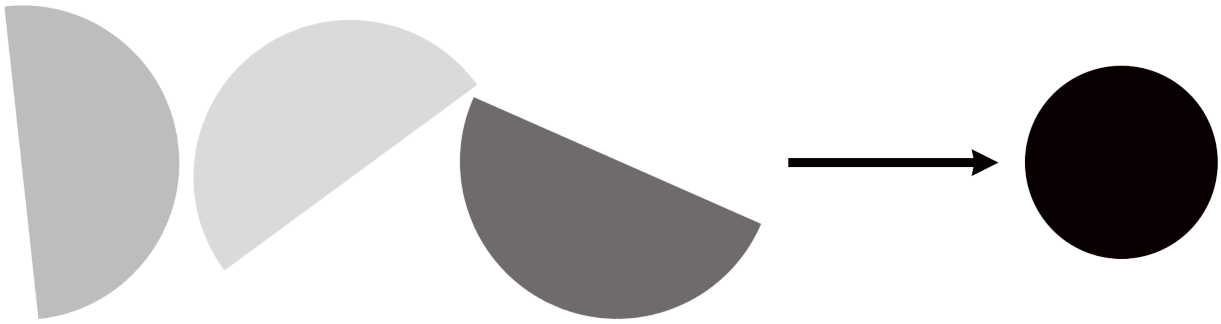
Unification in Physics and Philosophy
International Workshop in Helsinki on May 11th 2019



The workshop is devoted to dealing with problems in physics and philosophy by unification. The basic idea is that a minimal ontological core of postulates or hypothetical laws of nature could provide natural resolutions to long-standing problems that are caused by disunification, and that cannot be properly resolved by focusing only on details of isolated topics. Unification is urgently needed, for in neither discipline do we find a commonly accepted ontological core or world-view that could function as a unifying base. In effect, the great majority of physicists and philosophers focus on specialized problems in isolated research areas.

Physics is mainly practiced by developing mathematical descriptions for each isolated area with the help of heterogeneous postulates. On a unifying approach, mathematics should be coupled with hypothetical laws of nature in a unified core, which suffice for different research areas or scales of phenomena. Similarly, in philosophy there is a tendency to specialise in problems of a particular domain, say, what is time, what is persistence, what is causation, rather than to develop unified views of interrelated domains. Furthermore, attempts to address interrelations between physics and philosophy are rare, and when it is done the focus is again within particular domains.

The purpose of this workshop is to bring together scholars with a mutual interest in a unified approach of this kind, in order to discuss particular unifying resolutions and more generally what a unified approach should look like. The questions to be discussed include (but are not restricted to): What are the central problems in physics and scientifically oriented philosophy? Can we identify postulates of a provisional scientifically and philosophically sound unified ontology? How do specific provisional postulates unify domains of inquiry that are currently separate and how do they resolve their central problems? What are the criteria by which one theory is to be preferred over another? How did the historical development result in the current situation in physics and philosophy?

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Program

09.00-10.00 Coffee and Registration

10.00-10.30 Welcoming words. Cecilia af Forselles, National Librarian, Vice President of The Federation of Finnish Learned Societies, Chair for The Finnish Society for the History of Science and Learning.

Morning session 10.00-13.00

10.30-11.00 Introductory speech. Ph.D Avril Styrman: Unification, Evaluation and Development of Theories.

11.00-11.30 Ph.D Ling Jun Wang (USA): Physics Needs Nothing Less Than a Renaissance – On the Relation Between Physics and Philosophy.

11.30-12.00 Ph.D C.S. Unnikrishnan (IN): A New Gravitational Paradigm for Relativity, Dynamics, and their Philosophical Basis.

12.00-12.30 Ph.D Heikki Sipilä: Is the Solar System Expanding?

12.30-13.00 Ph.D Tuomo Suntola:Unification of Theories Requires a Postulate Basis in Common.

13.00-14.00 Lunch

Afternoon session 14.00-19.00

14.00-14.30 Ph.D Rögnvaldur Ingthorsson (SWE): Ontological and Methodological Reflections on the Virtues of Unification.

