

# **The Quantum Vacuum A Scientific And Philosophical Concept From Electrodynamics To String Theory And The Geometry Of The Microscopic World**

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# Vacuum A Scientific And Philosophical Concept From Electrodynamics To String Theory And The Geometry Of The Microscopic World hence simple!

*Romanian Studies in Philosophy of Science* - Ilie Pârvu 2015-05-29  
This book presents a collection of studies by Romanian philosophers, addressing foundational issues currently debated in contemporary philosophy of science. It offers a historical survey of the tradition of scientific philosophy in Romania. It examines some problems in the foundations of logic, mathematics, linguistics, the natural and social sciences. Among the more specific topics, it discusses scientific explanation, models, and mechanisms, as well as memory, artifacts, and rules of research. The book is useful to those interested in the philosophy of real

science, but also to those interested in Romanian philosophy. Quantum Reality and Theory of Śūnya - Siddheshwar Rameshwar Bhatt 2019-03-30  
The book deals with expounding the nature of Reality as it is understood in contemporary times in Quantum Physics. It also explains the classical Indian theory of Śūnya in its diverse facets. Thereafter it undertakes comparison between the two which is an area of great topical interest. It is a cross-disciplinary study by erudite Indian and western scholars between traditional Indian knowledge system and contemporary researches in Physical sciences. It points out how the

theory of 'Śūnyatā has many seminal ideas and theories in common with contemporary Quantum Physics. The learned authors have tried to dissolve the "mysteries" of Quantum Physics and resolved its "weird paradoxes" with the help of theory of Śūnyatā. The issue of non-separability or entanglement has been approached with the help of the Buddhist theory of Pratīyasamutpāda. The paradoxical situation of "wave-particle duality" has been explained with the help of Upaniṣadic theory of complementarity of the two opposites. The measurement problem represented by "Schrodinger's cat" has been dealt with by resorting to two forms of the calculation of probabilities. Some writers have argued for Śūnyatā-like non-

essentialist position to understand quantum reality. To make sense of quantum theory some papers provide a happy symbiosis of technical understanding and personal meditative experience by drawing multifarious parallels. This book will be of interest to philosophically inclined physicists and philosophers with interest in quantum mechanics.

**An Introduction To Quantum Field Theory -**  
Michael E. Peskin  
2018-05-04

An Introduction to Quantum Field Theory is a textbook intended for the graduate physics course covering relativistic quantum mechanics, quantum electrodynamics, and Feynman diagrams. The authors make these subjects accessible through carefully worked examples illustrating

the technical aspects of the subject, and intuitive explanations of what is going on behind the mathematics. After presenting the basics of quantum electrodynamics, the authors discuss the theory of renormalization and its relation to statistical mechanics, and introduce the renormalization group. This discussion sets the stage for a discussion of the physical principles that underlie the fundamental interactions of elementary particle physics and their description by gauge field theories.

*Parmenides: Paraphrasing Heraclitus in Verse* - Michael M Nikolettseas 2015-09-03

An analysis of the poem of Parmenides from a natural science perspective shows that it is based on Heraclitus' book.

Imagery, philosophy, and even words were borrowed from Heraclitus. The new picture that emerges warrants the conclusion that Parmenides paraphrased Heraclitus in verse.

**Geometry Of Quantum Potential, The: Entropic Information Of The Vacuum** - Fiscaletti

Davide 2018-03-06

In virtue of its features, Bohm's quantum potential introduces interesting and relevant perspectives towards a satisfactory geometrodynamical description of quantum processes. This book makes a comprehensive state-of-the-art review of some of the most significant elements and results about the geometrodynamical picture determined by the quantum potential in various contexts. Above all, the book explores the perspectives about the fundamental arena

subtended by the quantum potential, the link between the geometry associated to the quantum potential and a fundamental quantum vacuum. After an analysis of the geometry subtended by the quantum potential in the different fields of quantum physics (the non-relativistic domain, the relativistic domain, the relativistic quantum field theory, the quantum gravity domain and the canonical quantum cosmology), in the second part of the book, a recent interpretation of Bohm's quantum potential in terms of a more fundamental entity called quantum entropy, the approach of the symmetryzed quantum potential and the link between quantum potential and quantum vacuum are analysed, also in the light of the results obtained by the

author. Contents: Introduction The Geometry of the Quantum Potential in Different Contexts Quantum Entropy and Quantum Potential Immediate Quantum Information and Symmetryzed Quantum Potential The Quantum Potential ... and the Quantum Vacuum Conclusions References Index Readership: Researchers interested in the link between the geometrodynamical action of the quantum potential and a fundamental quantum vacuum, in the different contexts of quantum physics. Keywords: Entropy; Quantum; Potential; Symmetry; Geometry; Geometrodynamics Review: Key Features: This book provides a complete guide to the geometrodynamical features of the quantum potential as key of reading and understanding of the different fields of

quantum physics To explore relevant perspectives about the fundamental arena of quantum processes which determines the action of the quantum potential and its geometry This book introduces, in the light of relevant current research, interesting and novel perspectives as regards the link between the geometrodynamical action of the quantum potential and a fundamental quantum vacuum, in the different contexts of quantum physics

