

Physics use of mathematics

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Abstract

Orthodox physics makes extensive use of number relation mathematics such as mapping, probability, and infinite series. This mathematics is devoid of causative relations. Other scientific disciplines such as medicine and chemistry use causative models. Using causative models would advance physics. Causation should be overtly stated in the mathematics. Causation is linked with emergence philosophy and not reductionism.

1 Introduction

Humans have limited ability to comprehend the universe. Our knowledge is neatly divided into separate and independent disciplines. Our survival depends on a generalist approach that adheres to the laws of the universe. Our experience in the macroscopic world serves as a base for expanding our knowledge. Our environment is continually changing. Maintaining status quo is not an option.

Understanding is the ability to predict events and observations. Wisdom is the ability to cause events and observations (Hodge 2012). Humanity has discovered that greater Understanding and greater Wisdom yields survival and population growth.

Humanity lacks the Wisdom to create a universe. But it has the Understanding to predict some events. The Wisdom humanity has is a smaller subset of Understanding that is a small subset of ontology. Thinking any of humanity's Understanding reflects ontology of the universe is hubris.

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Human Understanding devoted to expanding our survivability can be divided into two general categories: religious and scientific. Each has developed methods and criteria to advance human Understanding. Each works by recognizing patterns in the universe and by passing tests of survival.

Human modeling starts from postulates, which include methods of reasoning (logic), and extends to theorems. Theorems must be useful in predicting events. Survival for a longer time requires the amount of useful information and models to be expanded. Humans have developed models of how the universe works to serve the required expansion. “More fundamental” means the models humans need to explain the complexity of the entire universe (most general) could be simpler and more useful at the expense of an increased need for synthesis. This is Occam’s razor applied to the human understanding of the universe. The synthesis of emergent models replaces the analysis of reductionism. The rules for synthesis must also be more universal.

Religious Understanding predominantly concerns human social and human organizing. The time span of test and improvement is centuries. The universe (nature) tends to work by rejecting competing systems (Carroll 2016) as does physics. Because of the time required to determine rejection, the religious method of logic is “trial-and-error”. Typical moral thinking seems to lack mathematics, but statistics can model the characteristics of human development and suggest human organization theories. However, these theories are not yet at the Wisdom state of Understanding. The observation of several existing moral systems suggests humanity has much to learn.

Scientific Wisdom is concerned with the physical effects in the universe. Mathematics can “prove” the theorems by being self-consistent with its own postulates. Being “useful” is not a criterion for mathematics. Physical sciences must be consistent with observations that are the result of the largely unknown ontological workings of the universe. Therefore, physics can only reject arguments from the postulates. If the logic and the measurements are valid, then adjusting the postulates attains an increase in Wisdom.

A necessary paradigm shift in the fundamental models is long overdue.

This paper considers current knowledge concepts. Religious concepts are part of life and society. The next Theory of Everything model is considered to be a unification of principles for cosmology and Quantum Physics (QP). The Scalar Theory of Everything model (STOE) suggests the same set of principles should include life and society observations. The STOE demonstrates the type of postulate changes required. The basic functioning of the Universe is discussed in Section 2, Section 3 discusses causality and determin-

ism, infinite mathematical series is discussed in Section 4, valid and invalid Mathematical Characteristics are discussed in Section 5, and emergence is discussed in Section 6. The conclusion is in Section 7.

2 Basic functioning of the Universe

Our daily experiences in our world suggests:

“Matter” coalesces into larger, cohesive bodies that may be considered as acting as one. Particles become atoms, molecules, bodies, life, and society. This is the emergence of increasing complexity.

Relations between bodies .

Change and Competition for limited Resources.

Fractal structures are common throughout the universe.

Causality .

Feedback loops cause a fine-tuning of parameters. The feedback loop between Sources and Sinks (Hodge 2006a) cause the hunting of the average temperature of the universe. This suggests that the universe is a series of nested feedback loops. The problem is identifying them. An atheist dilemma is from whence the feedback loops. Perhaps these are the many worlds within our universe.

3 Causality and Determinism

Causality is a prime topic and goal in many areas of human modeling (Beebe et al. 2009; Pearl 2010). Philosophers in epistemology investigate how causation may be inferred from statistical and observational data.

Causation is a contested concept in physics. Perhaps this is because a causal assumption is behind every causal conclusion. That is, causality is not an observation. The slogan “correlation does not imply causation” is particularly poignant in physics. However, models invoking causality rely on some premises that are not measured, but can result in predictions with changing conditions.