14.30-15.00 Ph.D Laurence Gould (USA): Quantum Ontology of de Broglie and Bohm with Reflections on the Meaning of Probability.

15.00-15.30 Coffee

15.30-16.00 Ph.D Tapio Ala-Nissilä: Quantum Mechanics in Action: a Working Physicist's Point of View.

16.00-16.30 Ph.D Tarja Kallio-Tamminen: Dynamic Universe – Natural Science and Philosophy in Unison.

16.30-19.00 Panel Discussion

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Abstracts

Avril Styrman, Ph.D
Chair, The Finnish Society for Natural Philosophy

Unification, Evaluation and Development of Theories.

The essentials of unification and theory evaluation are explained, and the development of theories in physics is analyzed. The development of physics since Newton is typically pictured as an unbroken success story where legendary scientists developed Relativistic physics and quantum mechanics. However, the situation appears very different when we look not only at accuracies of predictions of these theories, but also measure their metaphysical weight and understandability, inter alia. In this picture, although physicists have developed mathematics that gives incredibly accurate predictions, the Newtonian base where the predictions are embedded has been complemented by additional parameters ever since the early 20th century, and a unified and understandable scientific word-view is nowhere in sight. In the Kuhnian model of the progress of science, such development leads into a paradigm shift. Thus, if we take the historical development of theories into account, and we evaluate theories objectively, the standard view of how physics will be developed becomes questionable. In the standard view, it is only a matter of time when quantum mechanics and Relativistic physics will be fused together into a Grand Unified Theory, and currently the unifying basis is sought from String Theory and other additional theories. However, if we look at the development of Relativistic physics, and believe that it signals a becoming paradigm shift, the situation looks entirely different. In this picture, the real question is not how quantum mechanics and Relativistic physics can be unified, for unification cannot be achieved by adding even more new postulates to the Newtonian-Relativistic base. Instead, the main question is how to replace the Newtonian-Relativistic base by another base that suffices for quantum mechanics, manages to explain all phenomena that Relativistic physics explains, and manages to embed at least as accurate predictions of these phenomena.

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Ling Jun Wang, Ph.D
Professor, Department of Chemistry and Physics, University of Tennessee, Chattanooga

Physics Needs Nothing Less Than a Renaissance — On the Relation Between Physics and Philosophy

Recently, we have developed a classical theory of unification of gravitational and electromagnetic forces[1]. An important discovery from our unification theory is *Wang's Law* which says that the total linear momentum of the gravitational field transmitted into the space is conserved. The propagation of the gravitational wave offers a simple answer to the historical question of action-at-distance. Moreover, our unification theory has revealed that the inverse-square law is the result of the conservation of the total static and dynamic fluxes according to Gauss' law and Wang's law. Our unification theory shows that the gravitation propagates with the speed of light.

The impact of our classical unification theory on theoretical physics is far reaching. For over a hundred years, the physics community has been educated to believe that any effort of unifying gravity with other forces have to be built on general relativity and quantum field theory. The century long search for a unification theory, starting from Einstein to Hawking, along the approach of general relativity and quantum field theory proved a total failure. Our unification theory shows that the unification of gravitational and electromagnetic forces could be beautifully done within the classical framework. The simplicity, rigorousness and completeness of our unification theory leaves no doubt on the correctness of the classical approach. It will shake the confidence of physics community in the paradigm of theoretical physics of the 20th century. We can ask legitimate questions: Are the scientific logic, philosophy and methodology of the classical physics all obsolete? Why are there so many fundamental inconsistencies in theoretical physics? Why is modern theoretical physics running into a dead end? A scrutiny of the edifice of modern theoretical physics reviles that the ultimate reason for the multitude of unsolvable fundamental inconsistencies of the theoretical physics of 20th century is the shift of philosophy. It is a shift from scientific philosophy and methodology to mythological and theological philosophy and methodology.

Science is not about building a Tower of Babel that has nothing to do with the society except providing psychological satisfaction to an isolated club of theorists pursuing a "theory of everything". Science has its noble mission – to advance human civilization. Physical science needs nothing less than a Renaissance. The success of our unification theory is a testimony.