**The Cellular Automaton Interpretation of Quantum Mechanics -**

Gerard 't Hooft  
2016-09-02

This book presents the deterministic view of quantum mechanics developed by Nobel Laureate Gerard 't Hooft. Dissatisfied with the uncomfortable gaps in the way conventional quantum mechanics meshes

with the classical world, 't Hooft has revived the old hidden variable ideas, but now in a much more systematic way than usual. In this, quantum mechanics is viewed as a tool rather than a theory. The author gives examples of models that are classical in essence, but can be analysed by the use of quantum techniques, and argues that even the Standard Model, together with gravitational interactions, might be viewed as a quantum mechanical approach to analysing a system that could be classical at its core. He shows how this approach, even though it is based on hidden variables, can be plausibly reconciled with Bell's theorem, and how the usual objections voiced against the idea of 'superdeterminism' can be overcome, at least in principle. This

framework elegantly explains - and automatically cures - the problems of the wave function collapse and the measurement problem. Even the existence of an "arrow of time" can perhaps be explained in a more elegant way than usual. As well as reviewing the author's earlier work in the field, the book also contains many new observations and calculations. It provides stimulating reading for all physicists working on the foundations of quantum theory.

*Epistemology of Experimental Gravity - Scientific Rationality -*

Nicolae Sfetcu  
The evolution of gravitational tests from an epistemological perspective framed in the concept of rational reconstruction of Imre Lakatos, based on his methodology of research

programmes. Unlike other works on the same subject, the evaluated period is very extensive, starting with Newton's natural philosophy and up to the quantum gravity theories of today. In order to explain in a more rational way the complex evolution of the gravity concept of the last century, I propose a natural extension of the methodology of the research programmes of Lakatos that I then use during the paper. I believe that this approach offers a new perspective on how evolved over time the concept of gravity and the methods of testing each theory of gravity, through observations and experiments. I argue, based on the methodology of the research programmes and the studies of scientists and philosophers, that the current theories of

quantum gravity are degenerative, due to the lack of experimental evidence over a long period of time and of self-immunization against the possibility of falsification.

Moreover, a methodological current is being developed that assigns a secondary, unimportant role to verification through observations and/or experiments. For this reason, it will not be possible to have a complete theory of quantum gravity in its current form, which to include to the limit the general relativity, since physical theories have always been adjusted, during their evolution, based on observational or experimental tests, and verified by the predictions made. Also, contrary to a widespread opinion and current active programs

regarding the unification of all the fundamental forces of physics in a single final theory, based on string theory, I argue that this unification is generally unlikely, and it is not possible anyway for a unification to be developed based on current theories of quantum gravity, including string theory. In addition, I support the views of some scientists and philosophers that currently too much resources are being consumed on the idea of developing quantum gravity theories, and in particular string theory, to include general relativity and to unify gravity with other forces, as long as science does not impose such research programs. CONTENTS: Introduction Gravity Gravitational tests Methodology of Lakatos - Scientific



rationality The natural extension of the Lakatos methodology Bifurcated programs Unifying programs 1. Newtonian gravity 1.1 Heuristics of Newtonian gravity 1.2 Proliferation of post-Newtonian theories 1.3 Tests of post-Newtonian theories 1.3.1 Newton's proposed tests 1.3.2 Tests of post-Newtonian theories 1.4 Newtonian gravity anomalies 1.5 Saturation point in Newtonian gravity 2. General relativity 2.1 Heuristics of the general relativity 2.2 Proliferation of post-Einsteinian gravitational theories 2.3 Post-Newtonian parameterized formalism (PPN) 2.4 Tests of general relativity and post-Einsteinian theories 2.4.1 Tests proposed by Einstein 2.4.2 Tests of post-Einsteinian theories 2.4.3 Classic tests 2.4.3.1 Precision of

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10.13140/RG.2.2.35350.70  
724

**The Cosmic Landscape** -  
Leonard Susskind  
2008-12-14

In his first book ever,  
the father of string  
theory reinvents the  
world's concept of the  
known universe and man's  
unique place within it.  
Line drawings.

**Creation, Re-creation,  
and Entertainment: Early  
Modernity and**

**Postmodernity** - Benjamin  
Balak 2019-03-11

Orlando, Florida, may be

one of the best places  
to discuss the subject  
of creation and re-  
creation of  
entertainment: the city  
lives under the shadow  
of Disney corporation,  
whose most celebrated  
re-creations are based  
on French texts from the  
17th century French  
literature, and in  
particular Perraults  
fairy tales. From this  
perspective, whether we  
speak of ?reworks behind  
a princes castle, a  
morality tale to  
entertain children and  
parents alike, or even a  
theatrical

representation that  
seems to appear from  
magic, the three hundred  
years that separate  
Orlando and Versailles  
seem to disappear: the  
parallels between the  
17th and 21st centuries  
are founded on the same  
drive to enliven and  
enlighten ones world.