Statistical analysis assesses the parameters of a distribution drawn from a sample. Associations among the parameters are then inferred. This task is well managed to the purposes of physics as long as the experimental conditions remain the same. Indeed, the Universe is one, therefore one can expect all events are related to some degree of correlation to all other events.

The aim of physics must be to predict events under a dynamics of changing and unmeasurable conditions. The application of statistical methods is only a first step in observation that lack causality. Unfortunately, this is the condition in both cosmology and QP. However, “causality” is not a measurable observation. Therefore, causality is a necessary part of models, only. Further, models that omit causality are incomplete models.

A useful distinction between number concepts and causal concepts is as follows. A number, only, concept is any relationship that can be defined in terms of joint distribution of observable values. A causal concept is a relationship that cannot be defined from distributions alone and that has a before and after ingredient. The causal concept can be applied to observations that are outside the realm of the conditions of number models. Therefore, QP causation should be able to apply to cosmology.

Certain concepts have aided humanity develop greater Wisdom. The determinism of events and observations should be assumed even if the ontology of the universe is not deterministic. Therefore, cause-and-effect is assumed for all observations where effects are not assumed. Models are the suggestions of patterns of cause-and-effect. Yet, all models must have some assumed effects without causes. All other observations are then to be derived by the model. Because of human limitations, the better model has a minimum of uncaused effects while deriving all observations. For example, part of the unifying of cosmology observations and observation of the small should be the unifying of the uncaused effects. The STOE plenum is like the “space” of GR and the medium supporting wave action of QP. These are not anthropic type principles. Without determinism and cause-and-effect humanity would be unable to increase Wisdom.

However, even if the universe were ontologically deterministic, the assumptions made about the initial conditions would have to allow some undetermined cause. Therefore, the universe is ultimately unpredictable. So, the best that humanity could do is predict within a limited amount of duration and a limited amount of distance. Humanities quest for Wisdom is to expand these limits.

The use of statistical mathematics may be used when Understanding of

a physical model is inadequate. When the causes of disease were unknown, statistics help Understand and Predict likely outbreaks and correlations. The correlation with polluted water helped reduce cholera although a physical cause was unknown.

QP uses a statistical approach. Some interpretations of QP suggest a physical reality. However, some of these interpretations result in many weird propositions. The STOE suggests that the universe is self-similar. Therefore, the equations and physical reality of the Newtonian scale apply to the very small scale. The core of QP rests on the explanations of light. The interference experiments seem contradictory to particle experiments such as the photoelectric experiment. The STOE follows the Newtonian model of light (Newton 1730, queries 17, 18, 19, 20, and 21). The Bohm Interpretation suggests particles have a definite position and momentum and the statistics results from an imprecise measurement. The Transactional Interpretation (TIQP) posits a wave returning from the future. The STOE suggest the “future” wave is a real wave that travels much faster than light in a real medium and that reflects from objects ahead of the photon. This medium wave is Bohm’s “hidden variable”. Thus, quantum eraser and entanglement experiments can be explained.

The model of a photon as a structure (Hodge 2016a) also suggests the light emitted from atoms suggests the atomic structure is rigid photons not electrons in orbits(Hodge 2019b). This model avoids many conceptual problems such as the lack of the decay of orbits without emission and the many ad hoc “selection rules”.

Accepted physics has been reluctant to embrace causality among “space-like” events. This has resulted in separate and political coexistence between Relativity (GR) and Quantum Mechanics (QP). However, the recent endeavor to find a “graviton” is suggesting recognition to merge these models. Also, the “entanglement” experiments require a Bohm-type “hidden variable” (violating “local-causality”). That is, requiring models to be causal may result in better predicting and useful models.

That an equation is causative requires a replacement of the equals sign ($=$) such as \rightarrow . So, $\vec{\nabla}\rho \rightarrow \vec{F}$ implies $\vec{\nabla}\rho$ causes the \vec{F} . Whereas, $\vec{\nabla}\rho = \vec{F}$ implies only the values are the same.

Consider, the field equation in General Relativity. The right hand side (RHS) of energy and momentum are calculated values with an equal sign. The left hand side (LHS) are, at best mapped/fictitious values of s and t . These values have no suggested relation to QP. Now redo the basic concept

with causation. The RHS is of values, only. The reality to measured parameters is mass, distance, and time. That is, forces applied over distance and duration rather than energy which ignores dissipative forces. These cause the s and t parameters which now must be real and describe a varying geometry. But this interpretation may also apply to Bohm's model of his "hidden variables". Thus, insistence on causation provides a link between GR and QP. All we have to do is loose Special Relativity.

