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Why Does Newton's Apple Fall *Vertically* to the Ground: The Gravitation Code

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Abstract

No, Isaac Newton did not "explain" gravitation. What he did, and this certainly constituted all and by itself a great achievement, was to recognize (to "assert") the universal character of gravitation: all material objects (bodies) attract each other by gravitation. But how does gravitation perform its deeds? This remained a mystery to Newton. In a "desperate move" at the end of his life, he introduced the concept of "Particles which are moved by certain *active Principles* [our emphasis]—such as is that of Gravity" he said. We resurrect this scheme, we provide it with a quantum structure—a stunning new insight into the workings of gravitation obtains.

Keywords

Gravitation, Newton, Fatio de Duillier, Ethereal Particles, I-Meteons

1. Introduction

Ever since in 1896, the great Swedish physical chemist Svante August Arrhenius (1859-1927) propagated the fallacious assertion making carbon dioxide (CO_2) a dangerous "Greenhouse Effect" gas contributing to climate warming [1]. Physicists at large have displayed a startling ability to believe in just about anything. Astute observer of human nature, Albert Einstein, took advantage of this to cause physicists surreptitiously to see in him the greatest physicist who ever lived—after Newton, of course. Speaking of Newton, who has not heard of the legendary story of the future great Natural philosopher watching an apple fall off a tree to the ground under the influence of that mysterious force, Gravitation, deciding then that he would be the one, some day, who would unravel the secrets of gravitation—decode the Gravitation Code—, a natural ambition for someone who, like himself, was destined to become a devoted theologian and alchemist [2].

As it turned out, Newton did *not* break (decode) the Gravitation Code. What he did, and this certainly constituted all and by itself a great achievement, was to recognize (to "assert") the universal character of gravitation: all objects (bodies) having mass attract each other by gravitation. If one of the two bodies is the Earth, gravitation is conventionally called *gravity*. This constitutes, by the way; a circular reasoning: any two bodies which have mass attract each other by gravitation; any two bodies which attract each other by gravitation have mass.

Very well, but how does gravity (gravitation) operate? This remained a frustrating puzzle to Newton to the end of his life. In an ultimate "desperate move"—and this might have been in the wake of his encounter a few years earlier with a young genius mathematician who *did* propose a "Mechanical" explanation of the workings of gravitation—Newton introduced the concept of "*Particles* which are moved by certain *active Principles*—such as is *that of Gravity*", he said (our emphasizes) [3].

Gravity caused by "*active principles*"… Newton meant an action arising from the "Will and the Spirit" of God, *i.e.* not caused by any mechanical, material agent.

We retrieve this commonly ignored Newtonian scheme. We provide it with a quantum formulation. A breathtaking revolutionary insight into the (hidden) workings of gravitation obtains.

2. Birth of a Mechanical Model of Gravitation

2.1. Birth of a Genius

In 1683, after twenty years sharing the same rooms in Trinity College at the University of Cambridge, Newton's companion John Wickens left Cambridge to become a country vicar somewhere else. Henceforth on his own to pursue in secrecy his alchemical experiments and his arduous attempts to decipher the prophecies consigned in the Old Testament, Newton undertook to write the first Book of the philosophical treatise which was to make him famous, the renowned *Principia*. In the midst of these intense activities, he suddenly became involved with a young genius mathematician twenty-two years younger than him.

Born the seventh child in a family of fourteen siblings originally established in the small town of Chiavenna in northern Italy, the boy is eight-years-old in 1672 when his father, Jean Baptiste Fatio, or Faccio short for Bonifaccio, acquires a new residence in the canton de Vaud in Switzerland, the Seigneurie de Duillier (**Figure 1**), whereby his son Nicolas assumed proudly henceforth the name Nicolas Fatio *de Duillier*.

