

**Title –**

**COMMENT TO SCIENCE JOURNAL “PHYSICAL REVIEW D” REGARDING SERGEI KOPEIKIN’S ARTICLE “CELESTIAL EPHEMERIDES IN AN EXPANDING UNIVERSE”**

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**Abstract –**

Sergei Kopeikin, professor of physics and astronomy at the University of Missouri, thinks the previous explanation for the so-called Pioneer Anomaly<sup>1</sup> was only able to account for 15 to 20% of the observed deceleration. He devised a new set of calculations that included the universe's expansion, and the way expansion affects the speed of photons which compose the light and radio waves.

<sup>1</sup> In a paper published on June 12 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 ... conclude that, once the thermal recoil force is properly accounted for, no anomalous acceleration remains.”

Both the “thermal recoil” and “universal expansion” theories regarding Pioneer are extremely interesting. However, I suspect the emission of thermal radiation doesn't have a large enough effect, just as Sergei Kopeikin states. I also suspect the speed of photons in the vacuum of space is, as Relativity states, constant and always appears constant - and that universal expansion therefore doesn't have enough effect either. I'd therefore like to propose a refinement of gravitational physics. I redefine warping as 2.3 times General Relativity's value - deflection of starlight by the sun is still at 1.75 arcseconds since 57% of the light is diverted into solar wave packets (my ideas owe part of their inspiration to the MUH or Mathematical Universe Hypothesis formulated by MIT's Professor Max Tegmark).

I didn't originally intend to write about tides, falling bodies, Earth's orbit, and Greek philosophers. But if someone is attempting to explain the Pioneer slowdown by a new interpretation of space-time warping (and this warping is what gravitation is), it's a good idea – even an essential one – to not solely write about General Relativity and the spacecraft launched 40 years ago. Ideas from centuries ago – including those of Newton, Kepler, Galileo, Aristotle, Parmenides, Zeno – must also be analysed, as must original interpretations of the Mobius loop and figure-8 Klein bottle.

**Content –**

Sergei Kopeikin, professor of physics and astronomy at the University of Missouri, thinks the previous explanation for the so-called Pioneer Anomaly<sup>1</sup> was only able to account for 15 to 20% of the observed deceleration. He devised a new set of calculations that included the universe's expansion, and the way expansion affects the speed of photons which compose the light and radio waves.

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Prior to specifically addressing resolution of the Pioneer anomaly through refinement of gravitational physics, it's necessary to mention a few other topics as a result of the need to write at some length regarding the mathematical and unified nature of the cosmos. This nature includes the unavoidable introduction of a couple of unfamiliar concepts - 1) binary digits generating space-time from a 5th dimension<sup>2</sup> via matter-forming wave packets produced from the interaction of gravitation and electromagnetism (both ultimately made of 1's and 0's)<sup>3</sup>; and 2) the Mobius loop being changed into the physical form of Einstein's warping of space and time (since this universe is described by fractal geometry<sup>4</sup>, quantum loops describe wave packets). There is already support for the idea of the electronic mechanism of binary digits - in the Kabbalah (an interpretation of the Scriptures used by some Jews and Christians that seeks to discover mysteries by using special methods of interpretation). According to an email I received from a priest in the USA, "What you have presented is a confirmation of what the kabbalah has within its texts. That there is only nothing (represented by 0) and 1." 0 and 1 are pulses of energy being off or on. It can be phrased this way "... orientation of Mobius loops and the flow of the loops' binary digits accounting for the interference between gravitation and electromagnetism". That is: the flow of

