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BOOK REVIEW

Showing quantum tolerance

Salvatore Cannavo: Quantum theory: A philosopher's overview. New York: Suny Press, 2009, 188 pp, $60.00 HB

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When Oscar Wilde's *The Picture of Dorian Gray* is mentioned in a conversation, it is rarely the case that the narrator really believes that the deterioration attending old age can be transferred upon a painting. Nevertheless, we eagerly "suspend our disbelief" (to borrow Coleridge's phrase) in anticipation of the story's unfolding.

In the case of the quantum theory, it is this 'unfolding' of the history of theoretical physics that we must wait for. According to Cannavo, none of the currently available interpretations of the quantum theory provides us with the final word on how the elements of this theory should be understood. He even presents the reader with the daring claim that the quantum theory is nothing more than a mathematical tool for making predictions—rather than a more or less truthful description of reality.

In the twentieth century, the meaning of Coleridge's expression shifted and came to refer to the spectator's 'willingness' to suspend his or her judgment. For the term to apply, it became important to determine the disposition of the audience. Might it be expected to suspend its judgment?

A similar question haunts every writer of popular science, particularly of science as counterintuitive as the quantum theory. In the preface, Cannavo says of his own work that "the main body of discussion [is] accessible to the general reader with a mature interest in science" (xiii). The verity of this claim obviously depends on our appraisal of the 'general reader', but I'm afraid that *linearly independent orthogonal eigenstate* (14) is all Greek to anyone unfamiliar with basic linear algebra.

Before plunging into the morass of miscellaneous interpretations, Cannavo gives a fittingly short introduction to quantum theory and its intricacies. In order to appeal to the general reader, he has attempted to leave out all mathematical symbolism. But there is always a tradeoff in such an approach: the gain in appeal is counterbalanced by a loss of comprehensibility. True, mathematics can be daunting, but sometimes a

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small number of simple formulae can replace entire pages of explanation. Cannavo is probably aware of this, for in his discussion of Bell's Inequality (35), he does write it down in its mathematical form. However, not willing to scare away *mathophobic* readers, he merges the formula with the accompanying text, thus rendering it rather *less* intelligible. In most other places in the book, the mathematical formalism is redirected to the footnotes. But in the footnotes, too, the mathematical symbolism is obscured by the surrounding text. Nor have the notes themselves received proper attention. The explanation of a concept that was at first relegated to a footnote sometimes reappears in the main text (e.g., n. 7, p. 26), while some terms that appear in footnotes are sometimes only introduced in the next chapter of the main text (e.g., n. 14, p. 29).

Aside from these minor annoyances, the brevity of the account is appropriate for the approach Cannavo has chosen. Because of the high degree of counterintuitive character of quantum theory, it is impossible to grasp the book's later chapters without the scaffolding provided by the earlier ones. The conciseness of these opening chapters is of great help to the reader, as it prevents the concepts and definitions presented here from slipping from memory before they are called upon to penetrate the interpretational issues.

After discussing five different ways of interpreting the quantum theory (chapters 4 and 5) and finding none of these to be wholly satisfactory, Cannavo suddenly casts off his mask of impartiality. "Formal science consists," he writes, "at least in part, of laws and theories. For convenience, we shall refer to these collectively as nomological statements." (81) He distinguishes between *explanatory* and *algorithmic* nomological statements. He admits that the philosophical literature is replete with discussions on a precise definition of 'explanation', but he is quick to adopt the Hempel-Oppenheim construal of explanation as "deductive subsumption under a covering law" (83). An *algorithmic* nomological statement, on the contrary, is a mere mathematical device, which cannot explain. Unsurprisingly, Cannavo classifies the quantum theory as purely algorithmic—having no explanatory content. In the subsequent chapters, Cannavo reveals himself as a *realist* in the traditional sense and states his belief that the quantum theory may, 1 day, be replaced by, or incorporated into, some 'deeper' theory and that this theory "would probably harbor hidden variables of one sort or another" (101). But these hidden variables, Cannavo hastily adds, are nothing like those of Bohm's discredited 'hidden variable interpretation'. Rather, their status should be compared to that of elementary particles in the dawn of the quantum theory.

In a concluding paragraph, Cannavo writes: "In their philosophically unguarded moments, scientists tend to be *objective realists*" (122, my italics), indicating that he himself is of this opinion. According to Cannavo, while awaiting the unfolding of events in theoretical physics, the realist must show a bit of 'quantum tolerance', or, returning to Coleridge, must have some 'Poetic Faith'.

So who should read this book? For the most part, it is indeed understandable by the general readers with a mature interest in science, but they should not expect new insights into matters heretofore ill understood. For the students of physics, however, the work provides a nice overview of concepts and interpretations they might already be familiar with, but failed to place in the 'big picture' of science as a whole.