

*PROCESS PHYSICS:**FROM INFORMATION THEORY TO QUANTUM SPACE AND MATTER*

Process Physics: From Information Theory to Quantum Space and Matter, REGINALD T. CAHILL, ; in book series *Contemporary Fundamental Physics*, edited by V.V. Dvoeglazov, Nova Science Publishers NY 2005, ISBN: 1-59454-300-3.

Process Physics is about a very radical information-theoretic approach to comprehending and modelling reality. A physical space with quantum properties, and a rich new theory of gravity emerges, that gives predictions in accord with all well known phenomena, and in addition explains gravitational anomalies. Cahill uses a process model of time that for the first time in physics allows a distinction between past, present and future. The quantum nature of matter emerges without any *a priori* assumptions. Cahill tests his predictions against relevant historic data, some of which has previously been neglected.

1 Introduction

We need to recognise that great scientists such as Newton have given us powerful ways of understanding the observations that had been made up to the time of their working lives, but that advances in technology since then have enabled more accurate data to be acquired about the phenomena on which their paradigm was based. Most importantly new experiments on related phenomena, unknown to them have become possible and new observations have been made. At some stage in all fields of science phenomena will be observed that cannot be explained by the current paradigm. Then it is time to look for new theories.

Cahill's *Process Physics* presents physicists, philosophers and all people with a completely new fascinating approach to understanding how the physical universe functions. This includes a way to understand some well known phenomena better, and now to understand some observations that cannot be explained by the current paradigm. Readers will immediately see that Cahill meticulously sources original published experimental data to test the predictions that he has made with his innovative new theory. This objective strategy of testing against data that has been acquired completely independently of the theoretical predictions being tested, is the major point that has caused this reviewer to investigate Cahill's work in some detail.

Cahill's objective examination of data is a very different attitude from that of many famous physicists. As an example, in 1932-33 the measured behaviour of spiral galaxies showed that their rotational speeds are much greater than can possibly be sustained by the observable mass of these galaxies estimated from their luminosity, when their behaviour is analysed using Newtonian gravity or Einstein's General Relativity. To explain why this did not happen, the scientists invented "dark matter"; they said "there must be about 10 times more matter in the galaxy than we can detect by the emitted light in order that this fast rotation can be explained." What these inventors and famous contemporary researchers on "dark matter" do not emphasise is that they are happy to be suspicious of the data, but will in no way question the validity of the currently accepted "laws" of physics. In addition there are many cases where originally published data is misquoted, misinterpreted and possibly suppressed.

The most significant case of misinterpretation results from the fact that observations and data published by Dayton C Miller [1] from his many repeats of the Michelson-Morley [2] experiment are not referred to directly in any physics text book, and Miller's name and work is virtually unknown to physicists. In seeking tests for the properties of a locally physically defined space that emerged in *Process Physics*, Cahill has given us all access to the truth about Miller's observations and interpretations. Importantly Cahill has made a new analysis that includes relativistic effects and the refractive index of air in the light paths. This shows that gas filled light path experiments are capable of detecting motion through a physically defined space with sensitivity much less than historic predictions, but vacuum experiments are not.

2 Contents

We now address the theoretical content. In *Process Physics* Cahill points out that "The current paradigm is a symbol based system with symbols assigned to stand for various entities such as electrons, electric fields and the like. As well, rules or laws were proposed to determine how the symbols were to be manipulated and used for computations. In such systems the only sense of meaning is that the symbol manipulators — us, the scientists — may attach meanings to the symbols. While such a meaning might inspire us and guide us, it certainly has no significance for the entities that the symbols stand for.

"In *Process Physics*, information is represented by connection patterns and not by symbols. Information is then processed by interactions between patterns, and because of a built in randomness, such systems can actually generate new 'information' patterns. Amazingly there is good evidence that the system self-organises patterns that show the characteristics of quantum space and quantum matter, and the idea that these patterns of relationships are self-recognising. That means that the behaviour of the informational patterns is determined internally, they are not prescribed. To the extent so far reached by this approach we see emergent phenomena of a quantum field theory with attributes of the current standard model of 'particle physics'. We see, for the

first time, the emergence of quantum phenomena, where no assumptions about such phenomena were placed into the system at the start-up.”

“As well arguments were constructed that suggested that the phenomena of gravity was caused by differential processing of informational subsystems that constitute quantum space and quantum matter...”. A new theory of gravity emerges.

Cahill shows that in his model “space and quantum physics are emergent and unified, with time a distinct non-geometric process.” Importantly, in the context of the discussions of dark matter and other gravitational anomalies, this model of a quantum space has permitted the flow of such a space to provide a new and much richer theory of gravity than Newtonian gravity, and which is linked with quantum physics.