0's and 1's (in the 5th dimension) causes gravitational and electromagnetic waves (in the wave packets of the 4 familiar dimensions) to either cancel and produce nothing or 0 (or add up to an electrically neutral particle). Alternatively, the waves can reinforce and produce an "on" pulse or 1 (add up to a positively charged particle). Naturally, gravitational and electromagnetic waves can only cancel and reinforce if they're similar and approximately equivalent. In agreement with the idea that gravitation (the warping of space-time) is the foundation of the universe<sup>5</sup>; electromagnetism is referred to as modified gravity and subatomic phenomena like electric charge/magnetic polarity, the nuclear strong and weak forces, and quantum spin, are the product of gravitational and electromagnetic waves interacting in wave packets (it's possible that what we call quarks could be redefined as mathematical constructs and still agree with observational data). Since the flow of binary digits – base 2 mathematics - is a purely mathematical concept, the G and EM waves – being ultimately composed of 1's and 0's – don't have to result in a positively charged particle. Their maths can result in a negative charge.

<sup>2</sup> I don't believe the supersymmetry theories can provide a unified account of the 4 fundamental forces but supersymmetry attracts me because it's the child of hyperdimensionality (which is vital to my idea of binary digits originating in 5<sup>th</sup>-dimensional hyperspace and "creating" space-time). In 1919, German scientist Theodor Kaluza "... wrote to Einstein, proposing that Einstein's dream of finding a unified theory of gravitation and electromagnetism might be realized if he worked his equations in five-dimensional space-time. A few years after that, the Swedish physicist Oskar Klein published a quantum version of Kaluza's work. The resulting Kaluza-Klein theory ... turned out to be salutary in working on supersymmetry (in the 1970s)." (p.332 of "Coming of Age in the Milky Way" by Professor Timothy Ferris – published by The Bodley Head, 1988) (Supersymmetry is part of present-day string theory too.)

<sup>3</sup> Suppose Albert Einstein was correct when he said gravitation plays a role in the constitution of elementary particles (in "Do Gravitational Fields Play An Essential Part In The Structure Of The Elementary Particles Of Matter?", a 1919 submission to the Prussian Academy of Sciences). Einstein also said gravity and electromagnetism may be related – in his paper to the Prussian Academy, he

said "Therefore, by equation (1)  $G_{\mu\nu} - \frac{1}{2}g_{\mu\nu}G = -\kappa T_{\mu\nu}$ , we cannot arrive at a theory of the electron by restricting ourselves to the electromagnetic components of the Maxwell-Lorentz theory ..." A wave packet consisting of gravitation and EM (modified gravitation) would possess what we call mass because of that force's effect on other particles. Where does this leave the Standard Model Higgs field and boson?

<sup>4</sup> "Monthly Notices of the Royal Astronomical Society" reports that the WiggleZ galaxy survey confirms that matter is distributed evenly at the largest scales. But if we disregard the largest scale of infinite flatness, smaller scales reflect the idea

of fractals e.g. from roughly spherical galaxy clusters, down to stars, down to atoms.

(after examining recent measurements by the Wilkinson Microwave Anisotropy Probe, NASA declared "We now know that the universe is flat with only a 0.4% margin of error." - [http://map.gsfc.nasa.gov/universe/uni\\_shape.html](http://map.gsfc.nasa.gov/universe/uni_shape.html);  
and according to "The Early Universe and the Cosmic Microwave Background: Theory and Observations" by Norma G. Sánchez, Yuri N. Parijskij (published by Springer, 31/12/2003), the shape of the Universe found to best fit observational data is the infinite flat model).

<sup>5</sup> Actually, gravity is only the apparent foundation of the universe – the cause we can detect, and see the effects of. It'd be more accurate to call gravity the universe's middleman. It's the cause of things like electromagnetism, the nuclear strong and weak forces, wave packets, repulsion, and attraction. (If electromagnetism truly is nothing but modified gravitation, the same could be true of the strong and weak nuclear forces. Then there would not be 4 fundamental forces, or even the 2 of gravitation and electromagnetism, but only the 1 called gravitation. Would this 1 force introduce a Unified Field Theory and a Theory of Everything?) But gravity is also an effect – of mathematics generated in a 5<sup>th</sup> dimension\*. The true foundation of the universe is maths.

