

This content has been downloaded from IOPscience. Please scroll down to see the full text.

Download details:

IP Address: 3.138.134.168

This content was downloaded on 29/04/2024 at 22:26

Please note that [terms and conditions apply](#).

You may also like:

[Beyond the Science Wars: The Missing Discourse about Science and Society](#)

Ullica Segerstrale (ed.)

[Climate forcing growth rates: doubling down on our Faustian bargain](#)

James Hansen, Pushker Kharecha and Makiko Sato

Philosophy of Physics

Philosophy of Physics

Robert P Crease

Stony Brook University, New York, US

IOP Publishing, Bristol, UK

© IOP Publishing Ltd 2017

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the publisher, or as expressly permitted by law or under terms agreed with the appropriate rights organization. Multiple copying is permitted in accordance with the terms of licences issued by the Copyright Licensing Agency, the Copyright Clearance Centre and other reproduction rights organisations.

Permission to make use of IOP Publishing content other than as set out above may be sought at permissions@iop.org.

Robert P Crease has asserted his right to be identified as the author of this work in accordance with sections 77 and 78 of the Copyright, Designs and Patents Act 1988.

ISBN 978-0-7503-1542-5 (ebook)

DOI 10.1088/978-0-7503-1542-5

Version: 20171001

Physics World Discovery
ISSN 2399-2891 (online)

British Library Cataloguing-in-Publication Data: A catalogue record for this book is available from the British Library.

Published by IOP Publishing, wholly owned by The Institute of Physics, London

IOP Publishing, Temple Circus, Temple Way, Bristol, BS1 6HG, UK

US Office: IOP Publishing, Inc., 190 North Independence Mall West, Suite 601, Philadelphia, PA 19106, USA

Contents

Abstract	vi
Acknowledgments	vii
Author biography	viii
1 Introduction	1
2 Background: Three traditions	2
Analytic	3
Pragmatic	3
Continental	4
3 Current Directions	5
What is fundamental physics?	5
What are time and space?	7
How to interpret quantum mechanics?	10
Is there a scientific method?	12
4 Outlook	18
Additional resources	18

Abstract

There are some physics controversies that no amount of physics research can answer. Why is doing string theory scientific despite its lack of empirical predictions? How should we interpret quantum mechanics? What is the nature of time and space? What constitutes fundamental physics? One can answer these questions dogmatically by appealing to textbooks or by making rough and ready pronouncements, but the issues behind them can often be significantly clarified by the sort of systematic, critical reflection that philosophy practices. Philosophy comes in several traditions. Three of these—known as ‘analytic,’ ‘pragmatic’ and ‘continental’—have paid particular attention to physics. This ebook illustrates philosophy of physics in action, and how it can help physics, by using four examples from physics to exhibit the aims and value of these philosophical approaches.

Acknowledgments

Many thanks to Edward S Casey, Matin Durrani, Joseph D Martin, and Robert C Scharff. I'd also like to express my continuing gratitude to *Physics World* for allowing me to write the 'Critical Point' column for nearly 18 years. In that column, I have addressed many different topics including philosophy of science. This book includes material from several of these columns, including: 'Moving the goalposts' (January 2014), 'From wrong to right' (October 2015), 'A timely matter' (January 2016), 'Making space' (September 2017), and 'What philosophers do' (November 2017). I've also borrowed passages from my review of Patrick Heelan's book *The Observable*, in *Physics in Perspective* (2016 **18:1** 148).

Author biography

Robert P Crease



Robert P Crease is a professor in and chair of the Department of Philosophy at Stony Brook University, New York. He has written, translated, or edited over a dozen books on the history and philosophy of science and technology. He is past chair of the Forum for History of Physics of the American Physical Society. He is

Co-editor-in-chief of *Physics in Perspective*, and

for 17 years he has written a column, ‘Critical Point’, on the historical, social, and philosophical dimensions of science for *Physics World*. His books include *The Quantum Moment: How Planck, Bohr, Einstein, and Heisenberg Taught Us to Love Uncertainty* (with Alfred S Goldhaber, Norton 2014); *World in the Balance: The Historic Quest for an Absolute System of Measurement* (Norton 2011); *The Great Equations: Breakthroughs in Science from Pythagoras to Heisenberg* (Norton 2009); *The Prism and the Pendulum: The Ten Most Beautiful Experiments in Science* (Random House 2003); *Making Physics: A Biography of Brookhaven National Laboratory, 1946–1972* (University of Chicago Press 1999); *The Play of Nature: Experimentation as Performance* (Indiana University Press 1993); and *The Second Creation: Makers of the Revolution in 20th Century Physics* (with Charles C Mann, Macmillan 1986). His website is robertpcrease.com.