Talented, ambitious and adventurous, young Nicolas seeks from the start the company of men of high intellectual standing, preferring them to "little Persons". At nineteen, he is in Paris working under the leadership of the great astronomer Domenico Cassini at the Observatoire royal, but the 22 October 1685 the King of France, Louis XIV, who used to sign his name *Nous Louis Roi* (We Louis King) promulgates the Edict of Fontainebleau which forbids the practice of Protestantism on the territory of his kingdom. Young Nicolas takes refuge in the Netherlands in the company of the "excellent Mathematician and good Philosopher" Christiaan Huygens, who soon takes

Figure 1. Le château de Duillier.
https://upload.wikimedia.org/wikipedia/commons/thumb/a/a4/Chateau_Duillier2.jpg/420px-Chateau_Duillier2.jpg

him with him to London, where Fatio is promptly elected a Fellow of the *Royal Society*. He is twenty-four years old. Newton himself had been elected a Fellow of the Royal Society sixteen years earlier.

The encounter between the two Fellows left them both in a daze: young Fatio informed his elder that he had elaborated a "Mechanical" theory of gravitation!

Written in seventeenth century French, Fatio's *Mémoire Sur la Cause de la Pesanteur* [4]—Essay on the Cause of Gravity—remained unpublished during Fatio's lifetime. It was retrieved among his papers after his death at his residence in Maddersfield near Worcester in England on May 10th 1753.

2.2. Fundamental Assumptions

The starting points of Nicolas Fatio's mechanical theory of gravitation are four. We first list them as formulated by Nicolas Fatio in his original language, then express them using modern words and concepts. They are:

1) The World—the Universe, the Cosmos—is composed of (apparently) solid bodies—Fatio calls them "coarse bodies"—which in realty are composed of "Atoms" which are "porous"—*i.e.* full of (invisible) holes.

2) Atoms have geometrical shapes which make them look the same in all directions—they are *anisotropic.*

3) Besides "coarse bodies", the World—the Universe, the Cosmos—also contains another kind of matter—Fatio calls it *ethereal*.

4) *In fine*, the coarse bodies present in the Universe are so porous that the ethereal particles can move freely through them, generating in the process the phenomenon we observe as gravitation.

These assumptions take on added significance when expressed in contemporary terms. Astrophysicists tell us indeed nowadays that the observable universe contains a phenomenal number of *galaxies*, each composed of billions of suns (*stars*), themselves

agglomerates of atoms themselves made up of so-called *elementary particles.* If the observable universe—if the Cosmos—is made up of elementary particles—electrons, quarks, neutrinos and the rest—which individually occupy essentially no space, then, *in fine*, against all appearances said universe is fundamentally a huge vacuum—a *Void*— dotted of point-like "nothings", a thought that Fatio expressed in his days in these words: "*Je suppose que les differents Espaces du Monde sont presque entierement Vuides* [sic] *de Matiere*. —I assume that the different Spaces in the World are almost entirely Void of Matter."

Let us investigate these considerations in the context of a specfic example.

2.3. The Special Case of Newton's Falling Apple

Consider the legendary example of Isaac Newton as a boy observing an apple fall off a tree down to the ground (**Figure 2**). To us, ordinary inhabitants of the planet Earth, nothing special about this: grass is green, the sky is blue, and ripe fruits fall off branches. Newton was more subtle: to him the Earth as a whole does not "attract" the apple; instead, the apple "sees" the Earth's *Center*, "which is a mathematical point", he said; the apple is attracted by it, or to it, and moves toward it—an Act of God, by Newton's reckoning.

This is where Nicolas Fatio's genius intervenes. Let us idealize the apple by representing it as a small "coarse" solid sphere. By the criteria exposed in our Heading 2.2., this sphere is really a ghost shell containing porous Atoms immersed in the "Vuoid", as Fatio spells it. Essentially empty, this ghostly sphere is nevertheless capable of experiencing the effects of gravitation. How does it do that?

Young Fatio imagined the following clever scheme. In addition to "coarse matter", he said, the world—the universe, the cosmos—also contains other kinds or species of matter, and he described their qualities…

Figure 2. Young Newton observing the falling apple.
http://www.akg-images.co.uk/Docs/AKG/Media/TR5/0/3/3/f/AKG333767.jpg

Fatio wrote his memoir using a vocabulary composed of seventeenth century French words which are difficult to "translate" properly in any contemporary idiom. Giving up word-for-word translation, we express in modern terms Fatio's fundamental concept of the existence in the universe of at least two distinct kinds of matter—*coarse* matter and *ethereal* matter according to one of his choices of qualifiers.

