

References

ABBREVIATIONS

PWNB: Bohr, N., *The Philosophical Writings of Niels Bohr*, 3 vols., Woodbridge, CT: Ox Bow Press, 1987;
Bohr, N., *The Philosophical Writings of Niels Bohr, Volume 4: Causality and Complementarity, Supplementary Papers*, ed. Faye, J. and Folse, H. J., Woodbridge, CT: Ox Bow Press, 1998.

QTM: Wheeler, J. A. and Zurek, W. H. *Quantum Theory and Measurement*, Princeton, NJ: Princeton University Press, 1983.

Bell, J. S.

1987 *Speakable and Unsayable in Quantum Mechanics*, Cambridge: Cambridge University Press, 1987.

Beller, M.

1999 *Quantum Dialogue: The Making of a Revolution*, Chicago: University of Chicago Press, 1999.

Bertlmann, R. A. and Zeilinger, A., eds.

2002 *Quantum (Un)speakables: From Bell to Quantum Information*, Berlin: Springer, 2002.

Bohm, D.

1995 *Wholeness and Implicate Order*, London: Routledge, 1995.

Bohr, A., Mottelson, B. R., and Ulfbeck, O.

2004 "The Principles Underlying Quantum Mechanics," *Foundations of Physics* 34 (3) (2004), 405-517.

Bohr, N.

1935 "Quantum Mechanics and Physical Reality," in Wheeler, J. A. and Zurek, W. H. *Quantum Theory and Measurement*, Princeton, NJ: Princeton University Press, 1983.

1972-1996 *Niels Bohr: Collected Works*, 10 vols., Amsterdam: Elsevier, 1972-1996.

1987 *The Philosophical Writings of Niels Bohr*, 3 vols., Woodbridge, CT: Ox Bow Woodbridge Press, 1987.

- 1998 *Philosophical Writings of Niels Bohr, Volume 4: Causality and Complementarity, Supplementary Papers*, ed. Faye, J. and Folse, H. J., Woodbridge, CT: Ox Bow Press, 1998.
- Born, M.
2005 *The Einstein-Born Letters*, trans. Born, I., New York: Walker, 2005.
- Born, M., Heisenberg, W., Jordan, P.
1926 *Zur Quantenmechanik*. II, in Born, M., Heisenberg, W., and Jordan, P., *Zur Begründung der Matrizenmechanik (Dokumente der Naturwissenschaften —Abteilung Physik, Vol. 2*, Hermann, A. ed.), Stuttgart: E. Battenberg Verlag, 1962.
- Brown, H. R. and Pooley, O.
2001 “The Origin of Spacetime Metric: Bell’s ‘Lorentzian Pedagogy’ and its Significance in General Relativity,” in Callender, C. and Huggett, N., *Physics Meets Philosophy at the Planck Scale: Contemporary Theories of Quantum Gravity*, Cambridge: Cambridge University Press, 2001, 256-272.
- Butterfield, J. and Isham C.
2001 “Spacetime and the Philosophical Challenge of Quantum Gravity,” in Callender, C. and Huggett, N., *Physics Meets Philosophy at the Planck Scale: Contemporary Theories of Quantum Gravity*, Cambridge: Cambridge University Press, 2001, 33-89.
- Cartier, P.
2001 “A Mad Day’s Work: From Grothendieck to Connes and Kontsevich. The Evolution of Concepts of Space and Symmetry,” *Bulletin (New Series) of the American Mathematical Society* 38 (4) (2001), 389-408.
- Connes, A.
1994 *Noncommutative Geometry*, trans. Berberian, S. K., ed. Rieffel, M. A., San Diego, CA: Academic Press, 1994.
- Cushing, J. T. and McMullin, E., ed.
1989 *Philosophical Consequences of Quantum Theory: Reflections on Bell’s Theorem*, Notre Dame, IN: Notre Dame University Press, 1989.
- D’Espagnat, B.
1989 *Conceptual Foundations of Quantum Mechanics*, Redwood City, CA: Addison-Wesley, 1989.
- Dirac, P. A. M.
1933 Letter to Niels Bohr, August 10, 1933, copy in Niels Bohr Library, Center for the History of Physics, American Institute of Physics, College Park, Maryland.
1962 T. Kuhn, interview with Dirac, April 1, 1962, Niels Bohr Library, Center for the History of Physics, American Institute of Physics, College Park, Maryland.

