Guido Bacciagaluppi; Antony Valentini, eds. Quantum Theory at the Crossroads: Reconsidering the 1927 Solvay Conference.
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images subsequently crafted for the edition put together by Claude Clerselier, though nowadays taken to epitomize Descartes's mechanical understanding of humans, is in fact generally more remote from Descartes's text and intentions than the alternative set of illustrations made by Florentine Schuyl.

At a few points one wishes that Zittel had gone over his book one more time: there are some highly associative passages that lack the stringency of the rest of the text; and the proofreading has at times been done sloppily. For the rest, *Theatrum philosophicum* will not fail to delight Descartes scholars and early modernists interested in the role of techniques of visualization in scientific epistemology.

CHRISTOPH LÜTHY

■ Modern (Nineteenth Century to 1950)

Guido Bacciagaluppi; Antony Valentini. (Editors). *Quantum Theory at the Crossroads: Reconsidering the 1927 Solvay Conference*. xxviii + 530 pp., illus., app., bibl., index. Cambridge: Cambridge University Press, 2009. $126 (cloth).

Can the reassessment of a historical debate contribute to the better understanding of an open philosophical question? The editors of this volume say that it can. The open question concerns the interpretation of quantum mechanics. The historical debate under review is the famous 1927 Solvay conference in Brussels. According to the received view, the standard Copenhagen interpretation was established as the canonical understanding of the new concepts brought about by quantum mechanics during that conference. The conference is remembered, above all, for the famous debate between Bohr and Einstein about the limits and understanding of the quantum uncertainty relations. Again and again, the received view has it, Einstein would come up with ideas for an experiment proving the inconsistency or incompleteness of the new quantum theoretical concepts. And again and again, Bohr would come up with a refutation of Einstein's challenge, proving the Copenhagen interpretation to be consistent and inevitable. But we really know about that debate between Einstein and Bohr only from the latter's own account, published some twenty years later in Paul Arthur Schilpp's *Albert Einstein: Philosopher-Scientist* (Open Court, 1949). Contemporary accounts, most importantly a famous letter by Ehrenfest, are less explicit and more equivocal about the debate between Bohr and Einstein.

The current debate about the interpretation of quantum mechanics, too, has changed. In the wake of recent experimental efforts to explore and exploit the features of quantum entanglement and to test quantum theory on macroscopic scales, the prevailing Copenhagen interpretation has lost its status as the unchallenged, unanimously accepted doctrine about foundational issues raised by quantum theory. Modern physicists have begun to reclaim Einstein, the old skeptic of the quantum uncertainties, as the father of their current efforts to probe the boundaries of the theory. Among other commentators, the late James Cushing, to whom the present volume is dedicated, has put forward a penetrating philosophical and historical analysis in his *Quantum Mechanics: Historical Contingency and the Copenhagen Hegemony* (Chicago, 1994). That work, as well as Mara Beller's *Quantum Dialogue* (Chicago, 1999), has already done much to put the Copenhagen doctrine into question. Guido Bacciagaluppi and Antony Valentini share Cushing's and Beller's skepticism about the inevitability of the Copenhagen doctrine in any of its various incarnations. They invite us to reassess the historical debate and present an English translation of the proceedings of the 1927 Solvay conference. But the book is more than just an English translation of an existing source. The editors wrote 250 pages of introduction, laying out the historical context of the 1927 conference as well as opening up perspectives for the current foundational debate.

Reading *Quantum Theory at the Crossroads*, it becomes clear that the 1927 conference was very different from the way we now tend to think of it: as a mere stage for the Bohr–Einstein after-dinner debates. In a careful and meticulous reconstruction, the editors have put together the texts of the presentations to the conference, going back to the original drafts and taking into account all available archival information. Among the presenters at the Solvay conference were William Henry Bragg and Arthur Holly Compton, who presented the latest experimental findings about X-ray diffraction and Compton scattering, respectively. On the theoretical side, Louis de Broglie presented his ideas on a new dynamics of quanta based on the notion of a pilot wave, whereas Max Born and Werner Heisenberg, as well as Erwin Schrödinger, gave accounts, respectively, of the matrix mechanics and wave mechanics formulations. The presentations give a vivid and accurate picture of the

state of the young quantum mechanics. Even more interesting are the discussion remarks. They convey a sense of intellectual curiosity and interpretational openness, but also of emerging partisanship. It is most interesting here to note—and the editors don't fail to point this out—that de Broglie's pilot wave theory received more serious attention on the floor than Born's and Heisenberg's matrix mechanics.