In relation to wave packets (referring to Einstein's paper "Do Gravitational Fields Play An Essential Part In The Structure Of The Elementary Particles Of Matter?") - If gravity is actually a repulsive force, it would eliminate the need for dark energy<sup>6</sup> (see the paragraphs below, enclosed in borders) to exist and cause universal expansion. But the sun and moon would cause varying tide levels as a result of the constantly varying position, relative to Earth, of the gravitation-absorbing wave packets which compose them i.e. the gravity associated with the sun and moon appears to cause attraction (more about tides in next paragraph). The apple that was supposed to have hit Isaac Newton on the head wouldn't have been pulled there by our planet's centre – it would have been pushed there by gravity coming from the outer solar system (and ultimately by warps of space outside our galaxy). Not all of the gravity encountering the sun or moon is blocked by being diverted into solar and lunar wave packets. Much reaches Earth and is diverted into the wave packets of all things from the top of the atmosphere, to the surface, to the centre of the inner core. Gravity pushes planets toward the sun (planets' orbital speeds prevent them falling into the sun). Some gravitational waves from outside the solar system pass by and some are diverted towards the sun (just as some of the ocean waves passing an island are diverted to the shore by being refracted by the island's mass). As the waves pass the outer planets, more of the waves are refracted by the planetary masses to cancel at the planet's centres where, agreeing with conclusions from Isaac Newton's theories, objects weigh nothing.

If an equal amount of gravitational waves from every direction in the outer solar system converged on a planet whose composition was separate from the

gravitation; the orbit of our planet would be equally pushed towards and pushed away from the sun at every point in its orbit and would be a perfect circle. But the gravitational balance is upset because the gravitation composes the planet's matter-forming wave packets. We might expect waves from every direction to contribute equally to the formation of wave packets. This would be so if local space-time was uniform in composition or character everywhere (flat and homogeneous). However, General Relativity attests that space-time is curved and warped and the Mobius loop attests the same when it's transformed from the abstract world of maths to the world and cosmos we know via gravity being ultimately composed of binary digits. These digits make space-time (and its warps which are called gravity) appear to be nothing when they're actually something, and they make mass when they're combined in wave packets with the modified gravity known as electromagnetism. Upsetting of gravitational balance by planets means their orbits cannot be circular but must be elliptical. Fractal scaling of the Mobius could cause individual planets to each possess their own balance and have tiny variations in warping of the surrounding space (a variation resulting in the Pioneer anomaly, and also variously – sometimes imperceptibly - influencing the “flyby anomalies” of spacecraft receiving gravitational slingshots/gravity assists to alter their trajectory or speed). There is no independence of time and space; so if flyby anomalies occur at different points in space, they must also occur at different times at the same point in space (space-time warps are very dynamic).

Why will two bodies dropped from the same height in a vacuum reach the ground simultaneously (this was verified by the Apollo astronauts on the Moon using a feather and a wrench or hammer)? They actually don't. There's an incredibly tiny, immeasurable, difference explained this way - the more mass a body possesses, the more gravitation is diverted to play a part in that body's formation (and the more inertia is imparted by the gravitons); though the International Space Station weighs around 400 tons, it has tiny mass compared to any planet and produces so-called weightlessness while black holes – ranging from about 3 solar masses for the smallest stellar variety to billions of solar masses for supermassive black holes in galaxy centres – have so much mass and diverted gravity that light pushed into them is unable to escape.