- 1995 *The Principles of Quantum Mechanics*, Oxford: Clarendon, 1995.
- Dyson, F. J.
- 1949 “The S-Matrix in Quantum Electrodynamics,” *Physics Review* 75 (1949), 1736-1755.
- 2005 “Hans Bethe and Quantum Electrodynamics,” *Physics Today* 58 (10) (2005), 48-50.
- Einstein, A., Podolsky, B., and Rosen, N.
- 1935 “Can Quantum-Mechanical Description of Physical Reality be Considered Complete?,” in Wheeler, J. A. and Zurek, W. H. *Quantum Theory and Measurement*, Princeton, NJ: Princeton University Press, 1983, 138-141.
- Ellis, J. and Amati, D., eds.
- 2000 *Quantum Reflections*, Cambridge: Cambridge University Press, 2000.
- Faye, J.
- 1991 *Niels Bohr: His Heritage and Legacy. An Anti-Realist View of Quantum Mechanics*, Dordrecht: Kluwer, 1991.
- Faye J. and Folse, H. J., eds.
- 1998 *The Philosophical Writings of Niels Bohr, Volume 4: Causality and Complementarity, Supplementary Papers*, Woodbridge, CT: Ox Bow Press, 1998.
- Fine, A.
- 1989 “Do Correlations Need to be Explained?,” in Cushing, J. T. and McMullin, E., eds., *Philosophical Consequences of Quantum Theory: Reflections on Bell’s Theorem*, Notre Dame, IN: Notre Dame University Press, 1989, 174-94.
- Feynman, R.
- 1988 *QED: A Strange Theory of Light and Matter*, Princeton: Princeton University Press, 1988.
- Folse, H. J.
- 1985 *The Philosophy of Niels Bohr: The Framework of Complementarity*. Amsterdam, North Holland, 1985.
- 1987 “Niels Bohr’s Concept of Reality,” in Pekka Lahti and Peter Mittelstaedt, eds., *Symposium on the Foundations of Modern Physics 1987: The Copenhagen Interpretation 60 Years after the Como Lecture*, Singapore: World Scientific, 1987, 161-80.
- 2002 “Bohr’s Conception of the Quantum-Mechanical State of a System and Its Role in the Framework of Complementarity,” in Khrennikov, A., ed. *Quantum Theory: Reconsiderations of Foundations 2001*, Växjö: Växjö University Press, 2002, 83-98.

- Friedman, J. R., Patel, V., Chen, W., Tolytygo, S. K., and Lukens, J. E.
 2002 “Quantum Superposition of Distinct Macroscopic States,” *Nature* 406 (2000), 43-46.
- Fuchs, C. A.
 2001 “Quantum Foundation in the Light of Quantum Information,” in Gonis, T. and Turchi, P.E.A., ed., *Decoherence and Its Implications in Quantum Computation and Information Transfer*, Amsterdam: IOS Press, 2001, 38-82
 2003 “Quantum Mechanics as Quantum Information, Mostly,” *Journal of Modern Optics* 50 (2003), 987-1003.
- Fuchs, C. A. and Peres, A.
 2000 “Quantum Theory Needs No ‘Interpretation,’” *Physics Today*, 53 (3) (2000), 70.
- Garg, A.
 2001 “Prospects for Macroscopic Quantum Coherence,” in Gonis, T. and Turchi, P.E.A. Turchi, ed., *Decoherence and its Implications in Quantum Computation and Information Transfer*, Amsterdam: IOS Press, 2001, 256-283.
- Greene, B.
 1999 *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory*, New York: W. W. Norton, 2003.
- Gottfried, K.
 2000 “Does Quantum Mechanics Carry the Seeds of Its Own Destruction,” in Ellis, J. and Amati, D. eds., *Quantum Reflections*, Cambridge: Cambridge University Press, 2000, 165-185.
- Grattan-Guinness, I.
 1998 *The Norton History of Mathematical Sciences: The Rainbow of Mathematics*, New York: W. W. Norton, 1998.
- Griffiths, R. B.
 2003 *Consistent Quantum Theory*, Cambridge: Cambridge University Press, 2003.
- Hacking, I.
 1984 *Emergence of Probability*, Cambridge: Cambridge University Press, 1984.
- Haroche, S.
 2001 “Entanglement and Decoherence in Cavity Quantum Electrodynamics Experiments,” in Gonis, T. and Turchi, P. E.A., eds., *Decoherence and Its Implications in Quantum Computation and Information Transfer*, Amsterdam: IOS Press, 2001, 211-223.