4 Infinite series

Describing data relationships with infinite series such as the Fourier Series and the Power Series works with any data relations. Such descriptions may have many, even unlimited, constants. Ptolemaic description of the planets orbits involves a simple Fourier Series - circles within circles. The numbers matched the data with good precision and forecast ability. The later Copernican model with elliptic orbits and Newton's gravity replaced it with a causative model.

The early description of the Rotation Curves (RCs) by Vera Rubin used a Power Series to model the data. The later Dark Matter model and later still the Quasi Steady State Cosmology and STOE model placed a Source at the center of spiral galaxies as a cause of the observed RCs.

Currently, QP wave analysis is a Fourier Series approach. The STOE is suggesting a causative model to replace QP.

5 Valid and invalid Mathematical Characteristics

Humanity has created mathematical methods of the universe that aid Understanding and Wisdom. If mathematics is a core characteristic of our universe, the success of mathematics helping humanity suggests that a high degree of rationalism is fundamental. Mathematics rejects the idea of duality.

Mathematics has two varieties, algebraic and geometric. Algebra deals with numbers that are counts of discrete things. Physics adds the standard of measure as the thing counted. Special functions of mathematics may be abstract so that the count is unrelated to measures and, therefore, unrelated

to physical processes in the universe. Geometric mathematics deals with continuous shapes.

When describing physical events or entities in the universe, the computation must yield some other observed value or shape in the universe, which may be in the future. Physics models create algorithms. That is, algorithms are cause–effect models of universe processes. An algorithm that yields an unobserved outcome or fails to yield an outcome (addressed by Turing as “uncomputable” and by Gödel as undecidable) is non–physical. The universe does produce outcomes over time. If a model suggests the outcome should be observed and it’s not, then the algorithm is incorrect for the model or the model is incorrect. That is, an algorithm representing the physics of a universe process must be computable and decidable.

But mathematics and physics currently have limited ability to describe and predict events. Concepts outside those limits are considered with vague and poorly defined concepts. Consciousness, aims, and intentions are such concepts. Without a scientific definition, the discussion must be vague, subject to many interpretations, and, therefore, useless. Perhaps a new math may describe consciousness and brain functioning.

The STOE suggests a Universal Equation that calculates the force exerted at every point is a function of all galaxies and all mass in the universe (Hodge 2018b, 2020). The STOE is causal and Machian. However, the long–term average temperature of galaxy clusters hunts the same value for all clusters. Therefore, perhaps only a galaxy cluster need be considered (Hodge 2006b). The STOE concept serves to calculate the asymmetry of rotation curves (Hodge 2006c) and the periodic redshift measurements (Hodge 2006a) that mystify other models.

Human physics computability is limited by the degree of accuracy of a measurement. However, the universe has no such limitation. Another limitation results from having incorrect assumptions about the functioning of the universe and about the initial conditions of a modeled process. Mathematics starts with human assumptions, not physical assumptions.

The accepted units of standard measure lack some parameters such as the “cycle”. Also, commonly used is that $c = G = h = 1$ with no units. That these may vary is then lost in the mathematics.

The operation of division is used in mathematics but is disallowed in the universe. For example, a line is the extension of a point in space. A line defined as an infinite number of points is not physical. That is, irrational numbers such as $1/3$ and a result of infinity such as division by zero are

not points of a line. The key is that division introduces an uncertainty in a human calculation similar to a measurement uncertainty.

Transformation equations introduce fictitious parameters to aid the calculation. They are subject to all the potential problems of mathematics such as division by zero. The General Relativity (GR) field equation is such an equation. The introduced parameters are unreal. They must be re-converted to measurable parameters.

The STOE suggests the physical universe uses only cardinal numbers with zero and excludes negative numbers for physical values. For example, the particle and antiparticle behavior is due to differing structures (Hodge 2016a). The structure determines the type of vortices they cause. These vortices annihilate upon joining (+ and -) (Hodge 2018a). This model has the additional advantage that the less probable structures are less numerous in the universe.

The ordering of universe physical conditions (ordinal numbers) derives from the measurements. That is, a single step (+1) of the ordinal number may have varying measurement values and is non-physical. Therefore, the range of natural numbers is non-physical and confined to mathematics.

The STOE suggests one of the most fundamental components of the universe is physically continuous (Hodge 2014b). Natural numbers may represent the continuous component such as π and such as transcendental functions only to an uncertainty level. The waves in the continuous component and the Universal Equation maintain the geometric lengths of distance without the division required by the algebraic calculation.