Key words: unification of gravitational and electromagnetic forces, natural philosophy, science and society. PACS code: 04.50.kd; 05.50.-z; 04.20.cv

REFERENCES: 1. Wang, L.J., *Unification of Gravitational and Electromagnetic fields*, *Physics Essays,* 31, No. 1, 2018.

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C.S. Unnikrishnan, Ph.D
Professor, Department of Physics, TIFR, Mumbai, India

A New Gravitational Paradigm for Relativity, Dynamics, and their Philosophical Basis

The present views of dynamics and relativity are based on Einstein's special and general theories of relativity. However, the empty featureless space and its time that are assumed in constructing these theories are in conflict with the reality of the vast universe with enormous quantity of matter-energy, and its gravity. After proving the need for a new paradigm of relativity and dynamics based on the cosmic gravity, I will outline the complete theory and its crucial experimental support. The gravitational paradigm called Cosmic Relativity is Galilean and Machian, with the universe as the determining master frame and a universal time. These developments in physics enable us to complete and clarify Henri Bergson's program in philosophy, with its notions of universal time and absolute simultaneity.

Heikki Sipilä, Ph.D
AMETEK Finland Oy
Board member, Physics Foundations Society

Is the Solar System Expanding?

According standard physics, gravitationally bounded systems do not expand along with the expansion of space. This is referred to as the no-expansion hypothesis. Observations undermine the no-expansion hypothesis, and support the hypothesis that the Solar System does expand, proportionally to the expansion of space. This is referred to as the expansion hypothesis. The no-expansion hypothesis has difficulties in explaining the Faint Sun Paradox, i.e., why there has been oceans on Mars and why the Earth has been warm 3.5 billions of year ago, when luminosity of the Sun was 25% smaller than today, whereas the expansion hypothesis has not difficulties in explaining this. The no-expansion hypothesis does not match data gathered from sand stone layers, whereas the expansion hypotheses matches it perfectly. These two examples strongly indicate that solar system is expanding along with the expansion of space.

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Tuomo Suntola, Ph.D
Chair, Physics Foundations Society

Unification of Theories Requires a Postulate Basis in Common

A primary challenge of natural sciences in the new millennium is to cure the gap between metaphysics and empiricism – and puzzle out the obstacles to a unified theory and an understandable picture of reality. Antique science flourished via its strong philosophical impact but faded away due to the lack of supporting empirical science. The fast development of mathematical physics has led to the other opposite; theories are diversified, they are more like mathematical descriptions of observations; they provide precise predictions but lack a solid metaphysical basis and an understandable picture of reality. Anyway, modern science has increased our understanding of physics from elementary particles to cosmological structures and produced information that allows re-evaluation of the basis. In the presentation, we show that by switching from an observer-oriented perspective to a system perspective, any local energy object is related to the rest of space and relativity appears as a direct consequence of the conservation of total energy in the system – without scarifying the absolute time and distance essential for human comprehension. Such a holistic approach has led to the Dynamic Universe (DU) theory. After maturing for the last twenty years, DU produces precise, well-tested predictions for local and cosmological observables and an uncontradictory linkage to quantum mechanics.

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Rögnvaldur Ingthorsson, PhD
Researcher, Department of Philosophy,
Lund University, Sweden

Ontological and Methodological Reflections on the Virtues of Unification.