In further relation to wave packets and the tides - The difference in mass between a space station and a black hole is enormous; but the difference between a feather and tool is, in comparison, nothing. So while the heavier tool does fall faster than the lighter feather as the ancient Greek philosopher Aristotle believed, the difference is many billions of times beyond science's finest measuring instruments. It's appropriate to use the results of the experiments of Italian physicist Galileo, and say gravitation is absorbed into wave packets and the inertia of the gravitons carries objects towards Earth's centre at  $9.8 \text{ m/s}^2$  or  $32 \text{ ft/s}^2$ . The mass of the oceans on Earth is estimated at nearly 1.5 billion cubic kilometres (“Ocean Volume and Depth” – Van Nostrand's Scientific Encyclopedia, 10<sup>th</sup> edition 2008). All this water is being pushed towards Earth's

centre at 32 feet per second per second. But the seafloor prevents its descent. So there is a recoil, noticeable offshore (it is only where oceans and continents meet that tides are great enough to be noticed). This recoil is larger during the spring tides seen at full and new moon because sun, Earth and moon are aligned at these times. This alignment means more of the gravitational waves travelling from the outer solar system are captured by solar and lunar wave packets, and less of them are available on Earth to suppress oceanic recoil (there are still enough to maintain the falling-bodies rate of  $32 \text{ ft/s}^2$ ). At the neap tides of 1<sup>st</sup> and 3<sup>rd</sup> quarter, only the moon is significantly suppressing oceanic recoil. If variables like wind/atmospheric pressure/storms are deleted, this causes neap tides which are much lower than spring tides.

Production of wave packets is ultimately mathematical (the mathematical foundations could perform “packet switching” - transforming from the abstract world of maths to the physical world of matter’s wave packets). I believe the maths involved belongs to base 2 i.e. the binary digits of 1 and 0 are the cause of matter, gravity, EM, the nuclear forces, black holes, space (whose warps are gravity), and time. (Time is also warped, and possibly an electronic “clock” measuring the motions of matter i.e. producing frames as in a movie. If the universe is made of frames, the word “travel” would refer to one state or position (such as in a planet’s or moon’s orbit) being electronically represented in a “cosmic movie frame”, with possibly a billion times a billion frames displayed every second [or a billion times that] so that its “movement” would appear continuous. Time travel into the past or future would be like going to different points in the cosmic movie instantly. Were ancient Greek philosophers Parmenides and Zeno of Elea at least partly correct to speak of the absurdity of reality being made up of many changing things? Zeno also said motion is absurd. Motion and change would, in the end, merely be the switching of 1’s to 0’s and vice versa.)

I didn’t originally intend to write about tides, falling bodies, Earth’s orbit, and Greek philosophers. But if someone is attempting to explain the Pioneer slowdown by a new interpretation of space-time warping (and this warping is what gravitation is), it’s a good idea – even an essential one – to not solely write about General Relativity and the spacecraft launched 40 years ago. Ideas from centuries ago – including those of Newton, Kepler, Galileo, Aristotle, Parmenides, Zeno – must also be analysed.

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<sup>6</sup> An alternative interpretation of dark energy would be to consider it as radiation of binary digits from hyperspace. It seems to me that gravitation can be viewed as the effect of the cause known as binary digits. What if Israeli scientist Yakir Aharonov, and others, are correct about the theory of retrocausality (that effects influence causes – therefore, causes and effects are not necessarily separate?) Gravitation would then be dark energy too, and I think it would change the

astronomy world if scientists would study this possibility.

"Hidden variables" is an interpretation of quantum mechanics which is based on belief that the theory is incomplete (Albert Einstein is the most famous proponent of hidden variables) and it says there is an underlying reality with additional information of the quantum world. I suggest this underlying reality is binary digits generated in 5D hyperspace. These allow time travel by making it possible to warp space<sup>7</sup> (wormholes being one example of doing this) simultaneously adding precision and flexibility to the elimination of distances; and the "fitting together" of subuniverses (see this Comment's 2<sup>nd</sup> last paragraph) to form a continuous superuniverse. (The boundary where subuniverses meet might be called Cosmic Strings - analogous to "cracks" in spacetime formed as subuniverses cool and similar to cracks that form as water freezes into ice - and first contemplated by the theoretical physicist Tom Kibble in the 1970s.)