Einstein had been asked to give a report to the conference on the present status of quantum statistics but withdrew his paper a few weeks before the meeting. Neither, like most of the twenty-eight participants, did Bohr give a report at the conference. But when the proceedings of the 1927 conference were published a year later, the volume included a chapter by Bohr. Included in the official records of the conference, at the author's request, was an English translation of Bohr's 1928 Como lecture. True to their aim of presenting an account of the conference as it actually proceeded, the editors of the current volume have not included Bohr's later paper. Instead, they offer various notes, drafts, and manuscripts pertaining to Bohr's actual discussion contributions, which they have located in the Bohr Archives and at other places. The documents are sketchy and incomplete, but they allow the reader to get an impression of the openness and insecurity of Bohr's actual discussion remarks, elements buried in the polished paper that appears in the published proceedings.

On the basis of historical insight that draws on a thorough knowledge of the available sources and of the secondary literature, and philosophical analysis that is informed by an excellent understanding of the technical problems and the available interpretational alternatives, Bacciagaluppi and Valentini have put together a most useful volume for historians and philosophers of physics alike. The excellent introduction and the important sources make this volume a most valuable contribution to the philosophy and history of quantum mechanics. It should be included in the reading list of every class on that subject, and it should be read by anyone who is concerned with the conceptual problems of quantum mechanics. I also recommend it to physicists who are looking for a good place to start reading about the historical emergence of interpretational problems of modern quantum theory.

TILMAN SAUER

David Baneke. *Synthetisch denken: Natuurwetenschappers over hun rol in een moderne maatschappij, 1900–1940.* 240 pp., figs., bibls., index. Hilversum: Uitgeverij Verloren, 2008. €19 (paper).

Most work on Dutch scientific networks has focused on the early modern period or, more recently, the late nineteenth century. The early decades of the twentieth century have been less thoroughly treated, and the few studies that have been undertaken focus predominantly on technological rather than sociological or philosophical developments. That it fills this gap is what makes David Baneke's Ph.D. thesis, now published as *Synthetisch denken: Natuurwetenschappers over hun rol in een moderne maatschappij, 1900–1940*, such a worthwhile contribution to the field.

Baneke treats a change in attitude that made headway among many (but certainly not all) Dutch scientists in the first forty years of the twentieth century. Unfettered belief in the virtues of scientific advancement had given way to a profound skepticism, and even alarm, at the way in which scientific knowledge was causing fundamental and sometimes unwanted changes in society. Most of all, these were the dilemmas of modernity: social estrangement, class division, the relentless roller-coaster of technological progress, and the increase of societal pace in general. Many scientists articulated the need for a "synthesis" to deal with all these changes, a coherent and acceptable vision of the role of science in society.

In his text, Baneke roughly applies a twofold approach: he considers those issues affecting the relation between science and society, on the one hand, and discussions about the direction of science itself, on the other. He explores the opinions held by a host of scientists in the first third of the twentieth century. There is a good balance between lesser figures and more important ones, and the latter group is often explored further to add depth to the story.

The status of "the" scientist is equally important. What is clear is that the nature of scientific endeavor, and therefore the position of its protagonists, is usually not at issue: it is the relation with the outer world that is perceived as problematic. But Baneke doesn't oversimplify matters by reducing the history of early twentieth-century Dutch science to his "synthetic" hypothesis, and this is what makes his argument so convincing. Technocrats striving toward an even greater separation between the scientific and the "real" worlds and analytical philosophers are also discussed. But the central question remains, Does scientifically