Causality, time, and force

J.C. Hodge[1*]
[1]Retired, 477 Mincey Rd., Franklin, NC, 28734

Abstract

Orthodox physics makes extensive use of number relation mathematics such as mapping, probability, and infinite series. This mathematics is devoid of causative relations. A method to implement D. Hume's philosophy of causation and time is suggested. The method is applied to Newton's laws, the Faraday equation, and the Scalar Theory of Everything (STOE) Universal Equation. Including causation in physics modeling can result in increased understanding of physicality and new insights, which have been observed. The obfuscation of mathematics may be removed from physics by finding the cause–effect of observations.

keywords: causation, time, STOE, Newton.

1 Introduction

Conceiving of causation as a physical reality is part of intuitive thinking. Physics has increasingly used mathematics formalism to describe the universe and observations. Hodge [9, 18, 19] suggested the mathematics used by humans derived from the real physics of a very complex process in the universe and causation could be actualized in the equations by a modification of the equals sign. The linking of mathematics methods to physics has increased the usefulness of physics to better predict outcomes of observations. However, the more complex postulates and the accompanying mathematics reduces causality concepts and increases physical obfuscation. Hodge [18, 19]

*E-mail: jchodge@frontier.com

discusses several mathematics operations and constants that seem devoid of physicality and discusses causality and determinism.

The equations prior to ca. 1900 can be viewed as suggesting causation. However, the equations post ca. 1900 have increasingly changed to assignment and calculating operations of mapping, probability, and infinite series [3]. The fundamental problem is that the idea of causation has been increasingly ignored.

Adlam [1] suggested a "strong causation" model which had the time dependence as a signal that travels from the cause to the effect.

Newton [22]; Hodge [16] defined three types of body "mass" characteristics as weight, inertia, and gravitation. He then used the idea of "forces" to state his three laws of motion. Later, Newton [23] suggested an aether medium which transmitted forces induced in the medium (gravitational mass). The gradient of the aether medium impinging on a body induces (weight mass). The "forces" were abstractions for the purpose of calculating.

Kinsler [20, 21, and references therein] suggested the highest–order time derivative should be regarded as the effect in a causation equation. He applied this understanding to the Faraday's Law:

$$\vec{\nabla} \mathrm{X} \vec{E} = -\partial_t \vec{B}, \tag{1}$$

where $\vec{E}$ is the electric field, $\vec{B}$ the magnetic field, and ∂_t is the time derivative. The electric field variation causes the changes in the magnetic field. However, he discussed the apparent disagreement between the causality apparent in the experiments and the causality interpretation of his mathematical model. The effect of causation is a term or parameter in an equation.

The STOE considered the plenum density ρ obeyed the heat equation. This was successfully applied to the microwave background temperature [6]. The plenum flows from points of higher ρ to points of lower ρ. The rate of decrease of ρ varies with direction and the rate of amount of ρ crossing an element of spherical surface is proportional the greatest rate of the decrease $\vec{\nabla}\rho$. The proportionality constant is conductivity that is related to Maxwell's equations. So, several bodies in a volume each decreases the ρ. At short distance from the center of these bodies, the ρ varies laterally in addition to radially from the center. So, at a distance from the bodies, an equal potential ρ surface is formed spherically around the center of bodies. This is the Spherical Principle. The Spherical Principle applies after some distance from a body (hod). That is, it does not apply at less than the atomic scale

in bodies nor close (within 10s of AU) to Sources and Sinks.

Hodge [16] suggested a Universal Equation which is quoted (except for the equation numbering) here:

> The plenum density at all points ρ_{p} in the universe is the sum of the effects of all galaxies and all hods,
>
> $$\begin{aligned} \rho_{\mathrm{p}} &= K_{\epsilon} \sum_{i=1}^{N_{\mathrm{source}}} \frac{\epsilon_i}{r_i} - K_{\eta} \sum_{j=1}^{N_{\mathrm{sink}}} \frac{\eta_j}{r_j} \\ &\quad - K_{\mathrm{hods}} \sum_{k=1}^{N_{\mathrm{hods}}} \frac{m_{\mathrm{g}}}{r_k} \cos\left(\frac{2\pi r_k}{\lambda_{\mathrm{T}}} - \pi\right) \exp^{-j(\omega t_k)} \\ &> 0 \quad , \end{aligned} \tag{2}$$
>
> where K_{ϵ}, K_{η}, and K_{hods} are constants that relate the relative influence of the Sources, Sinks, and hods, respectively; ϵ_i, η_j, and m_{g} are constants that relate the value of a measurable parameter such as a galaxy's B-band luminosity or hod gravitational effect for Sources, Sinks, and hods, respectively; r_i, r_j, and r_k are distances from the center of each component to the point being evaluated; λ_{T} and t_k are wave characteristics generated in the plenum by moving hods. The λ_{T} and t_k depend on the ρ_{p} [7].
>
> The ρ as the r increases, like a fluid, becomes smoothed in the direction perpendicular to r. This is the "spherical principle". The number of hods appear as if they were concentrated at the center of the structure (center of mass) as r increases beyond a minimum value. The K_{hods} term looks like the gravitational mass effect in Newtonian scale observations.
>
> The K_{ϵ} and K_{η} terms become predominate on cosmological scale observations.
>
> The inclusion of all Sources, Sinks, and matter means the STOE is a Machian model.
>
> Note the r values are for the determination of distance for the ρ calculation. Therefore, the time required for a change in r to travel through the plenum determines the position of the emitting object for the calculation of ρ at a point. The change-in–r wave can be very much faster than the speed of light [26].
>
> The divergence of ρ_{p} is proportional to a force $\vec{f}_{\mathrm{s}}$ that acts on matter and directs a hod,