I-meteons—*i-points* in motion—constitute ideal quantum-world candidates to incarnate the "ethereal" or "second-nature" particles said by young Fatio to be responsible for gravitational effects. We invite the reader unfamiliar with the i-point and i-meteon concepts to consult the presentation of their significances in [5].

As per this contemporary quantum scheme, i-meteons are generated randomly, *i.e.* they propagate equally (indifferently) in all directions in Absolute space, the only restriction to their activity being that they each carry precisely one element—one unit, one *quantum*—of "motion", a designation introduced to replace the term "dynamical action" ill-appreciated by theoreticians in general nowadays (they prefer to speak of "energy").

Let our idealized spherical "coarse apple" be on its own, isolated somewhere in the cosmos far from the influence of any other "coarse body" such as the Earth. Our apple is then exposed "naked" so to speak to the random flux of i-meteons arriving from all parts of the world (**Figure 3(a)**). Arriving randomly from all directions, the i-meteons exert no net "push" on the apple in any one particular direction—no gravitational pull or push is generated on our "apple".

Now allow another "coarse body" to be in the viccinity of the apple, say next to it for the purpose of illustration. By Nicolas Fatio's contention—and this is the key to the proper functioning of his Mechanical model of gravitation—, being next to each other the two coarse bodies "filter" the ethereal Particles—the i-meteons for us—arriving on them from one side (**Figure 3(b)**). An asymetry or imbalance is generated in the system, each of the two bodies is impiged less on one of its sides and starts moving in that direction, being apparently gravitationally "attracted" by the other body whose

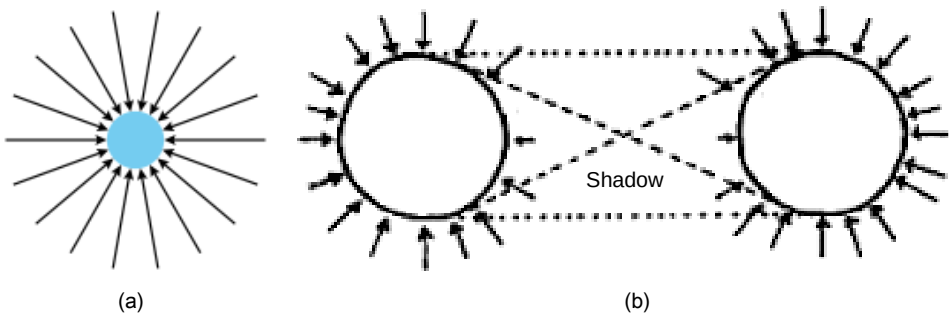

Figure 3. (a) I-meteons impinging randomly from all sides on an isolated coarse spherical body generate no net "push" on it.
https://upload.wikimedia.org/wikipedia/commons/thumb/2/2d/Pushing1.svg/225px-Pushing1.svg.png (b) Coarse bodies "shadowing" each other.
https://encrypted-tbn1.gstatic.com/images?q=tbn:ANd9GcRK4tfCKk7igUhiCcKXgXQJaZv7L6Y76rq6kWJwvInTWBGpgf2C

presence causes the imbalance to occur. In reality each of the two bodies is driven toward the other by the "push" of unbalanced incoming i-meteons—etheral Particles for Nicolas Fatio.

And suddenly, contemplating **Figure 3(b)**, a simple, startling "explanation" as to why Newton's apple falls v*ertically* to the ground and why we are held *vertically* when we stand erect on the ground somewhere—anywhere—on the surface of the Earth minding our own business emerges. Unseen but nevertheless present around us, i-meteons impige on our "coarse body" just about equally from all directions… from all directions but one: the massive coarse Earth under our feet prevents i-meteons from entering our body vertically upward through our feet. As a result the i-meteons which enter our coarse body vertically downward through the top of our head are not compensated by i-meteons entering our body from the opposite direction; they exert a net push vertically downward on our body—we stand *vertically* erect.

It remains to account for the quantitative aspects of the phenomenon.

3. Probing the Model

3.1. Why the Inverse Square Law

Gravitation is known to possess two fundamental characteristics: 1) it obeys an "inverse-square" law and 2) it satisfies the law of "mass proportionality". Does our quantum "shadow model" of gravitation satisfy these two requirements?

