

Why Gravity emerges as a Natural Consequence of Nature's Laws

3 May, 2020

Kenhoffman48@msn.com

This paper is to provide support for the position why Gravity is a force that emerges as a natural consequence of nature's rules described by Newton's laws and the laws of thermodynamics.

"The second law"... [of thermodynamics]... "is of central importance in the whole of science, and hence in our understanding of the universe, because it provides a foundation for understanding why any change occurs." ¹

"Power in science springs from abstraction...the second law...when expressed in abstract terms *applies to all change*." ²

Change can bring an imbalance and that imbalance elicits a natural response from Universe to correct that imbalance whether that change involves pressure, temperature, charge, concentration, and the point of this paper, even acceleration. Change provides the window of opportunity for the movement of energy and the possibility for all that has evolved.

Universe in Never Ending Change

What directs and drives Universe? Change is an underlying driving force. Change can never be stopped. Motion means change and change means more motion. Universe never stops moving from the micro to the galactic scale. From the Big Bang until now, universe has been in a constant state of evolution driven by change. And although it seems to be in complete harmony with this evolving change, oddly; its laws seem designed to suppress that change. Isn't it a strange paradox that Universe is always in a state of constant change while trying to move to a stable low energy state? Nature's response to an imbalance is directed to an optimum efficient process towards low energy, and a higher entropy system in equilibrium.

Universe is constantly challenged with maintaining stability and equilibrium at the same time that a constant change is mandated as time moves forward. When imbalances manifest, nature moves the system towards a minimum energy status to erase the imbalance. This is the inevitable consequence of a never ending change in the system's balance of energy, pressure, temperature, volume, charge, fluid flows, concentrations, and acceleration.

What drives Universe to move towards stability and change without end? One endlessly begets the other. How does it do this with optimum efficiency and no waste of energy? Universe is a cycle of forces searching for balance and along the way locally it finds from time to time both stability and chaos. What dominates in the end is what state the system is in at the time of change. Is it a closed, open, or isolated system?

“An **open system** is a system that freely exchanges *energy* and *matter* with its surroundingsA **closed system** is a system that exchanges **only energy** with its surroundings, not matter...An **isolated system does not exchange energy or matter** with its surroundings.” ³

Nature’s Intolerance of an Imbalance

Historic tales tell us that Aristotle is credited with the phrase, ‘nature abhors a vacuum.’ ⁴ This vacuum is not just about the absence of everything, it is about an inherent imbalance. If there is a void created purposefully or the result of natural events, nature moves to fill it. But any imbalance calls on nature to correct that imbalance. For example, the natural variations driven by sun and sea observed as a difference in pressure and temperature works as the driving force in our weather as nature responds to these changes.

When a closed system is opened to its surroundings, nature will act. A voltage difference will be erased accordingly. It follows the path directed by nature’s laws. A pressure difference will lead to a state of pressure equilibrium when opened to its surroundings. A temperature difference dissipates as per nature’s direction (Newton’s Law of cooling) to a state of thermal equilibrium. Apparently, this rule to seek balance is always in play whether its electricity, magnetism, voltage, pressure, temperature, or a charge or a fluid concentration imbalance. These are changes due to nature’s response at a small scale. Imbalances mentioned here involve movement of molecules, atoms, ions to return to an equilibrium state.

The collection of activity of these moving atoms and molecules includes accelerating vectors. Acceleration also means an imbalance that nature seeks to correct. Individually this is a tiny force and can easily be dismissed at a micro scale, which physics does, and would seem not to have any impact in light of the presence of the EMF and other forces.

It is proposed here that an accelerating mass even at the smallest quantum scale of an individual atom or within the atom is the bottom scale source of this Gravity force. Matter and space are connected at the smallest scale. The Gravitational Mass of an object is the response of Space as the accumulated sum of this isotropic spherical field generated at the quantum scale.

The scale does not matter for nature *to respond* to change, but it does affect *how* nature responds to change. Universe can detect change at any scale and regardless how small that change is, Universe can, it may trigger a response to correct that imbalance. But not every response to change, no matter how small is an assurance of movement to stability. The smallest change can lead to an unsteady state. Nature dislikes an imbalance and the correction takes place quickly or over some time frame as directed by her laws, but she is compelled to act.

