David Bohm and His Work—On the Occasion of His Seventieth Birthday

Max Jammer

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David Joseph Bohm was born on 20 December 1917 in Wilkes-Barre, a coal-mining town in the scenic and historic Wyoming Valley at the Susquehanna River in upstate Pennsylvania. His parents, Samuel and Freda (née Popky), owned there a furniture shop and wanted their son to continue the family business. But David decided to enroll in the nearby Pennsylvania State College and received there his B.S. in 1939. For his postgraduate studies he went to the California Institute of Technology in Pasadena and the University of California at Berkeley, where he attended Robert Oppenheimer's lectures on quantum mechanics. In 1943 he obtained his Ph.D. at Berkeley and served as a research fellow at the Lawrence Radiation Laboratory until 1946, when he accepted an assistant professorship at Princeton University.

While still in California, Bohm published, in collaboration with some of his colleagues, a series of papers on a variety of subjects such as the theory of the synchrotron, the low energy $\beta$-spectrum of $^{64}$Cu, and its agreement with Fermi's theory of beta-decay. When at Princeton, he developed a theory of plasma oscillations and in a paper on the self-oscillations of a charged particle tried, together with M. Weinstein, to show that "a systematic relativistic quantum theory of extended charges might readily lead to important revisions of some of our concepts of causality", his earliest challenge of a prevailing fundamental conception in physics.

His main interest, in fact, focussed upon the conceptual foundations of quantum mechanics, a subject on which he had long discussions with his colleagues who were enthusiastic adherents to Niels Bohr's complementarity philosophy. In Princeton he wrote his first book, entitled Quantum

1 Department of Physics, Bar-Ilan University, Ramat-Gan 52100, Israel.
mainly in order to understand, as he himself admitted, “the precise nature of the new quantum-theoretical concepts.” As stated in the Preface, it was influenced in its mathematical exposition by Oppenheimer’s lectures and in its philosophical outlook by Bohr’s ideas which, as Bohm put it at that time, “were of crucial importance in supplying the general philosophical basis needed for a rational understanding of quantum theory.” Reissued in 1960 and widely used still today, the book offers a lucid presentation of the experimental and computational aspects of the theory and an exceptionally profound analysis of the quantum-mechanical measurement problem and of the Einstein–Podolsky–Rosen paradox in terms of the since then generally accepted reformulation of two spin-$\frac{1}{2}$ particles in a singlet state. It is interesting to note that Bohm concluded the textbook with a “proof that the quantum theory is inconsistent with hidden variables” on the grounds that “no theory of mechanically determined hidden variables can lead to all the results of the quantum theory.”

Just when the book appeared in 1951 the crusade launched by Senator Joseph Raymond McCarthy against un-American activities forced Bohm, on grounds of having been working with Oppenheimer, to leave Princeton and to take refuge at the University of São Paulo in Brazil. Four years later he accepted an appointment at the Haifa Technion in Israel, where he married Sarah Woolfson in 1956. After having left for England to join the faculty of the University of Bristol, Bohm was finally appointed professor of physics at Birkbeck College of the University of London with which he is affiliated still today.

When Bohm, still in Princeton, had finished writing his *Quantum Theory* he felt that he did not yet really understand the theory. In the hope of reaching further clarification he sent copies of the book to Bohr, Pauli, and Einstein. Bohr remained silent, Pauli praised the book in general terms, and Einstein invited Bohm to discuss the matter in detail. These discussions and the accidental reading of an article, written by Blokhintsev or somebody else, were a turning point for Bohm. He studied the relation of the Schrödinger equation to the Hamilton–Jacobi equation and realized that modifying the latter by introducing what he called the “quantum potential” enables him to establish a consistent hidden-variable, or as he later preferred to call it a trajectory, interpretation, which “permits us to conceive of each individual system as being in a precisely defined state, whose changes with time are determined by definite laws, analogous to (but not identical with) the classical equations of motion.”

The paper “A suggested interpretation of the quantum theory in terms of ‘hidden’ variables,” in which he published his novel approach, inaugurated one of the most dramatic chapters in modern physical thought. Expressing the wave function $\psi$ as $R \exp(iS/\hbar)$, where $R$ and $S$ are