Haroche, S., Brune, M., and Raimond, J. M.

- 1997 "Experiments with Single Atoms in Cavity: Entanglement, Schrödinger's Cats, and Decoherence," *Philosophical Transactions of the Royal Society of London*, 355 (1997), 2367-2380.

Hawking, S. and Penrose, R.

- 1996 *The Nature of Space and Time*, Princeton, NJ: Princeton University Press, 1996.

Hegel, G. W. F.

- 1977 *Phenomenology of Spirit*, trans. Miller, A. W., Oxford: Oxford University Press, 1977.
- 1990 *Hegel's Science of Logic*, trans. Miller, A. W., Atlantic Highlands, NJ: Humanities Press International, 1990.

Heisenberg, W.

- 1925 "Quantum-Theoretical Re-Interpretation of Kinematical and Mechanical Relations," in Van der Waerden, B. L., ed. *Sources of Quantum Mechanics* Toronto: Dover, 1968, 261-77.
- 1927 "The Physical Content of Quantum Kinematics and Mechanics," in Wheeler, J. A. and Zurek, W. H. eds., *Quantum Theory and Measurement*, Princeton, NJ: Princeton University Press, 1983, 62-86.
- 1930 *The Physical Principles of the Quantum Theory*, trans. Eckhart, K. and Hoyt, F. C., New York: Dover, 1930, rpt. 1949.
- 1967 "Quantum Theory and its Interpretation," in Stephan S. Rozenal, *Niels Bohr: His Life and Work as Seen by his Friends and Colleagues*, Amsterdam: North-Holland, 1967.
- 1979 *Philosophical Problems of Quantum Physics*, Woodbridge, Conn.: Ox Bow Press, 1979.
- 1983 *Encounters with Einstein*, Princeton, NJ: Princeton University Press, 1983.

Heidegger, M.

- 1967 *What is a Thing?*, tr. W. B. Barton, Jr., and Vera Deutsch, South Bend, In.: Gateway, 1967.

Hoffmann, B.

- 1972 *Albert Einstein: Creator and Rebel*, London: Hart-Davis, 1972.

Holevo, A. S.

- 1973 "Information-Theoretical Aspects of Quantum Measurement," *Problems of Information Transmission* 9 (1973), 110-18.

Honner, J.

- 1987 *The Description of Nature: Niels Bohr and the Philosophy of Quantum Physics*, Oxford: Clarendon, 1987.

Iorio, A., Lambiase, G., and Vitiello, G.

- 2002 “Hopf’s Algebras, Thermodynamics and Entanglement in Quantum Field Theory,” quant-ph/020740, 8 July 2002.

Khrennikov, A. Yu.

- 2004 “Reconstruction of Quantum Theory on the Basis of the Formula of Total Probability,” in Khrennikov, A. Yu., ed. *Foundations of Probability in Physics 3 (AIP Conference Proceedings, v. 750)*, Melville, NY: American Institute of Physics, 2004, 187-211.

Kuhn, T.

- 1962 *The Structure of Scientific Revolutions*, Princeton: Princeton University Press, 1962.

Leggett, A. J.

- 1988 “Experimental Approaches to the Quantum Measurement Paradox,” *Foundations of Physics*, 18 (9) (1988), 939-952.

Mehra, J. and Rechenberg, H.

- 2001 *The Historical Development of Quantum Theory*, 6 vols., Berlin: Springer, 2001.

Mermin, N. D.

- 1990 *Boojums All the Way Through*, Cambridge: Cambridge University Press, 1990
- 1998a “What Is Quantum Mechanics Trying To Tell Us?,” *American Journal of Physics* 66 (9) (1998), 753-767.
- 1998b “Nonlocal Character of Quantum Theory?,” *American Journal of Physics* 66 (10) (1998), 920-924.

Mittelstaedt, P.

- 1987 “Language and Reality in Quantum Physics,” in Lahti, P. and Mittelstaedt, P., ed. *Symposium on the Foundations of Modern Physics 1987*, Singapore: World Scientific, 1987, 229-250.
- 1994 “Kant and the Quantum Theory,” Parrini, P., ed. *Kant and Contemporary Epistemology*, Dordrecht, The Netherlands: Kluwer, 1994.
- 1997 *The Interpretation of Quantum Mechanics and the Measuring Process*, Cambridge: Cambridge University Press, 1997.