The imbalance in i-meteon distribution is independent of the size of the enclosing sphere while the sphere surface area increases as the square of the radius. The imbalance per unit area decreases inversely as the square of the distance between the two body centers: the inverse-square law obtains.

3.2. Why Mass Proportionality

Nicolas Fatio spent three years of his life thinking about it, he said… until he came up with a plausible answer while in London in the Fall of 1689. The key of his discovery is this.

While crossing a "coarse body", an ethereal particle can experience two kinds of mishaps: 1) be "absorbed"—Fatio calls it be "condensed"; or 2) loose some of its momentum—Fatio calls it loose some of its "Mouvement" (Motion). "Je reconnus que cette Condensation, he said, etoit aussi petite qu'on vouloit, de même que la Perte du Mouvement, jusques à devenir infiniment petite, si l'on faisoit les Suppositions necessaires."—I found that the Condensation [Absorption] was as small as one might want, as well as the loss of momentum, so as to become infinitesimally small, if one made appropriate Suppositions [Hypothesises].

Anticipating the modern belief in the existence in nature of elementary particles, he postulated the presence in coarse bodies of several "Orders" of particles which attract each other by gravitation, except for the particles belonging to one particular Order. The particles belonging in this Order are so perfectly 'hard", he said, that their "Ressort" [ability to reflect off an impinging entity] can be thought to be infinite, the Cause

of which is "Metaphysical in essence" and has its origin in "the Will of the Creator", a belief he shared with Newton [2].

The fundamental question which arises in the frame of this scheme concerns the nature of the interaction which takes place when an ethereal Particle—an *i-meteon* for us—goes through the "Vuoid" contained in a given coarse body. Nicolas Fatio's key assumption in this regard stands in one sentence (our translation): "Gravity is produced, in my view, by Exceedance of the Speed of the Particles of this [ethereal] Matter which impinges on the Earth for example, or some coarse Atom of which it is composed, over their Speed when they are reflected..." [4]. In brief: incident ethereal Particles strike the body at a very high speed, then rebound with a slightly lower speed.

Advantages; This is actually a more sophisticated model than simply assuming total absorption because it reognizes that perfect reflection would result in no anisotropy at all in the surrounding flux, and therefore no net force of gravity. Instead it allows for a combination of reflection and absorption of momentum and avoids mass accumulation (Fatio assumed his ethereal Particles to have mass). He also stressed the fact that to produce a given amount of gravity, we can suppose the bombarding Particles to be arbitrarily small while assuming their speeds to be arbitrarily great. This automatically diminishes the drag induced by the movement of coarse bodies to a negligible amount. Fatio also argued that by supposing the speed of the ethereal Particles to be extremely great, the amount by which they are slowed can be made as small as we wish, so there need be no appreciable dimunition of their agitation over time.

These considerations fare well with our quantum scheme as described in [5]. When the ubiquitous quantum sets in motion one of the points the dimensionless Void contains, this point becomes a e-meteon if the quantum sets it to move at the speed of light c; a i-meteon if the quantum sets it to move at speeds slower or faster than the speed of light—in brief at speeds not related to the speed of light.

This concept will come as a shock to those who believe the speed of light to be the ultimate speed that a body can achieve while moving in the universe—a material body, yes, but i-meteons are not material bodies, they are i-meteons, *i.e.* they are points.

In this regard, we call attention to the invention made by the incomparable Richard Feynman, Nobel Laureate for Physics in 1965, when he postulated in 1969 the existence in nature of point-like *partons* defined with respect to a physical scale making it possible for them to exist either as "valence constituents" of elementary particles, or as "nonvalence partons" forming a "sea" [6].

Two kinds of point-like partons…. We will not be surprised to find in this magical invention matter useful for enriching our own invention of i-meteons and help in understanding the nature of their behavior in interactions. We shall leave these considerations for further studies to be conducted.