Other mathematical concepts of imaginary numbers, more than three spatial dimensions, and transforms should be viewed with skepticism. If a model calculation yields an unobserved value, then suspect the mathematics model process in addition to suspecting the assumptions. But, these mathematical concepts are mere band-aids to cover a need for a better physical model of initial conditions and processes. The STOE is an example of how this may be done.

Until humanity can create a universe, the inaccuracies of human physical models continue.

The synthesis of mathematics with physical observation has resulted in greater and more accurate predictability. The end goal is survival through usefulness.

6 Emergence

Emergent agents and their simple rules of behavior form more complex entities and behaviors (Hodge 2016c). Two is a very fundamental form of organization. The STOE suggests there are two fundamental, physical components (hods and plenum) with their Spirit (interaction) and two major structures (sources/spiral galaxies and sinks/elliptical galaxies) of the universe (Hodge 2014b). The STOE Universal Equation is not a mathematical transformation because both sides of the equation are posited to be real physical entities. The hod/plenum model is the only model to predict and describe the Hodge diffraction experiments that rejects all wave model of light (Hodge 2014c, 2019c).

The relation between the agents and the emerged entities is causal. Therefore, because a single universe exists, a single Theory of Everything exists involving causal and Machian relations from the very small to the very large and involving the cause of society's success and life's consciousness (Hodge 2020). Additional concepts such as fractal structures and negative feedback loops from the emergent principal that describe the universe are also helpful.

The dark matter hypothesis is not an emergent, causal component of the universe. It is not a more primitive form because it doesn't emerge into baryonic matter. Instead it adds complexity rather than being simpler.

For example, life's principle of the survival-of-the-fittest could be applied to particles where only the structures of the long-lived particles (photon, electron neutrino, and electron) are key. The Serengeti rules (Carroll 2016) suggest feedback rules reject the weak rather than support the stronger. Likewise the CMB's feedback forms the temperature of the universe (Hodge 2006b). So, the stable agents at a given level of emergence are allowed to form diverse structures with their spirit. The unstable are rejected. The remainders are merely temporary as they form into more stable structures.

Combinations of simpler structures form more complex life. Human embryos go through the stages of evolution. State societies are composed of families, tribes, and chiefdoms. Likewise, electrons and neutrons are composed of photons. The analogy of one fractal scale to another is the ancient Chinese "Proof by Analogy".

Life has found the division of labor/energy/force into two sexes provides survival for more complex life forms. Darwin is credited with making a great stride in Understanding about life without an understanding in mathematics (Livio 2013). But Darwin had problems in how traits are passed to the

next generation. Perhaps because of the lack of mathematics, it remained for Mendel to introduce genetics models into life process models. Gregor Mendel may have been thinking of sex division by two when he designed his experiments to look for two (dominant v. recessive) traits (Bronowski 1973). The sex of a child is not averaged. Cells divide by two. There are two strands of DNA. How the life functions are divided varies among species. The division of nurturing and provide/protect seems to allow humans a more complex structure (Hodge 2012). Boolean mathematics has allowed the construction of computers where base-three arithmetic failed. Societies must still survive natural internal collapse tendencies (Glubb 1977; Tainter 1990).

The life and society structures are thermodynamically open systems. Consequently, the universe is not adiabatic and is an open system with Sources and Sinks (Hodge 2014b).

Conversely, if a principle appears simpler for the data in physics but fails in life and society observations, then the principle is false. The fundamental principle is Nature's rules must be obeyed.

7 Conclusion

Humanity currently requires a paradigm shift in models of physics, life, and society. The amount of unexplained observational data is huge. More fundamental, causal, Machian descriptions are simpler, more useful, and apply to the entire universe including areas of mathematics, physical sciences, life, and society. Unphysical mathematical concepts are mere band-aids to cover a need for a better physical model of initial conditions and processes. The STOE is an example of how this may be done. However, because the universe's source of initial conditions is unknowable, the universe is unpredictable except for limited distance and duration.

Using causative models would advance physics. Causation should be overtly stated in the mathematics. Causation is linked with emergence philosophy and not reductionism.

References

(Eds.) Beebe, H., Hitchcock, C., and Menzies, P., 2009, *The Oxford Handbook of Causation*, (Oxford University Press, New York, New York, U.S.A.)