Most fascinating is that the quantum nature of matter emerges in *Process Physics* without any *a priori* assumptions. Quantum space also emerges with the same process, and the new theory of gravity is thus endowed with quantum properties. Cahill’s *Process Physics* enables numerical predictions to be made of the behaviour of spiral galaxies that are in accord with the observations, and about other gravitational effects; and is consistent with:

- The equivalence principle
- Mass-Energy equivalence
- Lorentz contraction (but now this is the physical contraction as originally postulated by Lorentz and by Fitzgerald).
- Time Dilation (but now the physical movement of the clocks through a locally physically defined space causes them to run more slowly).
- GPS systems, etc.

It is of great interest that a single dimensionless constant appears in the calculations whose required value turns out to be α , the fine structure constant. Thus α can be determined from gravitational observations ! This offers a true chance for a unified theory.

In seeking tests for his *Process Physics* Cahill looked for historic experimental evidence for a locally physically defined space. Cahill, unlike many others who are prepared to uncritically accept second hand textbook references, has examined a wide range of original papers that present data. We now look in more detail about the most significant example of this which is the understanding and interpretation of the original, and many repeat, Michelson-Morley type experiments.

In their paper in the *American Journal of Science* 1887, Michelson and Morley [2] reporting on their famous experiment to test whether electromagnetic waves are supported by a physically defined space give their original data and state: “Considering the motion of the earth in its orbit only... the displacement to be expected was 0.4 fringe. The actual displacement was certainly less than the twentieth part of this, and probably less than the fortieth part. But since the displacement is proportional to the square of the velocity, the relative velocity of the earth and the ether is probably less than one sixth the earth’s orbital velocity, and certainly less than one fourth.” The obser-

vations of Michelson-Morley were not ‘null’ as now always claimed, but were much smaller than predicted using the conventional analysis.

There was much concern because scientists did not understand how this could possibly happen. Fitzgerald, and independently Lorentz postulated that motion through space could physically contract the arm that is parallel to the velocity, and equalise the transit times. Michelson-Morley type experiments were repeated by Morley and Miller. In 1925-6 Miller [1] conducted the most detailed set of observations and, after careful data analysis and interpretation, in 1933 he reported his positive evidence of 12,800 single measurements for absolute motion and a physically defined space, in one of the most elegant physics papers ever published. Miller’s work went against the by then established paradigm and consequently his original work is not referred to in any text book.

In 2002 Cahill made a correction to an error in the analysis of the way Michelson-Morley type experiments work, now including the Lorentz contraction as a physical effect as originally postulated, and the refractive index of air in the light paths.

Cahill’s new analysis explains Miller’s work, and that of others who detected absolute motion. Miller’s experiments should be repeated but not in vacuum. Several recent Michelson-Morley type experiments made in vacuum confirm the concept of length contraction that Einstein ‘borrowed’ from Lorentz but these vacuum experiments have zero sensitivity to detect absolute motion. Not even Einstein understood how these experiments truly operated. In discussing the temperature effects in Miller’s apparatus on December 11th 1954 with Shankland, Einstein said that “he felt making the apparatus large was a mistake. . . . He also asked why no one had used vacuum in the light paths . . .”. If Miller had used Einstein’s suggestion of a small apparatus in vacuum he would have missed recording the truth.

Providing an understanding of the true mode of operation of experiments with gas filled light paths and giving access to data on all the Michelson-Morley type experiments, in itself makes Cahill’s *Process Physics* a valuable resource document, that should be in every university library collection. In addition, Cahill’s strategy of examining the original analysis, predictions, data and publications rather than second hand text book references should be adopted by all teaching institutions. Clearly what has happened is that physicists have been seeking ways to “verify” a particular point of view and uncritically accepted the perceived wisdom of famous scientists. Readers should follow the presentation of Feynman [3] and make the correction of putting in the refractive index. They will be convinced that the apparatus is capable of detecting absolute motion but is much less sensitive than originally thought. Even people such as Feynman can make errors.

Any reader of this review will have no difficulty in checking the original documents that give the data referred to above, and verifying that Cahill has correctly cited them. What is now needed is an objective examination of Cahill’s theoretical approach in *Process Physics*. It is of such depth that those who take on that task will need a high degree of skill in theoretical physics.

You may not immediately agree with his new theoretical approach, nor will you be able to lightly dismiss it, but you may be inspired to make your own contribution.

References

- [1] Dayton C. Miller, *The Ether-Drift Experiment and the Determination of the Absolute Motion of the Earth*, Rev. Mod. Phys. **5**, 203-242(1933).
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- [3] Richard P. Feynman, Robert B. Leighton and Matthew Sands, *The Feynman Lectures on Physics*, Vol I pp 15-3,4,5, (Addison-Wesley, Reading, 1965).

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