standing among men who live by thought. That both of these efforts were not entirely successful is perhaps more of a criticism of us than of Oppenheimer.

The contributors to this book, probably by choice, hardly touch upon the unspeakable hearings of 1954, at which Oppenheimer's services to his country were rewarded by his condemnation as disloyal, a procedure which reminds one of the Athenians' ostracism of Miltiades after his victory at Marathon. It might have been appropriate to include in this book the stirring speech about this injustice delivered by George Kennan at Oppenheimer's funeral service in Princeton. But perhaps it is better to simply describe Oppenheimer's achievements, and let each reader recognize the worth of the man we were privileged to have among us.

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Quanta and Ontology

Quantum Physics and the Philosophical Tradition. AAGE PETERSEN. Published in cooperation with the Belfer Graduate School of Science, Yeshiva University, by M.I.T. Press, Cambridge, Mass., 1968. x + 202 pp. $7.50.

Niels Bohr was convinced that the development of quantum mechanics contained a lesson, "an epistemological lesson with bearings on problems far beyond the domain of physical science." Although he wrote many essays on this theme in his later years, Bohr never attempted a full-scale discussion of the philosophical implications of quantum physics. Philosophers have taken up some of the issues raised by the statistical nature of quantum mechanics, but the subject as a whole has never attracted their attention in the way relativity did.

In this book Aage Petersen, who served as Bohr's assistant for many years, has undertaken an analysis of the relationship between quantum physics and traditional philosophy. Petersen considers *the* philosophical tradition to be an inquiry into the structure of being or the nature of reality, culminating in the work of Immanuel Kant. Classical physics is consistent with this ontological mode of thought, as he calls it, but quantum physics is not; it represents something new. In order to analyze how and where quantum physics departs from the tradition, Petersen has chosen to emphasize the concept of correspondence, and not the concept of complementarity, which Bohr himself stressed in his later writings. By giving the idea of correspondence such a prominent place, Petersen calls attention to the ways in which quantum mechanics is a rational generalization of the older physics. For, as Bohr put it: "The correspondence principle expresses the tendency to utilize in the systematic development of the quantum theory every feature of the classical theories in a rational transcription appropriate to the fundamental contrast between the [quantum] postulates and the classical theories." Petersen follows Bohr in stressing the indivisible nature of a quantum phenomenon, which requires the specification of the whole experimental arrangement for its definition. He, too, sees the goal of physical theory as unambiguous communication rather than intuitive understanding.

I am not sure that Petersen's concern over the relationship between quantum physics and the ontological mode of thought will be widely shared. Twentieth-century philosophers hardly seem to have been bound by one set of categories, anyway. We even know that Bohr read William James and profited from his reading, which suggests that Petersen may not have used the most relevant philosophical starting point.

Petersen draws an interesting parallel between the philosophical impact of quantum mechanics and that of the calculus, with its ensuing debate over the nature of continuity and limits. This debate was settled by a rigorous theory of limits within mathematics, and not on philosophical grounds, and Petersen suggests we may well see a similar outcome to the unresolved questions about the interpretation of the quantum theory, where we are still in the "pre-Cauchy" stage of the discussion. This is typical of Petersen's attitude. He does not pretend to have settled the difficult questions over which Bohr and Einstein struggled for a quarter of a century. On the contrary, it is his view that "our present understanding of the topic is much more primitive than is usually believed," an opinion in which Bohr and Einstein might well have concurred.

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An Achievement of Magnitude

The Stanford Two-Mile Accelerator. R. B. NEAL, Ed. Benjamin, New York, 1968. xiv + 1170 pp., illus. $35.

When I see one of the world's great suspension bridges, or when I see, on television, the Apollo spacecraft going into orbit, I feel proud to belong to the same human race as the men who conceived these projects and brought them to fruition. I get the same feeling when I look down upon SLAC, the two-mile-long accelerator at Stanford, from Skyline Boulevard, where it appears as a long line upon the landscape, and I get the same feeling as I read this book. There is a difference between SLAC and a suspension bridge. The beauty and usefulness of a bridge are apparent to most of us without special training, whereas one needs considerable technical knowledge to appreciate the beauty and usefulness of SLAC. This knowledge can be increased by reading this book.

SLAC is at present not only America's longest particle accelerator but also its most expensive; it cost $114 million exclusive of considerable preconstruction, research-and-development, and preoperation funds. It is therefore of interest to all taxpayers to see how this money was spent. It takes a book of 1170 pages to tell the story. The development of particle accelerators can be measured in several ways: A description of the first betatron was, I believe, published in two papers in *Physical Review*, one theoretical and one experimental. Most of an issue of the *Review of Scientific Instruments* was devoted to the Cosmotron. Hansen's first traveling-wave linear accelerator, the Mark I, a forerunner of SLAC, was described in 1948 in a single paper with three authors. This book is the work of 90 authors. This comparison is a familiar one at SLAC, and 10 pages are devoted to the history of accelerator projects at Stanford. I found particularly appealing a photograph, which is by now famous, of the Stanford Mark I linear accelerator being held up by four physicists headed by Bill Hansen, who remains a legend at Stanford.

With such an increase in the size of a project comes increasing complexity, and most of the problems of SLAC are problems of this complexity. For example, special techniques, using laser light, were developed to align the accelerator to unprecedented tolerances. These techniques, described in 23