<sup>7</sup> Maybe hidden variables called binary digits could permit time travel into the future by warping positive space-time. And maybe they'd allow time travel into the past by warping a 5D hyperspace that is translated 180 degrees to space-time, and could be labelled as negative or inverted. (The space-time we live in is described by ordinary [or "real"] numbers which, when multiplied by themselves, result in positive numbers e.g.  $2 \times 2 = 4$ , and  $-2 \times -2$  also equals 4. Inverted "positive" space-time becomes negative hyperspace which is described by so-called imaginary numbers that give negative results when multiplied by themselves e.g.  $i$  multiplied by itself gives  $-1$ . [Supporting info from Stephen Hawking's "A Brief History of Time" – Bantam Press 1988, p.134]) The past can never be changed from what occurred, and the future can never be altered from what it will be. Both are programmed by the 1's and 0's. Our free will can be used to a small extent to change the course of our personal lives ... but it's powerless to stop Hitler doing what he did, or to prevent humans learning to time travel oneday.

"Empty" space (according to Einstein, gravitation is the warping of this) seems to be made up of what is sometimes referred to as **virtual particles** by physicists since the concept of virtual particles is closely related to the idea of quantum fluctuations (a quantum fluctuation is the temporary change in the amount of energy at a point in space). The production of space by BITS (Binary digITS) necessarily means there is a change in the amount of energy at a certain point, and the word "temporary" refers to what we know as motion or time. Vacuum energy is the zero-point energy (lowest possible energy that a system may have) of all the fields (e.g. electromagnetic) in space, and is an underlying background energy that exists in space even when the space is devoid of matter. Binary digits might be substituted for the terms zero-point energy (since BITS are the ground state or lowest possible energy level) and vacuum energy (because BITS are the underlying background energy of empty space). Relativistically, space can't be mentioned without also mentioning time, whose warping can therefore

also be viewed as gravitation (since “dark matter” is invisible but has gravitational influence, its existence could be achieved by ordinary matter travelling through time).

I call hidden variables (or virtual particles) binary digits generated in a 5th-dimensional hyperspace which makes them - as explained in the next sentence - a non-local variety, in agreement with the limits imposed by Bell's theorem. (Bell's Theorem is a mathematical proof discovered by John Bell in 1964 that says any hidden variables theory whose predictions agree with quantum mechanics must be non-local i.e. it must allow an influence to pass between two systems or particles instantaneously, so that a cause at one place can produce an immediate effect at some distant location [not only in space, but also in time].) Comparing space-time to an infinite computer screen and the 5th dimension to its relatively small – in this case, so tiny as to be nonexistent in spacetime – Central Processing Unit, the calculations in the “small” CPU would create and influence everything in infinite space and infinite time. This permits a distant event to instantly affect another (exemplified by the quantum entanglement of particles separated by light years) or permit effects to influence causes (exemplified by the retrocausality or backward causality promoted by Yakir Aharonov and others (see “Five Decades of Physics” by John G. Cramer, Professor of Physics, University of Washington - <http://www.physics.ohio-state.edu/~lisa/CramerSymposium/talks/Cramer.pdf>). This means quantum processes, in which effects and causes/distant events are not separated, wouldn't be confined to tiny subatomic scales but would also occur on the largest cosmic scales.

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On September 9th 2012, Pioneer 10 was 9.918 billion miles from Earth. It was launched on March 2, 1972 so it had been travelling for 14,799 days. It's trajectory has not always been a straight line but let's assume another 820 million miles have been involved in its encounters with planets (including Earth) and moons, plus in its course corrections. Then we can make its path a straight line i.e. 180 degrees which is 10 billion miles long. If we also assume exactly 15,000 days of travel (that takes us to late April-early May 2013), the spacecraft travels an average of  $10,000,000,000/15,000$  or 666,666 miles per day i.e. 243,333,090 miles each year. Since everything in a unified field theory or Theory of Everything is united <sup>8</sup> (including spacecraft, miles, and angles), it travels (in a year) 243,000,000 miles in 180 degrees (648,000 arcseconds). In <http://vixra.org/pdf/1212.0096v2.pdf> I suggested the curvature of space proposed by Relativity is only 43% of the actual figure. In that article, it's said starlight does indeed get deflected 1.75 arcseconds by the sun (as Einstein stated), but that 57% of the light is diverted into the sun's matter-forming wave packets (as  $E=mc^2$  implies when it's converted to  $m=E/c^2$ ). But in the present article, the relevant figures (100%, 43%, 1.75 in fractional form) become  $(100/43 \times 7/4)$  and equal 4.069. The true curvature would be 4 arcseconds or 2.3 times the accepted 1.75. In one arcsecond, Pioneer travels  $243,000,000/648,000 = 375$  miles.