4. Sad Ending

After French King Louis XIV revoked the Edict of Nantes in 1685, a group of radical Protestants, the *Camisards,* began a violent insurrection in the French countryside. In

1706, after the movement was put down in France, some of the Camisards immigrated to England where they became known as the *French Prophets*. Fatio became a disciple of their leader, Elie Marion. He went with him into animated visionary trances during public sermons, claiming to perform miracles (including raising the dead), and made extravagant prophecies of the imminent end of the world. In 1707 Marion, Fatio, and another French Prophet were convicted of blasphemy and sedition and sentenced to be pilloried for two days. A sign placed over Fatio's head explained the reason(s) for his being exposed to the pillory (**Figure 4**).

"Nicolas Fatio convicted for abbeting and favouring Elias Marion, in the Wicked and counterfeit prophecies, and causing them to be printed and published, to terrify the Queen's people."

In 1710 the French Prophets left England for Holland, where Nicolas Fatio was twice more sentenced to the pillory. He accompanied Marion thereafter on travels through various European countries, attempting to make converts. While in Turkey in 1712, Marion fell ill, and died. Fatio returned to England, settling near the town of Worcester where he remained for the rest of his life, meditating on the prophecies and pursuing his scientific research. After his death on May 12, 1753 (he was then 89-years old), Swiss mathematician Georges-Louis Le Sage, himself a Huguenot, visited Fatio's former English estate in Maddersfield and retrieved his gravitation papers. In 1784 he made Fatio's gravitation theory known under his own name, asserting that the ethereal particles responsible for gravitation actually originated in another world, deserving to be called accordingly "ultramundane corpuscules". But this is another story, outside the scope of

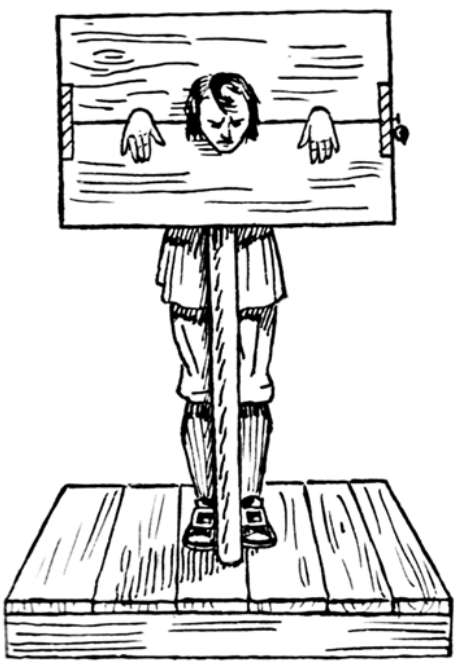

Figure 4. Pillory.
http://media.virbcdn.com/cdn_images/resize_1024x1365/0f/ContentImage-9524-287624-545pxPillory_PSF.png

the present note.

5. Conclusions: Breaking the Gravitation Code

Newton recognized ("asserted") in his days the universal character of gravitation, but he never found nor proposed an explanation for it. He ended up believing gravitation to be the result of a (permanent) "Act of God" and he was sharply critical of those who thought otherwise. "That gravity should be innate, inherent, and essential to matter, he wrote, so that one body may act upon another at a distance through a vacuum, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me **so great an absurdity** [our emphasis], that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it." To which he added this verdict: "Gravity must be caused by an agent acting constantly according to certain laws; but whether this agent be material or immaterial, I have left to the consideration of my readers." [3]

An "agent acting constantly according to certain laws"… *the quantum* to us in this note.

Great mathematicians—among them James Maxwell and French mining engineer genius Henri Poincaré, inventor in 1900 of the famous relation $E = mc^2$—have shown convincingly that classical collisions of incoming particles of some sort with the particles constitutive of matter could not legitimately account for gravitation [7].

I-meteons are quantum *points*, not "particles". Their interventions in the affairs of the System of the World—at speeds not related to the "speed of light"—cannot be assimilated to those of the plain particles described in the Standard Model. Indeed, a new era in our understanding of the way motion (action) models the cosmos has been initiated and awaits further investigations [8].

In his dreams, Newton decided "Gravity must be caused by an agent acting constantly according to certain laws". To us in this note, the agent Newton envisioned is the ubiquitous quantum. We shall leave it happily at that and salute with respect the memory of the brilliant young genius ex-Camisard sympathizer, ex-*French Prophet* who showed the way to Newton… and to us. Wouldn't it be a wonder if, thanks to him, the Gravitation Code had at last been broken?

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