For nature, this response is spontaneous. It is an instantaneous response according to thermodynamics which “means not to be driven by doing work of some kind.” ⁴ This is not about speed. It may occur quickly or happen over a long time period. Regardless of the time frame, there is “the tendency for a change to occur.” ⁵

Instead of assigning human qualities to nature, a more objective approach adopted by science is that probability tells us that there are many more ways a system can be in a disorganized steady state and only a few ways it can be in an organized state. Those disorganized states mean low energy and high entropy. The universe is always moving in that direction. That is the arrow of time.

If there is a natural spontaneous correction for nature to make when there is an imbalance at the micro scale, is it not reasonable to suggest that Universe is again making a spontaneous response when an imbalance manifest at the macro scale? Is this what we see when there is an acceleration of any object in space not in the presence of a gravitational mass field?

Newton's Laws of motion:

- First, an object in constant motion or stationary will remain in that state unless acted upon by some unbalanced outside force.
- Second, the acceleration times the mass of an object defines that force.
- Third, for every action there is an equal and opposite reaction.

These laws have defined the rules for motion and give the sense that all has been included in Newton's three laws. The first two laws give reasonable statements about motion and force. Interestingly, the amount of force is directly proportional to the acceleration.

The third makes this subtle observation of a force being countered by an equal and opposite force. Why should this happen? What solicits this response from nature? What is it that is responding to this change? What is there to give any response? There is only matter and space and the energy exchange between them. If there is action from matter, space is there to respond.

An emergent response of space is driven by nature's universal reaction to any unbalance. When an object or particle accelerates, energy has been transferred to it via an applied force and Newton's laws apply on the macro scale; and at any scale the laws of thermodynamics are in play.

But what about nature's response at the larger macro scale.

The Laws of Thermodynamics as that driving force.

Einstein showed that to be inside a spaceship accelerating at 'g' cannot be distinguished from the force of gravity on earth. We are told Newton's 3rd law is displayed in the balancing force response we experience when standing on the Earth. Any acceleration and generating G-force is compared to some multiple of earth's gravitational force and this G-Force is considered a pseudo force. It is just the consequence of opposing earth's gravity.

But is this the same in the case of an accelerating spaceship without being in the presence of a gravitational force field? Just the accelerating body and space are present. How does this equal and opposite force emerge? This is Universe resisting change. The force applied to achieve acceleration is necessary to overcome inertia, the tendency to change from as is, is resisted, as per Newton's 1st law. Is this response force truly equal? It is just Universe responding spontaneously to change. It can do so because **thermodynamics tells us any spontaneous process will increase entropy.** ⁶

The laws of thermodynamics demand that a tax be paid to the cold sink surroundings of space. "Work is Motion against opposing forces." ⁷ So if space responds to the motion of acceleration with an opposing force as given by Newton's 3rd law, then work is being done. A tax is being paid, so the opposing energy force is not exactly equal. Some energy tax is paid in producing that force. Energy is given up to the cold sink of space.

Gravity emerges also with any object's Inertial Mass (that large number of collected particles) accelerating vector at any scale. A new perspective is realized by applying the laws of thermodynamics and extending the contribution of Newton's Laws of motion and his gravitational force equation.

A total combined force emerges when all contributions are considered on the scale range from the microscopic to the vastness of the mass of galaxies with their billions of stars and all of their accelerating parts. Whenever and where ever there is acceleration of matter, that is, a changing mass velocity vector whether translational, angular, rotational, or any combination at any scale; there is a response from Space. Thus, any acceleration calls on nature to act, to respond to the imbalance.

Newton gave us Gravity as the undetectable force mysteriously acting from a distance, but somehow reaching across space, to invisibly tug on another object and control its path. His formulas:

$$F = GMm/r^2 \quad \& \quad F = ma$$

These provide answers for a moving mass and the movement of the planets in our solar system. But is this complete? It is known that velocities of masses in the outer spiral arms found in distant galaxies are not consistent with Newton's formula which has led to the speculation of the presence of Dark Matter.