**Ontological Aspects of  
Quantum Field Theory** -

Meinard Kuhlmann  
2002-11-26  
Quantum field theory (QFT) provides the framework for many fundamental theories in modern physics, and over the last few years there has been growing interest in its historical and philosophical foundations. This anthology on the foundations of QFT brings together 15 essays by well-known researchers in physics, the philosophy of physics, and analytic philosophy. Many of these essays were first presented as papers at the conference "Ontological Aspects of Quantum Field Theory", held at the Zentrum für interdisziplinäre Forschung (ZiF), Bielefeld, Germany. The essays contain cutting-edge work on ontological aspects of QFT, including: the role of

measurement and experimental evidence, corpuscular versus field-theoretic interpretations of QFT, the interpretation of gauge symmetry, and localization. This book is ideally suited to anyone with an interest in the foundations of quantum physics, including physicists, philosophers and historians of physics, as well as general readers interested in philosophy or science. Contents: Approaches to Ontology: Candidate General Ontologies for Situating Quantum Field Theory (P Simons) 'Quanta', Tropes, or Processes: Ontologies for QFT Beyond the Myth of Substance (J Seibt) Analytical Ontologists in Action: A Comment on Seibt and Simons (M Kuhlmann) How Do Field Theories Refer to Entities in a Field? (S Y Auyang) Field

Ontologies for QFT: A Naive View of the Quantum Field (A Wayne) Comments on Paul Teller's Book, "An Interpretive Introduction to Quantum Field Theory" (G Fleming) So What Is the Quantum Field? (P Teller) Relativity, Measurement and Renormalization: On the Nature of Measurement Records in Relativistic Quantum Field Theory (J A Barrett) No Place for Particles in Relativistic Quantum Theories? (H Halvorson & R Clifton) Events and Covariance in the Interpretation of Quantum Field Theory (D Dieks) Measurement and Ontology: What Kind of Evidence Can We Have for Quantum Fields? (B Falkenburg) Renormalization and the Disunity of Science (N Huggett) Gauge Symmetries and the Vacuum: The Interpretation of Gauge

Symmetry (M Redhead) Comment on Redhead: The Interpretation of Gauge Symmetry (M Drieschner et al.) Is the Zero-Point Energy Real? (S Saunders) Two Comments on the Vacuum in Algebraic Quantum Field Theory (M Rédei) Readership: Physicists, historians of physics and philosophers. Keywords: Quantum Field Theory; Ontology; Foundations of Physics; Philosophy; Measurement; Gauge Field Theory Reviews: "A strength of the volume is its inclusion of commentaries and exchanges." Studies in History and Philosophy of Modern Physics **String Theory For Dummies** - Andrew Zimmerman Jones 2009-11-16 A clear, plain-English guide to this complex scientific theory String theory is the hottest

topic in physics right now, with books on the subject (pro and con) flying out of the stores. String Theory For Dummies offers an accessible introduction to this highly mathematical "theory of everything," which posits ten or more dimensions in an attempt to explain the basic nature of matter and energy. Written for both students and people interested in science, this guide explains concepts, discusses the string theory's hypotheses and predictions, and presents the math in an approachable manner. It features in-depth examples and an easy-to-understand style so that readers can understand this controversial, cutting-edge theory.

**The Quantum Vacuum** -  
Luciano Boi 2011-10-28  
A vacuum, classically understood, contains

nothing. The quantum vacuum, on the other hand, is a seething cauldron of nothingness: particle pairs going in and out of existence continuously and rapidly while exerting influence over an enormous range of scales. Acclaimed mathematical physicist and natural philosopher Luciano Boi expounds the quantum vacuum, exploring the meaning of nothingness and its relationship with physical reality. Boi first provides a deep analysis of the interaction between geometry and physics at the quantum level. He next describes the relationship between the microscopic and macroscopic structures of the world. In so doing, Boi sheds light on the very nature of the universe, stressing in an original and profound way the relationship between

quantum geometry and the internal symmetries underlying the behavior of matter and the interactions of forces. Beyond the physics and mathematics of the quantum vacuum, Boi offers a profoundly philosophical interpretation of the concept. Plato and Aristotle did not believe a vacuum was possible. How could nothing be something, they asked? Boi traces the evolution of the quantum vacuum from an abstract concept in ancient Greece to its fundamental role in quantum field theory and string theory in modern times. The quantum vacuum is a complex entity, one essential to understanding some of the most intriguing issues in twentieth-century physics, including cosmic singularity, dark matter and energy, and the

existence of the Higgs boson particle. Boi explains with simple clarity the relevant theories and fundamental concepts of the quantum vacuum. Theoretical, mathematical, and particle physicists, as well as researchers and students of the history and philosophy of physics, will find *The Quantum Vacuum* to be a stimulating and engaging primer on the topic.

