time would form the matter in the galaxies, and it would form the Earth/objects on this planet. How? By some of the currents of space-time or gravity which pass the solar system's outer boundary being diverted towards the massive Sun's centre (just as some of the waves passing an island are refracted toward the shore by the

island’s mass). Along their course, the refracted gravitational waves are concentrated in the intense warping we call matter.

In the April 4 issue of SCIENCE, scientists report that NASA's Cassini spacecraft measured the gravitational tug of Saturn's moon Enceladus on the spacecraft during 3 flybys - thus learning about Enceladus' gravitational field and, in turn, its distribution of mass. Do I hear people saying this proves gravitation originates within bodies; and that it cannot come from the solar system's outer boundary and be diverted towards the massive Sun's centre, forming astronomical bodies/objects on those bodies during the journey?

Matter would, in this case, be the concentrated form of gravitational waves. Purely for convenience, let's switch our attention from Enceladus to Earth (the principle remains identical). There's a stronger gravitational force on the surface of, and within, the Earth because gravity is concentrated in the matter there. So, like in a black hole, time is slowed down (by much less and at lower altitudes, in the case of Earth). The high velocities experienced by orbiting astronauts also slows time at their extreme altitudes. The article “Gravitation” by Robert F. Paton - The World Book Encyclopedia (Field Enterprises Educational Corporation, 1967) – states, “… when one object is inside another, gravitation decreases the closer their centers are to each other” and also states that Isaac Newton’s 1687 Law of Gravitation explains why an object at the center of the earth would weigh nothing*. Objects in space or an orbiting spaceship are similarly free from the earth’s (or any planet’s or star’s) concentrated gravity/mass which is below, instead of above, them and makes them relatively weightless. Gravity’s pan-directional repulsive** force is UNconcentrated and, as Penguin Encyclopedia tells us, FAR less than Earth gravity. The concentrated gravity forming the spaceship is insignificant compared to the gravity forming a planet or star, and causes no reduction of weightlessness.

* The interpretation in this vixra article says the concentrated gravity, which we call mass, above the object pushes equally on it from every direction and renders it weightless since it isn’t attracted to any portion of the overlying mass.

** Einstein showed that attraction of two bodies of matter actually results from space-time’s curvature pushing bodies.

When Einstein penned E=mc^2, he used c (c^2) to convert between energy units and mass units. The conversion number is 90,000,000,000 (light's velocity of 300,000 km/s x 300,000 km/s) which approx. equals 10^11. After gravity forms matter, successive gravity waves are, via gravitational lensing, concentrated 10^24 times (to 10^25, weak nuclear force’s strength, giving the illusion that a weak nuclear force exists without being a product of gravitation). Then they’re further magnified by the matter's density to achieve electromagnetism’s strength (10^36 times gravity's strength) i.e. 10^25 is

multiplied by Einstein's conversion factor [10^11] and gives 10^36 (this gives the illusion of electric and magnetic fields that are not a product of gravitation existing). Successive gravity waves are absorbed by the matter and radiated as longer-wavelength waves (both as electromagnetic waves - possibly gamma rays, or a microwave background – and as gravitational waves which have lost 10^24 of their energy or strength (and are labelled “10^1”.)

That 5/100,000 g, though only a tiny amount, is enough to slow the spaceprobes and place them 5,000 kms short of their predicted positions. How much gravitational energy, in the form of space-time currents in the outer solar system, is required to produce a mass that would weigh 0.00005 gram on Earth? This is calculated by solving the famous mass-energy formula E=mc^2 for mass i.e. by using m=E/c^2. E (energy) is measured in joules (J), m is the mass in kilograms (kg; 1 kg = approx. 2.2 pounds), and c is the speed of light (about 186,282 miles/299,792.458 kilometres per second) measured in metres per second (m/s or ms^-1).

Using m=E/c^2, 0.000 000 05kg equals x(gravitational)J divided by 299,792,458 metres per second squared. Simplified, that’s 0.000 000 05 = x / 300,000^2 (90,000,000,000).
x=.000 000 05 times 90,000,000,000
x=4,500
4 and a half thousand joules (approximately) are encountered by each Pioneer - 1 joule is about the amount of energy it takes to lift an apple one meter against earth’s gravity.

The RTG is used where solar cells, fuel cells, batteries etc, are impractical. It converts the heat from a radioactive source such as plutonium-238 into electricity with thermocouples (thermoelectric devices consisting of two different conductors connected in a closed loop – if the junctions are at different temperatures, an electric current will flow in the loop). The RTG releases energy at a fairly constant rate for a reasonable period e.g. in a space probe whose mission extends several decades. An RTG generates a few hundred watts (1 watt = 1 joule per second). Using 500 watts in m=E/c^2 means
m=500 (joules per second)/90,000,000,000
and that is not enough to provide 0.000 000 05 kg. Therefore, the cause of the Pioneer anomaly cannot be thermal – and a gravitational explanation is supported.

Remember - 0.000 000 05 kg is merely one example. While a thermal cause may be sufficient to produce a smaller mass, a gravitational cause will always be more likely to form both the example and larger masses. Recall the above sentences that say “When gravity waves (the warping of space-time) concentrate to form matter …” and “Then (gravitational waves are) further magnified by the matter's density to achieve electromagnetism’s strength (10^36 times gravity's strength) i.e. 10^25 is multiplied by Einstein's conversion factor [10^11] and gives

10^36 (this gives the illusion of electric and magnetic fields that are not a product of gravitation existing)". Though it's possible that high-frequency electromagnetic waves like X-rays or gamma rays, as well as the subatomic particles in cosmic rays, might contribute to Pioneer's extra mass**;** a gravitational cause is not invalidated since both matter and electromagnetism have their origins in gravitation.