$$\vec{f}_{\mathrm{s}} = K_{\mathrm{G}} \sum_{l=1}^{N_{\mathrm{hods}l}} m_{\mathrm{hod}} (\vec{n}_l \bullet \vec{\nabla} \rho_{\mathrm{p}l}) \vec{n}_l, \tag{3}$$

where m_{hod} is the surface area of a hod that is the same for all hods and $\vec{n}_l$ is the unit vector perpendicular and centered on the hod's surface. .

For matter,

$$\vec{f}_{\mathrm{s}} = G_{\mathrm{s}} m_{\mathrm{w}} \vec{\nabla} \rho_{\mathrm{p}}, \tag{4}$$

where the G_{s} is a proportionality constant analogous to the gravitational constant G without the $m_{\mathrm{i}}/m_{\mathrm{g}}$ value. The m_{w} is experienced as the effective surface area of the particle, and the familiar negative sign is included in the $\vec{\nabla} \rho_{\mathrm{p}}$.

Because electromagnetic signals speed is that of light, electromagnetic signals are hods [14]. The amount of plenum captured by a hod is constant and is the cause of m_{i} of bodies. Photons are a column of hods [7]. Because hods are two dimensional, hods and photons experience no impressed force in their direction of travel. That is, for smaller than electron structures such as photons or neutrinos, there can be directions with varying force depending on direction and $m_{\mathrm{w}} = 0$ in the direction of travel. Therefore, they travel at the maximum allowed speed of other bodies.

The structure of baryonic matter has hod surfaces facing all three directions such that the effective surface area is less than the number of hods times m_{hod} [10].

The inverse mapping produces the movement of a body:

$$\vec{a} = \frac{\vec{f}_{\mathrm{s}}}{m_{\mathrm{i}}}, \tag{5}$$

where $m_{\mathrm{i}} \neq 0$ because it is the captured plenum around the hods in the body and $\vec{a}$ is the acceleration of the body. Reference frames result when some terms of Eq. 2 are ignored for calculation simplicity.

Newton's three masses are (1) m_{w} is the effective surface area on which the $\vec{f}_{\mathrm{s}}$ is exerted, (2) m_{i} is the captured plenum which is proportional to the number of hods in a body, and (3) m_{g} is the deformation of the plenum caused by the hods and is proportional

to the number hods in a body. Note the number of effective hods vary by type of assembly (photon, neutrino, or baryon [10]).

Physicists have been struggling to find a fundamental approach to uniting cosmology and quantum worlds. Physics modeling could be aided by finding causality relations beyond the mathematics [4].

This paper suggests restoring the causality to physics mathematics is a necessary requirement. The Scalar Theory of Everything (STOE) demonstrates the type of postulate changes required [16]. Section 2 discusses how to show causality and what time is in physics mathematics. Section 3 discusses three examples of applying causality mathematics and the changed physicality understanding resulting from the application. The discussion and conclusion are in Section 4.

2 Causality and time mathematics

Hodge [18] suggests the basic functioning of the universe is based on our daily experiences. Humans' experience of the universe attributes the witnessed effects as being due to some cause. The understanding of the link between cause and effect offers greater ability to survive. Causality becomes more intuitive. So, if all effects may be modeled as causative, human understanding may be advanced.

Our experience in the macroscopic world results in our intuition as a base for expanding our knowledge. The Fractal (self-similar) Principle posits the processes in humans' classical scale are repeated in other size scales. Physics may then seek analogy from our intuition about how the universe functions. The trial–and–error method of problem solving has been successfully used by physics [8]. It is more productive than other methods for complex problem solving.