[The Philosophy of Vacuum](#)  
- Assistant Professor of Philosophy Simon Saunders 1991

\* Contains a hitherto untranslated paper by Einstein. The vacuum is fast emerging as the central structure of modern physics. How is this possible? What is the vacuum concept, and why is it so important? This collection brings together philosophically-minded specialists who engage these issues in the

context of classical gravity, quantum electrodynamics, and the grand unification programme. The vacuum emerges as the synthesis of concepts of space, time, and matter; in the context of relativity and the quantum this new synthesis represents a structure of the most intricate and novel complexity. The Philosophy of Vacuum is unashamedly a project in metaphysics. The science of our time has transformed the concepts of space and time and of force and matter, yet the philosophy of Bohr and his school has found small purchase on the contemporary concerns of physics, and there are few guidelines to be found within the empiricist tradition of contemporary philosophy. However slippery the conundrums of metaphysical realism,

the message of contemporary science remains the same: concepts and heuristics are grounded in consideration of what exists in the world. Here, then, is a work in modern metaphysics, in which the concepts of substance and space interweave in the most intangible of forms, the background and context of our physical experience: vacuum, void or nothingness.

*Weyl and the Problem of Space* - Julien Bernard  
2019-10-09

This book investigates Hermann Weyl's work on the problem of space from the early 1920s onwards. It presents new material and opens the philosophical problem of space anew, crossing the disciplines of mathematics, history of science and philosophy. With a Kantian starting point Weyl asks: among all the infinitely many

conceivable metrical spaces, which one applies to the physical world? In agreement with general relativity, Weyl acknowledges that the metric can quantitatively vary with the physical situation. Despite this freedom, Weyl "deduces", with group-theoretical technicalities, that there is only one "kind" of legitimate metric. This construction was then decisive for the development of gauge theories. Nevertheless, the question of the foundations of the metric of physical theories is only a piece of a wider epistemological problem. Contributing authors mark out the double trajectory that goes through Weyl's texts, from natural science to philosophy and conversely, always through the mediation of mathematics. Readers may

trace the philosophical tradition to which Weyl refers and by which he is inspired (Kant, Husserl, Fichte, Leibniz, Becker etc.), and explore the mathematical tradition (Riemann, Helmholtz, Lie, Klein) that permitted Weyl to elaborate and solve his mathematical problem of space. Furthermore, this volume analyzes the role of the interlocutors with whom Weyl discussed the nature of physical space (Einstein, Cartan, De Sitter, Schrödinger, Eddington). This volume features the work of top specialists and will appeal to postgraduates and scholars in philosophy, the history of science, mathematics, or physics.

*Quantum Field Theory in a Nutshell* - A. Zee  
2010-02-01

A fully updated edition of the classic text by acclaimed physicist A.



Zee Since it was first published, Quantum Field Theory in a Nutshell has quickly established itself as the most accessible and comprehensive introduction to this profound and deeply fascinating area of theoretical physics. Now in this fully revised and expanded edition, A. Zee covers the latest advances while providing a solid conceptual foundation for students to build on, making this the most up-to-date and modern textbook on quantum field theory available. This expanded edition features several additional chapters, as well as an entirely new section describing recent developments in quantum field theory such as gravitational waves, the helicity spinor formalism, on-shell gluon scattering, recursion relations for amplitudes with complex

momenta, and the hidden connection between Yang-Mills theory and Einstein gravity. Zee also provides added exercises, explanations, and examples, as well as detailed appendices, solutions to selected exercises, and suggestions for further reading. The most accessible and comprehensive introductory textbook available Features a fully revised, updated, and expanded text Covers the latest exciting advances in the field Includes new exercises Offers a one-of-a-kind resource for students and researchers Leading universities that have adopted this book include: Arizona State University Boston University Brandeis University Brown University California Institute of Technology Carnegie Mellon College of William & Mary

Cornell  
Harvard  
University  
Massachusetts  
Institute of Technology  
Northwestern University  
Ohio State University  
Princeton University  
Purdue University - Main  
Campus  
Rensselaer  
Polytechnic Institute  
Rutgers University - New  
Brunswick  
Stanford  
University  
University of  
California - Berkeley  
University of Central  
Florida  
University of  
Chicago  
University of  
Michigan  
University of  
Montreal  
University of  
Notre Dame  
Vanderbilt  
University  
Virginia Tech  
University