This formula for Gravitational Mass (GM) is sufficient for our analyzing and predicting movement of planets and their moons, but why does it fall short when applied to movements within galaxies? Is it because it has missing terms that are needed in this larger scale, high mass, high velocity, high acceleration application? A force emerges whenever, where ever there is any acceleration of the GM (a changing translational vector, an angular vector, and/or a rotational vector).

$$F = GMm/r^2 \quad \text{force for Gravitational Mass (GM)}$$

A possible adjusted formula with added missing gravity forces from additional accelerations would include:

$$F = GMm/r^2 + \text{Force from any translational accelerating Inertial Mass (IM)} + \text{force from angular acceleration vector} + \text{force of rotational acceleration vector.}$$

These force terms could be high value additional factors in defining galactic movements if there are large masses and velocities, and large accelerations that are not accounted for.

Summary

Yes, the force is incredibly small at the micro scale and is ignored at that level, but it is still present and its presence is experienced when enough atoms collectively manifest this isotropic force field. A large accumulation of atoms such as in a planet provides the mass force response for what is called a Gravitational Mass (GM). The G-Force response of any accelerating Gravitational Mass is the gravitational force response of an accelerating Inertial Mass (IM). This perspective gives an understanding to the question physicists ask- why is the force of gravity so small compared to the other forces, the hierarchy problem? ⁸ The hierarchy problem..."ultimately boils down to the weakness of gravity compared with all the other known forces." ⁹

The smallest strength of the gravity 'force' is at the micro/quantum scale. The force emerges when Space encounters any acceleration of matter at any scale. At this level the purpose of the force is to make stable the constituent matter and force fields of quarks, gluons, protons, neutrons, and electrons, etc.

Gravity emerged at the 'beginning' with the same need to make stable the whole system. It was necessary for its power to increase with increasing scale to deal with the immensity encountered at cosmological scales of mass and acceleration, but it was also essential that it not burden or be a hindrance at small macro scales.

The purpose of gravity is to provide a means for Space of system Universe to reach an outcome that does not lead to its own death.

Gravity fills all of Space. It is the 'DNA' of the Universe. It is the directive code that moves Space and Matter fields towards equilibrium and low energy and it transcends the speed of light. It happens outside the dimension of time. The equal and opposite force that manifests per Newton's third law is the energy of Gravity as Space responds to any accelerating mass at any scale. It covers all of space at every possible scale. It is the response to all acceleration at all scales to promote a stable system.

An accelerating system is a transfer of energies. There is the possibility to do work. The system entropy is decreasing and that goes against the path of nature's reaction. Thus, any acceleration calls on nature to act.

Gravity being connected to Matter and Space was proposed by the author previously in papers published at The GSJ. ¹⁰ Space is connected to matter at the smallest scale and Gravity emerges when Space detects any acceleration at any scale.

Occam's razor applies here. It is the simple explanation for the emergence of the force of gravity that has long defied an explanation. Newton's and Einstein's equations do not lead us to the source of gravity. They, respectively, describe this as a mysterious action at a distance between masses and as the curvature of space as a result of that interaction.

Kenneth Paul Hoffman

- 1) Atkins, Peter; FOUR LAWS THAT DRIVE THE UNIVERSE; page 49
- 2) Atkins, Peter; FOUR LAWS THAT DRIVE THE UNIVERSE; page 50
- 3) [https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_\(Physical_and_Theoretical_Chemistry\)/Thermodynamics/Fundamentals_of_Thermodynamics/A_System_and_Its_Surroundings](https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Thermodynamics/Fundamentals_of_Thermodynamics/A_System_and_Its_Surroundings)
- 4) <http://factmyth.com/factoids/nature-abhors-a-vacuum/>
- 5) Atkins, Peter; FOUR LAWS THAT DRIVE THE UNIVERSE; page 65
- 6) <http://faculty.uml.edu/ndeluca/84.122/topics/topic8.htm>
- 7) FOUR LAWS THAT DRIVE THE UNIVERSE by Peter Atkins; page 23
- 8) <https://www.forbes.com/sites/startswithabang/2015/12/11/the-greatest-unsolved-problem-in-theoretical-physics-why-gravity-is-so-weak/#424ec8c91826>
- 9) Randall, Lisa; Warped passages; page 243
- 10) <https://www.gsjournal.net/Science-Journals/Research%20Papers/View/7442>

<http://gsjournal.net/Science-Journals/Research%20Papers-Relativity%20Theory/Download/7389>

<http://gsjournal.net/Science-Journals/Research%20Papers-Cosmology/Download/7037>