The universe exists now and only now (the NOW). Our brain configuration suggests there was a different NOW in what we perceive as antecedent to NOW. Our memory has taken something akin to a picture of a different placement of objects (bodies) than currently seen. Thus, our method of dealing with this is to consider that positions and things change. So, our intuition suggests change and a link from antecedent to the consequence of NOW as suggested by D. Hume [5]. Time is created in our minds and is measured by passage of events such as the ticking of a clock or motion of heavenly bodies. With time comes the modeling of causation as a link.

Whether time and causation exists is one philosophical discussion. If we humans are to survive, humanity has linked an ability to predict future conditions to our survival. Therefore, physics should include causation in our models [18; 5].

3 f causality

Define f as a causal factor or term in equations. If f is on right hand side (RHS) of an equation, it is an effect. If f is on left hand side (LHS) of an equation, it is a cause. The "=" sign equates the calculated number with units of measure on each side of equations.

3.1 Newtonian Force

The Newtonian suggestion of "force" as the f was an abstraction which allowed the relation of measurable acceleration to measurable weight and measurable gravitational attraction of bodies. Interpreting f as a causative agent yields Newtonian causation in his physics by a slight re-arrangement of the equations:

$$\frac{GM_{\rm g}m_{\rm g}}{r^3}\vec{r} = \vec{f_{\rm g}}, \tag{6}$$

or

$$\vec{f_{\rm g}} = \text{weight} \quad \text{If the mass is restricted,} \tag{7}$$

$$\vec{f_{\rm g}} = m_{\rm i}\vec{a} \quad \text{If the mass is non} - \text{restricted,} \tag{8}$$

where G is the gravitation constant, $M_{\rm g}$ is the gravitation mass of a body, $m_{\rm g}$ is the gravitation mass of a second body, $\vec{r}$ is the radial distance between the centers of mass of the bodies, and $\vec{f_{\rm g}}$ is the causative action of $M_{\rm g}$, $\vec{a}$ is the observed acceleration of another body, and $m_{\rm i}$ is a proportionality constant that is a characteristic of the second body called inertial mass. "Non-restricted" means free to change the r - move.

The suggested interpretation is the left side of Eq. 6 CAUSES the $\vec{f_{\rm g}}$ and the $\vec{f_{\rm g}}$ causes the movement $\vec{a}$ of the second body. The G and $m_{\rm i}$ are proportionality constants to make the numbers equate ("="). That is, the cause is specifically acknowledged in the physics math that has yielded the

recognition that there are other physics being described. Whereas, from the equality of numbers statement:

$$\frac{GM_{\rm g}}{r^3}\vec{r} = \vec{a}, \tag{9}$$

where the physics of causality is lost. Among other mysteries are the issue of inertia, the need to postulate rather than derive the $m_{\rm g} \propto m_{\rm i}$, and the issue of intervening causal contact (instantaneous action-at-a-distance - not propagation [1]) that our senses suggest.

3.2 Farada's Law

Faraday's Law (Eq. 1) as usually stated omits considerable physics as the experiments suggest. The first is Faraday's experiment wherein he used a battery to form a current in a coil that then was brought close to another coil where a voltage was induced. So, the current of $\vec{E}$ caused a force which then caused a "magnetic field" $\vec{B}_{\rm EM}$ with $\vec{f} = \vec{f}_{\rm EM}$.

$$\begin{aligned} \vec{\nabla}{\rm X}\vec{E} &= -\vec{f}_{\rm EM} \\ \vec{f}_{\rm EM} &= \partial_t \vec{B}_{\rm EM}, \end{aligned} \tag{10}$$

There is another experiment wherein a moving permanent magnet with $f = \vec{f}_{\rm M}$ and a permanent magnet field $\vec{B}_{\rm permanent}$.

$$\begin{aligned} \partial_t \vec{B}_{\rm permanent} &= -\vec{f}_{\rm M} \\ \vec{f}_{\rm M} &= \vec{\nabla}{\rm X}\vec{E}, \end{aligned} \tag{11}$$

This causative statement suggests separate experiments [11; 12; 13; 14]. There was something wrong with Maxwell's equations when examining practical applications. I concluded that Maxwell's equations are misinterpreted.

For example, the Biot-Savart experiment is interpreted as the first part of the causative Eq. 10 and Ampere's equation and is how the magnetic constant μ is measured. The length l of a bar is the length in the Biot-Savart equation. Thus, because the assumption that the magnetic field is emitted in all direction of each element of bar length, the integration is around the entire

[1] as used herein, "propagation" includes contact and causation.

circuit. So, experiments found the l is not the length of the current flow, but the overlap distance L - a redefinition of l [12; 13]. So, the equation where the Biot-Savart or Ampere's integration is around a loop is inconsistent with experiment.