This workshop revolves around the idea that there is a need to strive for unification of fields and theories—within and across disciplines—to counteract the increasing fragmentation and disunification of science and philosophy. But how should we think of unification and what are its methodological virtues? Styrman and Suntola stress the need to develop a common unified ontology that is empirically sufficient, metaphysically minimal, and generally constitutes a virtuous belief system for human beings. The principle of economy is to be used to decide between alternatives. Their hypothesis is that an ontology of that kind can provide resolutions to long-standing problems that cannot be resolved only within a an isolated topic. I agree to all that, but want to incorporate into the unificationist manifesto some ideas from the history of philosophy that I think support the idea that a unifying big picture approach could succeed where more specialized approaches fail. First, a unifying approach is appropriate *if* we are right to suppose that reality surely must make up a determinate and unified whole; ergo, we should expect our understanding of that whole to also make up a unified whole. Fragmentation and disunity are then signs of an inadequate understanding of the world. If we assume to the contrary that reality is fragmented and indeterminate, it seems to follow not only that our knowledge should be equally fragmented and uncertain, but also that we stand little chance of ever being able to understand it; the world should strike us as being non-uniform and largely unintelligible. Second, the unifying big picture approach is methodologically virtuous in much the same way methodological triangulation is virtuous. We can suspect that each particular method of measurement is to some degree fallible, and so we seek to validate it by comparison to other methods. If different methods come to same conclusion, they support each other. Similarly, if a solution to one particular problem sits well with a solution to other problems, this can be taken as support of the validity of the solution. Basically, if the world is a determinate and unified whole, system building is our only hope of understanding it. Third, the virtuous belief system we ultimately should want is one in which includes the mind and its contents as phenomena that we need to consider. In trying to understand the world we must try to understand the mind and its place in nature too. What is the world like such that it can contain minds whose thoughts and words relate to subject matters distinct from those thoughts and words. In fact, it has been plausibly argued that subjective experience may contain an important criterion of success for any objective theory about the world, even if we accept that subjective experience provides a poor basis for knowledge about the world.

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Laurence Gould, Ph.D
Professor, Department of Physics,
University of Hartford, USA

Quantum Ontology of de Broglie and Bohm with Reflections on the Meaning of Probability.

Although the Copenhagen Interpretation of Schroedinger's quantum theory predominates, there are alternatives. One of those, called the Ontological Interpretation, has become more prominent over the years; primarily due to the work of physicist David Bohm. In this interpretation the wave function has *real* aspects to it (in the ontological sense, not in the mathematical functions-of-a-complex-variable sense). A certain function of the "amplitude" of the wave function (roughly corresponding to how likely is the occurrence of an event) determines the existence of a "quantum potential" that can be an important factor in governing the manner in which particles move. In this interpretation particles have definite values of position and momentum at each instant of time. An unusual aspect of the quantum potential is that it is "nonlocal" in the sense that some entities can have a strong influence on other entities which are far away from them. This presentation will explore some of the ontological interpretation's historical development, starting with Louis de Broglie's approach of the 1920's and ending with the contemporary contributions of Bohm.

Tapio Ala-Nissilä, Ph.D
Professor, Aalto and Loughborough University

Quantum Mechanics in Action: a Working Physicist's Point of View

Rapid development on nanotechnology and related experimental techniques have allowed detailed experimental tests on the basic features of quantum mechanics. These include some of the most counterintuitive aspects of QM such as nonlocality and superposition. In this talk I will review recent progress in this field and its significance to philosophical, theoretical and technological developments in QM.

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Tarja Kallio-Tamminen, Ph.D

Physics Foundations Society

Dynamic Universe – Natural Science and Philosophy in Unison.

In a coherent conception of reality physics and metaphysics should both come together to create a comprehensible worldview. This was the case in the Newtonian picture of reality which modern physics proved limited in the beginning of 20th century. The quest for a new synthesis, a more reliable picture of reality incorporating current theories and observations, has not been fulfilled in spite of a hundred years of interpretative discussions. The claim of this paper is that the missed unison occurs in Tuomo Suntola's Dynamic Universe (DU) which in a natural manner covers the domains of theory of relativity and quantum phenomena. DU is studied from the perspective of natural philosophy concentrating on the basic principles of the theory, the prominent metaphysical features that in addition to the mathematical structure should be contained in a decent physical theory. The recipe for success in DU is a spherically closed metric space in 4 dimensions and the zero-energy principle which are both reliable and well known principles in physics. The fresh metaphysical context permits the mathematical abundance typical for present theories be reduced to take in more physics. Time and lenghts are allowed to maintain their shape and bodies can be constructed out of waves. In addition to its importance for physics, the seamless connection disclosed between mass, space, motion and energy provides unprecedented solutions to many age-old questions in natural philosophy - the most basic questions pondered by giants like Democritos, Plato, Aristotle, Descartes, Leibniz and Newton.