- Bronowski, J., 1973, *The ascent of man*, (BBC DVD, Ambrose Video Publishing, Inc., New York, New York, U.S.A.)
- Carroll, S. B., 2016 *The Serengeti Rules the quest to discover how life works and why it matters*, (Princeton University Press, Princeton, New Jersey, U. S. A.)
- Diamond, J., 1997 *Guns, Germs, and Steel*, (Norton, New York, New York, U. S. A.)
- Diamond, J., 2012 *The World Until Yesterday*, (Viking, New York, New York, U. S. A.)
- Glubb, J., 1973, *The fate of empires and search for survival*, (William Blackwood & Sons, Edinburgh, Scotland).
<http://www.rexresearch.com/glubb/glubb-empire.pdf>
- Hodge, J.C., 2006a, *Scalar potential model of redshift and discrete*, New Astronomy, Volume 11, Issue 5, March 2006, Pages 344-358, arXiv: astro-ph/0602344v1.
- Hodge, J.C., 2006b, *Scalar potential model of the CMB radiation temperature*, arXiv: astro-ph/0603140v1.
- Hodge, J.C., 2006c, *Scalar potential model of spiral galaxy rotation curves and rotation curve asymmetry*, arXiv: astro-ph/0611029v2.
- Hodge, J.C., 2012, *Survival is the only moral goal of life*, <http://intellectualarchive.com/?link=item&id=694> .
- Hodge, J.C., 2013, *Growth challenge of the United States*, <http://intellectualarchive.com/?link=item&id=1093> .
- Hodge, J.C., 2014a, *Scalar Theory of Everything for steering humanity's growth*, <http://intellectualarchive.com/?link=item&id=1310> .
- Hodge, J.C., 2014b, *Universe according to the STOIE*, IntellectualArchive, Vol.4, No. 6, P.6 , ISSN 1929-4700, Toronto, Jan., <http://intellectualarchive.com/?link=item&id=1648> .

Hodge, J.C., 2014c, *Diffraction experiment and its STOE photon simulation program rejects wave models of light*, IntellectualArchive, Vol.4, No. 6, P.11 , ISSN 1929-4700, Toronto, Jan., <http://intellectualarchive.com/?link=item&id=1603> .

RG project:

<https://www.researchgate.net/project/STOE-photon-diffraction-and-interference>

Videos:

<https://www.youtube.com/watch?v=OMAjKk6k6-k>

https://www.youtube.com/watch?v=qFDB-K_sSjU

Hodge, J.C., 2016a, *Structure and spin of the neutrino, electron, and positron*, IntellectualArchive, Vol.5, No. 2, <http://intellectualarchive.com/?link=item&id=1694> .

Hodge, J.C., 2016b, *STOE assumptions that model particle diffraction and that replaces QP*, IntellectualArchive, Vol.5, No. 3, <http://intellectualarchive.com/?link=item&id=1719> .

Hodge, J.C., 2016c, *STOE emergence*, IntellectualArchive, Vol.5, No. 3, 2014, <http://intellectualarchive.com/?link=item&id=1757> .

Hodge, J.C., 2018a, *STOE electric charge*, IntellectualArchive, Vol.7, No. 2, <http://intellectualarchive.com/?link=item&id=1917> .

Hodge, J.C., 2018b, *STOE replaces relativity and quantum mechanics*, IntellectualArchive, Vol.7, No. 5, 2018, <http://intellectualarchive.com/?link=item&id=1979> .

Hodge, J.C., 2019a, *QSSC model's next step is the STOE*, IntellectualArchive, Vol.8, No. 1, <http://intellectualarchive.com/?link=item&id=2043> .

Hodge, J.C., 2019b, *Magnetic field evolves to gravity field part:4 Atomic structure*, IntellectualArchive, Vol.8, No. 4, 2019, <http://intellectualarchive.com/?link=item&id=2199> .

Hodge, J.C., 2019c, *Interference Experiment with a Transparent Mask Rejects Wave Models of Light*, OPJ, Vol. 9, No. 6, <https://www.scirp.org/journal/paperinformation.aspx?paperid=93056>

- Hodge, J.C., 2020, *Scalar Theory of Everything (STOE) unites the big, the small, and the four forces (GUT) by extending Newton's model*, IntellectualArchive, Vol.9, No. 14, 2020, <http://intellectualarchive.com/?link=item&id=2414> .
- Livio, M., 2013 *Brilliant Blunders*, (Simon & Schuster, Inc., New York, New York, U. S. A.)
- Newton, I., 1730 ed. *Opticks*, (Dover Publications, Inc., New York, New York, U. S. A.). Different edition have a different numbering scheme.
- Pearl, J., 2010 *The Mathematics of Causal Relations*, in Shrouf, P.E., Keyes, K., and Ornstein, K. (Eds.) *Causality and Psychopathology: Finding the Determinants of Disorders and their Cures* (Oxford University Press, Oxford, UK).
- Tainter, J. A., 1990. *The Collapse of Complex Societies* , (Cambridge University Press, New York, New York, U. S. A.)