*From Electrons to  
Elephants and Elections*

- Shyam Wuppuluri

2022-04-08

This highly  
interdisciplinary book,  
covering more than six  
fields, from philosophy  
and sciences all the way  
up to the humanities and  
with contributions from  
eminent authors,  
addresses the interplay

between content and  
context, reductionism  
and holism and their  
meeting point: the  
notion of emergence.  
Much of today's science  
is reductionist (bottom-  
up); in other words,  
behaviour on one level  
is explained by reducing  
it to components on a  
lower level. Chemistry  
is reduced to atoms,  
ecosystems are explained  
in terms of DNA and  
proteins, etc. This  
approach fails quickly  
since we can't cannot  
extrapolate to the  
properties of atoms  
solely from  
Schrödinger's equation,  
nor figure out protein  
folding from an amino  
acid sequence or obtain  
the phenotype of an  
organism from its  
genotype. An alternative  
approach to this is  
holism (top-down).  
Consider an ecosystem or  
an organism as a whole:  
seek patterns on the  
same scale. Model a

galaxy not as 400 billion-point masses (stars) but as an object in its own right with its own properties (spiral, elliptic). Or a hurricane as a structured form of moist air and water vapour. Reductionism is largely about content, whereas holistic models are more attuned to context. Reductionism (content) and holism (context) are not opposing philosophies – in fact, they work best in tandem. Join us on a journey to understand the multifaceted dialectic concerning this duo and how they shape the foundations of sciences and humanities, our thoughts and, the very nature of reality itself.

The Shape of Inner Space

- Shing-Tung Yau

2010-09-07

String theory says we live in a ten-dimensional universe,

but that only four are accessible to our everyday senses. According to theorists, the missing six are curled up in bizarre structures known as Calabi-Yau manifolds. In *The Shape of Inner Space*, Shing-Tung Yau, the man who mathematically proved that these manifolds exist, argues that not only is geometry fundamental to string theory, it is also fundamental to the very nature of our universe. Time and again, where Yau has gone, physics has followed. Now for the first time, readers will follow Yau's penetrating thinking on where we've been, and where mathematics will take us next. A fascinating exploration of a world we are only just beginning to grasp, *The Shape of Inner Space* will change the way we consider the universe on

both its grandest and smallest scales.

Einstein, Relativity and Absolute Simultaneity -

William Lane Craig

2007-11-08

Einstein, Relativity and Absolute Simultaneity is an anthology of original essays by an

international team of leading philosophers and physicists who have come together to reassess the contemporary paradigm of the relativistic concept of time. A great deal has changed since 1905 when Einstein proposed his Special Theory of Relativity, and this book offers a fresh reassessment of Special Relativity's relativistic concept of time in terms of epistemology, metaphysics, and physics.

Three Roads To Quantum Gravity - Lee Smolin

2008-03-18

"It would be hard to imagine a better guide

to this difficult subject."--Scientific American In Three Roads to Quantum Gravity, Lee Smolin provides an accessible overview of the attempts to build a final "theory of everything." He explains in simple terms what scientists are talking about when they say the world is made from exotic entities such as loops, strings, and black holes and tells the fascinating stories behind these discoveries: the rivalries, epiphanies, and intrigues he witnessed firsthand.

"Provocative, original, and unsettling." -The New York Review of Books "An excellent writer, a creative thinker." -

Nature

Modern Vacuum Physics - Austin Chambers

2004-08-30

Modern Vacuum Physics presents the principles and practices of vacuum

science and technology along with a number of applications in research and industrial production. The first half of the book builds a foundation in gases and vapors under rarefied conditions, The second half presents examples of the analysis of representative systems and describe *Approaches to Quantum Gravity* - Daniele Oriti 2009-03-05

Containing contributions from leading researchers in this field, this book provides a complete overview of this field from the frontiers of theoretical physics research for graduate students and researchers. It introduces the most current approaches to this problem, and reviews their main achievements.

**Condensed Matter Field Theory** - Alexander Altland 2010-03-11

Modern experimental developments in condensed matter and ultracold atom physics present formidable challenges to theorists. This book provides a pedagogical introduction to quantum field theory in many-particle physics, emphasizing the applicability of the formalism to concrete problems. This second edition contains two new chapters developing path integral approaches to classical and quantum nonequilibrium phenomena. Other chapters cover a range of topics, from the introduction of many-body techniques and functional integration, to renormalization group methods, the theory of response functions, and topology. Conceptual aspects and formal methodology are emphasized, but the discussion focuses on practical experimental

applications drawn largely from condensed matter physics and neighboring fields. Extended and challenging problems with fully worked solutions provide a bridge between formal manipulations and research-oriented thinking. Aimed at elevating graduate students to a level where they can engage in independent research, this book complements graduate level courses on many-particle theory.

*Reality and the Physicist* - Bernard

D'Espagnat 1989-01-27

This book investigates the nature of reality from the viewpoint of a physicist.

*Information-Consciousness-Reality* - James B.

