**Dean Rickles**, ed.
*The Ashgate Companion to Contemporary Philosophy of Physics*.
Aldershot: Ashgate 2008.
395 pages
US$124.95 (cloth ISBN 978-0-7546-5518-3)

Philosophy of science has, for much of its history, been largely occupied with the philosophy of physics. Although other sub-disciplinary fields have appeared, such as the philosophies of biology and—more recently—chemistry, few would deny that it is the physical sciences which continue to occupy the attention of the majority of philosophers of science. Due to this historical presence, argues Dean Rickles, a sort of schism has emerged within philosophy of physics, between the over-familiar problems and issues which are the staple of undergraduate and introductory texts, and the abundant literature in more advanced contemporary philosophy of physics research. In response to this lacuna, this new Ashgate Companion aims at bridging 'the middle ground between absolute beginner and consummate professional', and in so doing 'providing a way in to contemporary debates' (1).

Rickles' avowed aim is to provide a textbook suitable for an advanced undergraduate and postgraduate readership, which could serve as a comprehensive introduction to contemporary philosophy of physics, especially emerging areas of research such as quantum gravity and quantum computation. Since Rickles' aspiration is to provide an effective textbook in philosophy of physics, my review will focus on its pedagogical utility, and assess it on those terms.

The first chapter is Rickles' 'Advancing the Philosophy of Physics'. It provides a programmatic overview of the aims and concerns of philosophy of physics, especially on the question—always central to philosophy of science—of its relation to the science (and scientists) that it studies. Like most philosophers of science, Rickles emphasizes that philosophy of physics is not simply 'ontological book-keeping' or 'sideline commentary' for physicists, but an autonomous discipline whose critical function is to examine the assumptions, theories, methods, and interpretations of physicists. In other areas, such as quantum information theory, philosophers of physics can enjoy a more constructive role, contributing to the 'nuts and bolts' of ongoing research; especially since many philosophers of physics were, or are, practicing physicists, as has so often been the case in the history of philosophy of science. Indeed, Rickles endorses Einstein, Heisenberg, and Bohr's conviction that 'physics and philosophy of physics are not really so different' (6). Much of this book can be profitably seen as an attempt to play out this claim.

The four main chapters are topical, covering quantum mechanics, statistical

mechanics, quantum information theory, and quantum gravity. David Wallace's 'Philosophy of Quantum Mechanics' addresses the most familiar area of philosophy of physics, one which has subjected to philosophical scrutiny since the early last century, especially in the guise of the measurement problem. Surveying a wealth of recent research, Wallace provides a concise history of the measurement problem, and its subsequent treatment. There is a particularly engaging discussion of hidden variables. However, navigating his chapter, and his arguments, requires of readers a sufficiently confident and dauntless attitude towards mathematical formalisms and equations, and one worries that many undergraduate students, however advanced, will not be persuaded by Wallace's insistence that '(i)nterpreting formalisms is a distinctively philosophical project' (85).

Roman Frigg's 'A Field Guide to Recent Work on the Foundations of Statistical Mechanics' is perhaps the most difficult chapter. The discussion focuses on two main 'schools', those associated with Boltzmann and Gibbs, each of which generate incommensurable formulations of the 'core' problems, like equilibrium and non-equilibrium. The explanations of these two 'approaches' requires some lengthy formalisms, which may alarm the mathematically-inexperienced, although Frigg's presentation of the problems provides welcome interludes.

Chapter 4, Chris Timpson's 'Philosophical Aspects of Quantum Information Theory', provides an introduction to quantum information theory, 'one of the most lively and up-and-coming new areas of research in physics', albeit a familiar one since, as Timpson argues, its central question is the familiar one: 'How does the quantum world differ from the classical one?' (197). This chapter explores 'applied' questions like 'what can one *do* with entanglement' and other quantum notions, and so will be useful to those who find the more 'abstract' physical and philosophical discussions earlier in the book a little overwhelming. Certainly, Timpson's mention and discussion of quantum computing, cryptography, and teleportation are bound to excite the undergraduates at whom the book is aimed. Throughout, Timpson also regularly pauses to reiterate the philosophical significance of the quantum physics he draws upon, making this a particularly engaging chapter.

The final chapter is Dean Rickles' 'Quantum Gravity: A Primer for Philosophers'. Rickles' aim is to provide 'a catalyst for future research projects' within philosophy of physics, rather than delve into 'the nitty gritty philosophical problems' (262). The reason is that there is, as yet, no existing theory of quantum gravity to focus on, even if there are a cluster of related problems. Rickles opens his chapter with a clear historical sketch of the 'strange case of quantum gravity', including an emphasis on the pleasing point that quantum gravity research is 'one of the few areas of contemporary physics' where physicists 'actively engage with philosophers' (263). The last two sections, on the future of quantum gravity and resources, are particularly useful, and provide a nice coda to the book.

*The Ashgate Companion to Contemporary Philosophy of Physics* would serve as an excellent resource for advanced undergraduate and postgraduate courses in the philosophy of physics. The rich bibliography offers ample sources for further research. Understandably for a textbook on the philosophy of physics, some degree of mathematical competence is required, and this may deter those students and teachers who lack sufficient *nous* with equations and formalisms. Of course, this may hurt its potential as a general purpose textbook, especially for philosophers who lack scientific training, and one might worry that Rickles presumes more mathematical skill (and confidence!) from his intended student readership than they might in fact possess. However, this is sure to be a general problem for all philosophers who wish to enjoy close contacts with contemporary science, whether philosophers of science, metaphysicians, or whatever. In that case, philosophers of physics might perhaps simply get more mathematics under their belt, and, on those terms, this *Ashgate Companion* would serve as a good textbook for them.

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