Next, apply this to the current flowing in a loop that produces a "magnetic field" (Ampere's equation). The field in the center of the loop is as suggested by Maxwell's equations. However, close to the side of the loop, the overlap L changes and the data deviates from Maxwell's equations. But the electric current induced (Faraday's law) by a moving (permanent) magnet as measured by the voltage is the same wherever in the loop the magnet moves [14]. Thus, Faradays law and Ampere's law are not referring to the same type of magnetic field [3]. Thus we arrive at a source of the Faraday paradox (or the moving magnet and conductor problem) that is one of the experiments that resulted in the Special Theory of Relativity (SR) [17].

Note about speeds of interaction/causation: The Biot-Savart set-up is like a radio antenna. The speed of the emitted signal is the speed of light c. The STOE suggests this is of photons being emitted straight out of the wire. The speed of gravity [26] and the speed of the coulomb force [25] is $> 10^6 c$ and is the speed of the magnetic field from magnets. So, the speed of the signals becomes important in the consideration of causality. This different speed should be included in the criteria of causation. A signal must be sent from the cause to the effect that may replace the time order. Indeed, different observers (the SR concern) may observe different time orders.

3.3 STOE universal Equation

The Scalar Theory of Everything (STOE) defines a "strong causation" in which a body causes a change in the plenum density ρ that propagates to impinge a $\vec{\nabla}\rho$ to affect another body. There is only one field ρ and one force $\vec{\nabla}\rho$ for all effects.

The STOE's Sources, Sinks, and hods cause changes in the plenum by contact (following Hume [5]). The plenum ρ adopts the Spherical Principle starting at some distance from the cause. Unlike Newtonian physics, the ρ change then propagates at superluminal speed from the cause. This is "strong causation". The f of causes are $\epsilon_i K_\epsilon = f_{\text{source}i}$ for the i^{th} source, $\eta_j K_\eta = f_{\text{sink}j}$ for the j^{th} sink, and $K_{\text{hods}} m_{\text{g}} \cos\left(\frac{2\pi r_k}{\lambda_{\text{T}}} - \pi\right) \exp^{-j(\omega t_k)} = f_{\text{hod}k}$ for each hod. These cause changes in ρ that are then propagated to a point:

$$\sum_{i=1}^{N_{\rm source}} \frac{f_{{\rm source}i}}{r_i} - \sum_{j=1}^{N_{\rm sink}} \frac{f_{{\rm sink}j}}{r_j} - \sum_{k=1}^{N_{\rm hods}} \frac{f_{{\rm hod}k}}{r_k} = \rho_{\rm p} > 0, \quad (12)$$

When the ρ change reaches a hod, it exerts a force $\vec{f}_{\rm s}$ on the surface area of the hod. Newtonian mechanics suggest the action of the gravitational force is on the 3 dimensional body not the surface area. Yet the Spherical Principle is of a (spherical) surface expanding potential to give the r^{-1} dependence. The ρ then causes a force on the hods in a body:

$$K_{\rm G} \sum_{l=1}^{N_{{\rm hods}l}} m_{\rm hod}(\vec{n}_l \bullet \vec{\nabla}\rho_{{\rm p}l})\vec{n}_l = \vec{f}_{\rm s}, \quad (13)$$

Therefore, the r terms include a time of travel factor to reflect the position of the emitter when the ρ change was started. For distances less than astronomical, this seems ignorable or instantaneous [25]. However the idea that there is a time delay was key in understanding light (photon) interference [7].

The causation loop causes plenum changes that propagate at superluminal speed to other bodies and cause a Newtonian like force on the other body. All interactions occur at superluminal speeds. In this sense, all interactions are non-local.

Because the STOE postulates the reality of the plenum, the measurement of ρ directly seems unfeasible. That is our measurement instruments measure hod interactions.

4 Discussion and Conclusion

Whether symmetry along with structure is a fundamental part of a causation model is still unclear.

The present suggested causation method considers forces rather than energy. This allows the incorporation of dissipation such as friction as a resistive force. The energy methods have difficulty incorporating dissipation. Causality violates conservation laws. By basing physics on causative processes, mathematics on the classical (our everyday) scale, and a self-similar principle; physics models could be more comprehensive, easier to understand, and more useful [24]

The Hume "necessary connection" in the Newtonian model is that both masses are part of the causal implementation. This is because of the required instantaneous action. That is the bodies are physically linked. The STOE considers the causative agents are physically connected to the plenum. The causal force is then a signal that propagates at a finite speed to direct other bodies. This signaling is required to describe the photon (a particle) interference experiments of Young, Afshar [2], and Hodge [7; 15].

A method to implement D. Hume's philosophy of causation and time is suggested. The method is applied to Newton's laws, the Faraday equation, and the Scalar Theory of Everything (STOE) Universal Equation. Including causation in physics modeling can result in increased understanding of physicality and new insights, which have been observed. The obfuscation of mathematics may be removed from physics by finding the cause–effect of observations.

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