Glattfelder 2019-04-10

This open access book chronicles the rise of a new scientific paradigm offering novel insights into the age-old enigmas of existence. Over 300

years ago, the human mind discovered the machine code of reality: mathematics. By utilizing abstract thought systems, humans began to decode the workings of the cosmos. From this understanding, the current scientific paradigm emerged, ultimately discovering the gift of technology. Today, however, our island of knowledge is surrounded by ever longer shores of ignorance. Science appears to have hit a dead end when confronted with the nature of reality and consciousness. In this fascinating and accessible volume, James Glattfelder explores a radical paradigm shift uncovering the ontology of reality. It is found to be information-theoretic and participatory, yielding a computational and programmable universe.

*String Theory and the Real World* - Gordon Kane  
2017-03-27

This book attempts to explain why 'string theory' may provide the comprehensive underlying theory that describes and explains our world. It is an enthusiastic view of how compactified string/M-theories (plus data that may be reachable) seem to have the possibilities of leading to a comprehensive underlying theory of particle physics and cosmology, perhaps soon. We are living in a hugely exciting era for science, one during which it may be possible to achieve a real and true understanding of our physical world.

**When Form Becomes Substance** - Luciano Boi  
2023-01-01

This interdisciplinary volume collects contributions from experts in their

respective fields with as common theme diagrams. Diagrams play a fundamental role in the mathematical visualization and philosophical analysis of forms in space. Some of the most interesting and profound recent developments in contemporary sciences, whether in topology, geometry, dynamic systems theory, quantum field theory or string theory, have been made possible by the introduction of new types of diagrams, which, in addition to their essential role in the discovery of new classes of spaces and phenomena, have contributed to enriching and clarifying the meaning of the operations, structures and properties that are at the heart of these spaces and phenomena. The volume gives a closer look at the scope

and the nature of diagrams as constituents of mathematical and physical thought, their function in contemporary artistic work, and appraise, in particular, the actual importance of the diagrams of knots, of braids, of fields, of interaction, of strings in topology and geometry, in quantum physics and in cosmology, but also in theory of perception, in plastic arts and in philosophy. The editors carefully curated this volume to be an inspiration to students and researchers in philosophy, phenomenology, mathematics and the sciences, as well as artists, musicians and the general interested audience.

**Reclaiming Space** - James S. J. Schwartz 2023

"Space, to use a worn metaphor, is in the mind of the beholder. When we

contemplate the seemingly limitless universe, we tend to project onto space our own hopes and dreams (as well as our fears and anxieties). But like responses to Rorschach inkblots, there are many different hopes, dreams, fears, and anxieties that one can project onto the night's sky. To those who approach it with a thirst for profits, space appears as a resource-rich goldmine, beckoning to anyone with enough wealth and privilege to take advantage of untapped markets. To those who approach it with a yearning for human expansion, space appears as a frontier that is humanity's birthright to conquer, its new manifest destiny. To those who approach it with a passion for knowledge and understanding, space appears as a tantalizing



and pristine laboratory for scientific exploration. In these ways, our visions for humanity's future in space--what planets and moons we hope to visit, what we hope to accomplish when we get there--are more products of our perspectives about space (and our underlying worldviews and value systems) than anything else"--

**Duality of Time** -  
Mohamed Haj Yousef  
2018-01-01

The Duality of Time Theory is the result of more than two decades of ceaseless investigation and searching through ancient manuscripts of concealed philosophies and mystical traditions, comparing all that with the fundamental results of modern physics and cosmology, until all the contradicting jigsaw pieces were put together into this brilliant portrait. Without the

overwhelming proofs and strong confirmations that accumulated over time, it would have been impossible to pursue this long research path, as it was extremely challenging to appreciate the unfathomable secret of time and the consequences of the ongoing perpetual creation of space, that result from the Single Monad Model of the Cosmos. The complex-time geometry of the Duality of Time Theory explains how the physical dimensions of space are sequentially being re-created in the inner levels of time, which makes the outward time genuinely imaginary with respect to the inner real levels. This is easily expressed in terms of the hyperbolic split-complex numbers, that characterize the Relativistic Lorentzian Symmetry. This will have

deep implications because space-time has become naturally quantized in a way that explains and unites all the three principles of Relativity, leading to full Quantum Field Theory of Gravity, as well as explaining all the other fundamental interactions in terms of the new granular space-time geometry. This ultimate unification will solve many persisting problems in physics and cosmology. The homogeneity problem, for example, will instantly cease, since the Universe, no matter how large it could be, is re-created sequentially in the inner time, so all the states are updated and synchronized before they appear in the outer level that we encounter. Furthermore, the Duality of Time does not only unify all the fundamental interactions

in terms of its genuinely-complex time-time geometry, but it unifies this whole physical world with the two other even more fundamental domains of the psychical and spiritual worlds. All these three conclusive and complementary realms are constructed on the same concept of space-time geometry that together form one single absolute and perfectly symmetrical space. This particular subject is treated at length in the Third Volume of this book series - the Ultimate Symmetry, which explores how the apparent physical and metaphysical multiplicity is emerging from the absolute Oneness of Divine Presence, descending through four fundamental levels of symmetry: ultimate, hyper, super and normal. Among many other astonishing

