

On Thinking

Series Editors

Ernst Pöppel

Parmenides Foundation, Kirchplatz 1, D-82049 Munich/Pullach, Germany

and

Human Science Center, Ludwig-Maximilians-University Munich,

Goethestr. 31, D-80336 Munich, Germany

Albrecht von Müller

Parmenides Foundation, Kirchplatz 1, D-82049 Munich/Pullach, Germany

More information about this series at
<http://www.springer.com/series/7816>

Albrecht von Müller • Thomas Filk
Editors

Re-Thinking Time at the Interface of Physics and Philosophy

The Forgotten Present

 Springer

Editors

Albrecht von Müller
Parmenides Stiftung
Pullach
Bayern
Germany

Thomas Filk
Institute of Physics
University of Freiburg
Freiburg
Germany

ISSN 1867-4208

ISBN 978-3-319-10445-4

DOI 10.1007/978-3-319-10446-1

ISSN 1867-4216 (electronic)

ISBN 978-3-319-10446-1 (eBook)

Library of Congress Control Number: 2015940546

Springer Cham Heidelberg New York Dordrecht London

© Springer International Publishing Switzerland 2015

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media (www.springer.com)

Editor's Preface to This Volume

Our most immediate and intimate experience of the world, the experience of a present is not accounted for in physics, and even modern philosophy tends to avoid this subject. This is in sharp contrast to classical philosophy: the treatises of Aristotle and Augustine of Hippo on time and the notion of “now” belong to the deepest discussions of this subject even until today. While Einstein might have hoped that “the present” will find its place in the theory of relativity, he later, in a discussion with Carnap, expressed his disappointment that he was not able to realize this hope.

In October 2006 and in May 2010, the Parmenides Foundation organized two workshops dedicated to the subject of “The Present.” In both cases, scientists from Physics and Philosophy presented and discussed their ideas about how a theory of “the present” may look like or how it can be incorporated into the existing theories. The participants as well as the subjects were mainly from physics and philosophy, and the workshop aimed to foster the exchange between these two disciplines about the concept of “time.”

This volume is not meant to be a Proceedings volume. Many of the participants of the workshops contributed with articles related to their presentations at the workshops; however, we also contacted other scientists, who for various reasons could not take part in the workshops, and invited them to contribute to this volume. In this way, we hope to have managed to collect a remarkable series of articles from many renowned scientists working in this field.

It was not easy to order these articles in a sequential structure, mainly because the subject has been addressed from various perspectives. However, we think that the overall arrangement starting from more mathematical and, in particular, relational concepts of space and time and developing towards more philosophical ideas helps the reader to find his or her way through the various ideas.

As editors of this volume, we refrain from giving our own view on this subject here, as it could only be biased and we also contributed articles to this volume. The first by one of us, Albrecht von Müller, offers a fundamental revision of the notion of time in which the phenomenon of the present moves to its center. In a sense, the reader may consider this article as describing the opinion of the editors,

which replaces an extended summary here in the preface. The next two articles by Andrej Nikonov and Thomas Filk emphasize relational concepts of space and time in general. To a certain degree, they describe a physical model of the general philosophical ideas outlined in the article of Albrecht von Müller (this holds in particular for the contribution by Andrej Nikonov).

The two articles by Dustin Lazarovici and Domenico Giulini deal with more mathematical aspects of classical (in the sense of non-quantum) space–time. The article by Domenico Giulini addresses the fundamental problems related to the mathematical description and the operational meaning of space–time in relativity, while the article by Dustin Lazarovici deals with the problem of locality of interactions in a relativistic theory as well as nonlocal extension and their relation to the notion of a “Now.”

Quantum aspects of space–time are addressed in the article by Mohammad Bahrami, Angelo Bassi, Sandro Donadi, Luca Ferialdi, and Gabriel León. Even though space–time is still treated as a classical “background,” the collapse of quantum states is attributed to certain collapse-centers distributed in space–time. Irreversibility, the “arrow of time,” is built into the model right from the beginning, and the collapse may be a physical correlate to what we call a “Now.”

The contributions by Basil Hiley and Tejjinder P. Singh emphasize a more algebraic approach towards concepts of time and the present. In the case of Basil Hiley's article, the point of departure is an algebraic theory of “processes” inspired by Grassmann algebras, while Tejjinder P. Singh starts from non-commutative geometries.

An almost continuous bridge to the more philosophically oriented articles are two contributions about the role of probability in physics, in particular in quantum physics, and its relation to the notions of time and “now.” While the article by Philippe Blanchard is still very mathematical and emphasizes the non-commutativity of observables and its relation to non-boolean logic, the contribution of Michael Drieschner deals with the relation of probability to the concepts of future and past. This article also contains a nice survey of historical approaches to the concept of time and the present.

The contribution of Michael Esfeld concentrates on the philosophical notion of presentism (the only form of reality is the present—as opposed to eternalism). In contrast to claims from physics (in particular general relativity), the article argues that presentism cannot be proven to be wrong, neither by physical nor by meta-physical arguments.

Finally, in his article, Hartmann Römer touches upon the difference between the physical (outer) time and the experienced (inner) time. The conscious perception of the observer plays an important role for the existence of inner time and “now,” and quantum mechanics (and maybe already thermodynamics) requires this conscious observer.

We would like to thank all scientists who contributed to this volume as well as all participants of our workshops for their presentations and stimulating input.

Pullach, Germany
Freiburg, Germany
Spring 2014

Albrecht von Müller
Thomas Filk

Contents

The Forgotten Present	1
Albrecht von Müller	
Autogenetic Network Theory	47
A. Nikonov and A. von Müller	
Relational Events and the Conflict Between Relativity and the Collapse	67
Thomas Filk	
Relativistic Interactions and the Structure of Time	93
Dustin Lazarovici	
Instants in Physics: Point Mechanics and General Relativity	109
Domenico Giulini	
Irreversibility and Collapse Models	125
Mohammad Bahrami, Angelo Bassi, Sandro Donadi, Luca Ferialdi, and Gabriel León	
Time and the Algebraic Theory of Moments	147
B.J. Hiley	
The Problem of Time and the Problem of Quantum Measurement	177
Tejinder P. Singh	
Classical and Quantum Probability: The Two Logics of Science	193
Philippe Blanchard	
Present and Future in Quantum Mechanics	211
Michael Drieschner	

Quantum Physics and Presentism	231
Michael Esfeld	
Now, Factuality and <i>Conditio Humana</i>	249
Hartmann Römer	
Index	269