Remembering that my contributions to viXra often describe space-time warps as Mobius warps (you need to travel around a Mobius loop twice to reach your starting point); we must multiply the 375 miles by 2. In one arcsecond, Pioneer travels 750 miles. In 4 arcseconds, three thousand miles. The total shortfall in travel distance (see next sentence) is 3,000 miles per year if Pioneer is traversing space-time that is curved and warped 2.3 times General Relativity's prediction.

If it was possible to do, flattening the very small arc formed by introducing 4 arcseconds each year would extend the endpoint of the space probe's travelled distance by 3,000 miles. The probes are travelling some 3,100 miles less than expected each year according to "The Pioneer anomaly - solved?" by Liz Kruesi in "Astronomy" magazine - Nov. 2012, p.20. Did my fondness for approximating, both here and in <http://vixra.org/pdf/1212.0096v2.pdf>, remove some 100 miles (about 3%)? The Planetary Society comes to my rescue and says, "Each year, they (the Pioneer space probes) fell behind in their projected travel by about 5,000 kilometers (3,000 miles).

<sup>8</sup> See the earlier paragraph where gravitation is called the universe's apparent foundation and mathematics is called its true foundation. As well, see <http://vixra.org/pdf/1301.0040v1.pdf> which speaks of using transcendental and irrational numbers to connect two programs (Mobius loops) into an infinite number of figure-8 Klein bottles (each is the basic unit – a subuniverse completed with two loops of its own – comprising the universe). I could branch into a discussion of these subuniverses, but that doesn't seem appropriate at this point. I'm here to talk about Pioneer. The only thing connecting Pioneer and a subuniverse is the Mobius. A subuniverse has two loops, but Pioneer is travelling through the warped space-time created by only one. Why is this? Could it be related to the unified field/TOE and be the result of the 2 Mobiuses being integrated into 1 figure-8 Klein bottle?

The inverse-square law further states that the force between two particles becomes infinite if the distance of separation between them goes to zero. Remembering that gravitation partly depends on the distance between the centres of objects, the distance of separation between objects only goes to zero when those centres occupy the same space-time coordinates (not merely when the objects' sides are touching i.e. infinity equals the total elimination of distance – the infinite cosmos could possess this absence of distance in space and time, via the electronic mechanism of binary digits). Zero separation is the case in **quantum-entangled** space-time and physicist Michio Kaku says in his book "Physics of the Impossible" that modern science thinks the whole universe has been quantum-entangled forever. This means there's still room for the infinity known as God. God would be a suprapantheistic union of the universe's spatial, temporal, hyperspatial, material and conscious parts; forming a union with humans in

a cosmic unification, and a universal intelligence. Science's own Law of Conservation says the total mass (or matter) and energy in the universe does not change, though the quantity of each varies (I interpret this Law as saying – to get matter and energy, you have to start with matter and energy; which means time must be warped). So subtracting humans of the distant future (with their ability to travel into the past and use incomprehensibly-advanced cosmogenesis, terraforming and biotechnology) from the origins of life makes it impossible for inorganic materials and – referring to the creation of amino acids in the laboratory by Harold Urey and Stanley Miller in 1952, relatively simple amino acids - to be assembled into complex plants and animals.

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