consequences, this astounding conclusion means that the psychical world is composed of atoms and molecules that are identical with the physical world except that they are evolving in orthogonal time direction. It may appear initially impossible to believe how the incorporeal worlds may have the same atomic structure as the physical world, but it is more appropriate to say that physical structures are eventually incorporeal, because they become various wave phenomena and energy interactions as soon as we dive into their microscopic level, as it is now confirmed by Quantum Field Theories. In the Duality of Time Theory, since rigid space is created sequentially in the inner time, energy may become negative, imaginary and even

multidimensional, which simply means that all things in creation are various kinds of energy moments that are spreading on different intersecting dimensions of time; so not only mass and energy are equivalent, but also charge and all other physical and metaphysical entities are interconvertible types of energy, including consciousness and information.

Quantum Theory: Concepts and Methods - A. Peres  
2006-06-01

There are many excellent books on quantum theory from which one can learn to compute energy levels, transition rates, cross sections, etc. The theoretical rules given in these books are routinely used by physicists to compute observable quantities. Their predictions can then be compared with experimental data. There

is no fundamental disagreement among physicists on how to use the theory for these practical purposes. However, there are profound differences in their opinions on the ontological meaning of quantum theory. The purpose of this book is to clarify the conceptual meaning of quantum theory, and to explain some of the mathematical methods which it utilizes. This text is not concerned with specialized topics such as atomic structure, or strong or weak interactions, but with the very foundations of the theory. This is not, however, a book on the philosophy of science. The approach is pragmatic and strictly instrumentalist. This attitude will undoubtedly antagonize some readers, but it has its own logic: quantum

phenomena do not occur in a Hilbert space, they occur in a laboratory. The Road to Reality - Roger Penrose 2021-06-09  
**\*\*WINNER OF THE 2020 NOBEL PRIZE IN PHYSICS\*\***  
The Road to Reality is the most important and ambitious work of science for a generation. It provides nothing less than a comprehensive account of the physical universe and the essentials of its underlying mathematical theory. It assumes no particular specialist knowledge on the part of the reader, so that, for example, the early chapters give us the vital mathematical background to the physical theories explored later in the book. Roger Penrose's purpose is to describe as clearly as possible our present understanding of the universe and to convey a feeling for its deep

beauty and philosophical implications, as well as its intricate logical interconnections. The Road to Reality is rarely less than challenging, but the book is leavened by vivid descriptive passages, as well as hundreds of hand-drawn diagrams. In a single work of colossal scope one of the world's greatest scientists has given us a complete and unrivalled guide to the glories of the universe that we all inhabit.

'Roger Penrose is the most important physicist to work in relativity theory except for Einstein. He is one of the very few people I've met in my life who, without reservation, I call a genius' Lee Smolin

Quantum Processes -  
Frank Hättich 2004

Coherent Quantum Physics  
- Arnold Neumaier

2019-10-21

This book introduces mathematicians, physicists, and philosophers to a new, coherent approach to theory and interpretation of quantum physics, in which classical and quantum thinking live peacefully side by side and jointly fertilize the intuition. The formal, mathematical core of quantum physics is cleanly separated from the interpretation issues. The book demonstrates that the universe can be rationally and objectively understood from the smallest to the largest levels of modeling. The thermal interpretation featured in this book succeeds without any change in the theory. It involves one radical step, the reinterpretation of an assumption that was virtually never

questioned before - the traditional eigenvalue link between theory and observation is replaced by a q-expectation link: Objective properties are given by q-expectations of products of quantum fields and what is computable from these. Averaging over macroscopic spacetime regions produces macroscopic quantities with negligible uncertainty, and leads to classical physics. - Reflects the actual practice of quantum physics. - Models the quantum-classical interface through coherent spaces. - Interprets both quantum mechanics and quantum field theory. - Eliminates probability and measurement from the foundations. - Proposes a novel solution of the measurement problem. *Understanding Space, Time and Causality* - B.V. Sreekantan

2019-12-04

This book examines issues related to the concepts of space, time and causality in the context of modern physics and ancient Indian traditions. It looks at the similarity and convergence of these concepts of modern physics with those discussed in ancient Indian wisdom. The volume brings the methodologies of empiricism and introspection together to highlight the synergy between these two strands. It discusses wide-ranging themes including the quantum vacuum as ultimate reality, quantum entanglement and metaphysics of relations, identity and individuality, and dark energy and anti-matter as discussed in physics and in Indian philosophical schools like Vedanta, Yoga,

Buddhist, Kashmiri Shaivism and Jaina Philosophy. First of its kind, this book will be an essential read for scholars and researchers of philosophy, Indian philosophy, philosophy of science, theoretical physics and social science.

