

# BELL'S COLLECTED WRITINGS ON THE FOUNDATIONS OF QUANTUM MECHANICS

## Speakable and Unspeakable in Quantum Mechanics

J. S. Bell

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Reviewed by N. David Mermin

John S. Bell is well known for having provided one of the more spectacular displays of an unclothed emperor when he pointed out that John von Neumann's venerable and oft-cited no-hidden-variables proof relies on an entirely unreasonable assumption. He is downright famous among philosophers, mystics, all kinds of physicists and the readers of gee-whiz books about modern science for filling the gap he himself had opened up with Bell's theorem—a simple and entirely reasonable proof that no local hidden-variable theory can reproduce the statistical predictions of the quantum theory. He has also for many years written about the foundations of quantum mechanics more beautifully, more lucidly, more interestingly, more entertainingly and in more obscure places than anybody else I know of. The editors at Cambridge University Press are to be congratulated for having persuaded him to let them collect and publish his writings on quantum philosophy over the last two and a half decades, primarily from various conference proceedings, unpublished CERN reports and even that most infuriatingly elusive of sources, *Epistemological Letters*.

Perusing the book is sheer pleasure. If you, hardheaded working physicist that you are, were to decide, whether out of idle curiosity or from some dim pang of conscience, that the time had

come to examine a contemplative work on the nature of quantum mechanics, then there could be no better book for you. In addition to the two celebrated pieces of analysis mentioned above, Bell's theorem and the Einstein-Podolsky-Rosen business are also touched on in several of the other essays, which include my longtime favorite, the sublime "Bertlmann's Socks and the Nature of Reality," addressed to "the philosopher in the street, who has not suffered a course in quantum mechanics."

The interesting de Broglie-Bohm view of quantum mechanics also gets a clear presentation and a lot of attention. "Why is the pilot wave picture ignored in the text books?" asks Bell. "Should it not be taught, not as the only way, but as an antidote to the prevailing complacency? To show that vagueness, subjectivity, and indeterminism, are not forced on us by experimental facts, but by deliberate theoretical choice?" There is even a recent neat extension of this formulation by Bell himself, in "Beables for Quantum Field Theory," pronounced, by the way, not in almost irresistible analogy to "beagles," but as "beables"—entities with more than the ontologically puny status of observables. If beables ever catch on it will be urgent to rename them "existables."

Wave packet reduction is another major concern. What kind of a theory is it that admits of an interpretation only when the system interacts with something else? "For the universe there is nothing else, and quantum mechanics in its traditional form has simply nothing to say. It gives no way of, indeed no meaning in, picking out from the wave of possibility the single unique thread of history." These considerations lead (in an essay with Michael Nauenberg) "inescapably to the conclusion that quantum mechanics is, at the best, incomplete," though "we emphasize not only that our view is that of a minority, but also that

current interest in such questions is small. The typical physicist feels that they have long been answered, and that he will fully understand just how if ever he can spare twenty minutes to think about it." In one essay Bell describes a very recent proposal by G. C. Ghirardi, A. Rimini and T. Weber for a stochastic modification in the Schrödinger equation that introduces at the fundamental dynamical level an occasional jump ("Yes, a jump!") that in a fairly natural way happens rarely for microscopic systems, but frequently enough for macroscopic ones to make such embarrassments as Schrödinger's cat even more transitory than a blush.

In the middle of the collection is an essay, "How to Teach Special Relativity," that while unrelated to the central topic, is, like the others, informed by a spirit entirely uncowed by sacred cows. This essay gave me particular pleasure since several years ago I wrote a little book, and even a lengthy poem, expounding the subject from just the point of view Bell advocates.

It would have been helpful if the editors of the collection had augmented the many references these papers make to one another to include the numbers and page numbers they have in the present volume. The data you need are there, but you have to look up the journal reference in a table of Bell's papers on quantum philosophy to find out the title, and then look up the title in the table of contents. Aside from that I have no complaints. This is a wonderful book.

## Theory of Simple Liquids

J.-P. Hansen and  
I. R. McDonald

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1987. Second edition. 547 pp.  
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Since its appearance in 1976, the first edition of Jean-Pierre Hansen and Ian R. McDonald's *Theory of Simple*

David Mermin is a condensed matter theorist at Cornell University. He didn't learn about Bell's theorem until 1979, but he was so impressed that he's been writing about it ever since.