**Modern Quantum Field Theory** - Tom Banks

2008-09-18

Presenting a variety of topics that are only briefly touched on in other texts, this book provides a thorough introduction to the techniques of field theory. Covering Feynman diagrams and path integrals, the author emphasizes the path integral approach, the Wilsonian approach to renormalization, and the physics of non-abelian gauge theory. It provides a thorough treatment of quark confinement and chiral symmetry breaking,

topics not usually covered in other texts at this level. The Standard Model of particle physics is discussed in detail. Connections with condensed matter physics are explored, and there is a brief, but detailed, treatment of non-perturbative semi-classical methods. Ideal for graduate students in high energy physics and condensed matter physics, the book contains many problems, which help students practise the key techniques of quantum field theory.

**Physics Meets Philosophy at the Planck Scale** -

Craig Callender

2001-01-29

Was the first book to examine the exciting area of overlap between philosophy and quantum mechanics with chapters by leading experts from around the world.

*String Theory in a*

*Nutshell* - Elias Kiritsis 2019-04-16  
The essential introduction to modern string theory—now fully expanded and revised  
*String Theory in a Nutshell* is the definitive introduction to modern string theory. Written by one of the world's leading authorities on the subject, this concise and accessible book starts with basic definitions and guides readers from classic topics to the most exciting frontiers of research today. It covers perturbative string theory, the unity of string interactions, black holes and their microscopic entropy, the AdS/CFT correspondence and its applications, matrix model tools for string theory, and more. It also includes 600 exercises and serves as a self-contained guide to the literature. This

fully updated edition features an entirely new chapter on flux compactifications in string theory, and the chapter on AdS/CFT has been substantially expanded by adding many applications to diverse topics. In addition, the discussion of conformal field theory has been extensively revised to make it more student-friendly. The essential one-volume reference for students and researchers in theoretical high-energy physics Now fully expanded and revised Provides expanded coverage of AdS/CFT and its applications, namely the holographic renormalization group, holographic theories for Yang-Mills and QCD, nonequilibrium thermal physics, finite density physics, and entanglement entropy Ideal for mathematicians and physicists specializing in



theoretical cosmology, QCD, and novel approaches to condensed matter systems An online illustration package is available to professors *The Dream Universe* - David Lindley 2020-03-17 A vivid and captivating narrative about how modern science broke free of ancient philosophy, and how theoretical physics is returning to its unscientific roots In the early seventeenth century Galileo broke free from the hold of ancient Platonic and Aristotelian philosophy. He drastically changed the framework through which we view the natural world when he asserted that we should base our theory of reality on what we can observe rather than pure thought. In the process, he invented what we would come to call science. This set the stage for all the

breakthroughs that followed--from Kepler to Newton to Einstein. But in the early twentieth century when quantum physics, with its deeply complex mathematics, entered into the picture, something began to change. Many physicists began looking to the equations first and physical reality second. As we investigate realms further and further from what we can see and what we can test, we must look to elegant, aesthetically pleasing equations to develop our conception of what reality is. As a result, much of theoretical physics today is something more akin to the philosophy of Plato than the science to which the physicists are heirs. In *The Dream Universe*, Lindley asks what is science when it becomes completely untethered from

measurable phenomena?  
Information and Living  
Systems - George Terzis  
2011

The informational nature of biological organization, at levels from the genetic and epigenetic to the cognitive and linguistic. Information shapes biological organization in fundamental ways and at every organizational level. Because organisms use information-- including DNA codes, gene expression, and chemical signaling--to construct, maintain, repair, and replicate themselves, it would seem only natural to use information-related ideas in our attempts to understand the general nature of living systems, the causality by which they operate, the difference between living and inanimate matter, and the emergence, in some

biological species, of cognition, emotion, and language. And yet philosophers and scientists have been slow to do so. This volume fills that gap. Information and Living Systems offers a collection of original chapters in which scientists and philosophers discuss the informational nature of biological organization at levels ranging from the genetic to the cognitive and linguistic. The chapters examine not only familiar information-related ideas intrinsic to the biological sciences but also broader information-theoretic perspectives used to interpret their significance. The contributors represent a range of disciplines, including anthropology, biology, chemistry, cognitive science, information theory,

philosophy, psychology, and systems theory, thus demonstrating the deeply interdisciplinary nature of the volume's bioinformational theme. *The Modus Cogitandi of Heraclitus* - Michael M Nikolettseas 2015-08-03 This is a new reading of Heraclitus by a natural scientist who challenges the traditional view of Heraclitus as the philosopher of flux. A parallel analysis of Heraclitus and Parmenides removes the alleged enigmas and obscurity of their thought, and reveals groundbreaking epistemological thinking. Heraclitus'

work is simply an epistemological essay, an essay on method in natural science. How is Quantum Field Theory Possible? - Sunny Y. Auyang 1995 How can we know the microscopic world without a measurement theory? What are the general conditions of the world that make possible such knowledge? What are the presuppositions of physical theories? This book includes an analysis of quantum field theory, and quantum mechanics and interacting systems are addressed in a unified framework.