Myatt, C. J., King B. E. , Turchette, Q. A., Sackett, C. A. , Kielpinski, D., Itano, W.M., Monroe, C., and Wineland, D. J.

- 2000 “Decoherence of Quantum Superpositions through Coupling to Engineered Reservoirs,” *Nature* 403 (2000), 269-273.

- Nietzsche, F.
 1974 *The Gay Science*, trans. Walter Kaufmann, New York: Vintage, 1974.
- Omnés, R.
 1994 *The Interpretation of Quantum Mechanics*, Princeton, NJ: Princeton University Press, 1994.
 1999 *Understanding Quantum Mechanics*, Princeton, NJ: Princeton University Press, 1999.
- Pais, A.
 1982 *Subtle is the Lord: The Science and the Life of Albert Einstein*, Oxford: Oxford University Press, 1982.
 1986 *Inward Bound: Of Matter and Forces in the Physical World*, Oxford: Oxford University Press, 1986.
 1991 *Niels Bohr's Times, In Physics, Philosophy, and Polity*, Oxford: Clarendon, 1991.
- Pauli, W.
 1979-1999 *Wissenschaftlicher Briefwechsel*, Scientific Correspondence, Berlin: Springer, 1979-1999.
- Penrose, R.
 1994 *Shadows of the Mind: A Search for a Missing Science of Consciousness*, Oxford: Oxford University Press, 1994.
- Peres, A.
 1993 *Quantum Theory: Concepts and Methods*, Dordrecht: Kluwer, 1993.
 1984 "What Is A State Vector?," *American Journal of Physics* 52 (1984), 644-650.
 2002 "Karl Popper and the Copenhagen Interpretation," *Studies in History and Philosophy of Modern Physics* 33 (2002), 23-34.
 2003 "Einstein, Podolsky, Rosen, and Shannon," quant-ph/0310010, 2003.
- Petersen, A.
 2005 "The Philosophy of Niels Bohr," in *Niels Bohr: A Centenary Volume*, eds. A. P. French and P. J. Kennedy. Cambridge, Mass.: Harvard University Press, 1985.
- Plotnitsky, A.
 1994 *Complementarity: Anti-Epistemology After Bohr and Derrida*, Durham, NC: Duke University Press, 1994.

- 2002 *The Knowable and the Unknowable: Modern Science, Nonclassical Thought, and the "Two Cultures,"* Ann Arbor, MI: University of Michigan Press, 2002.
- 2003 "Mysteries without Mysticism and Correlations without Correlata: On Quantum Knowledge and Knowledge in General," *Foundations of Physics* 33 (11) (2003), 1649-1689.
- Plotnitsky, A. and Reed, D.
- 2001 "Discourse, Mathematics, Demonstration, and Science in Galileo's *Discourses Concerning Two New Sciences*," *Configurations* 9 (2001), 37-64.
- Popper, K.
- 1982 *Quantum Theory and the Schism in Physics*, Totowa, NJ: Rowan and Littlefield, 1982.
- Readhead, M.
- 1988 "A Philosopher Looks at Quantum Field Theory," in Brown, H. R. and Harré, R. *Philosophical Foundations of Quantum Field Theory*," Oxford: Clarendon, 1988, 9-23.
- Reichenbach, H.
- 1956 *The Direction of Time*, Los Angeles: University of California Press, 1956.
- Rovelli, C.
- 1996 "Relational Quantum Mechanics," *International Journal of Theoretical Physics* 35 (1996), 1637-1678.
- Schilpp, A. P., ed.
- 1949 *Albert Einstein: Philosopher-Scientist*, New York: Tudor, 1949.
- Schrödinger, E.
- 1935 "The Present Situation in Quantum Mechanics," in Wheeler, J. A. and Zurek, W. H. eds., *Quantum Theory and Measurement*, Princeton, NJ: Princeton University Press, 1983, 152-167.
- Schweber, S. S.
- 1994 *QED and the Men Who Made It: Dyson, Feynman, Schwinger, and Tomonaga*, Princeton, NJ: Princeton University Press, 1994.
- Stapp, H. P.
- 1987 "Quantum Nonlocality and the Description of Nature," in Cushing, J. T. and McMullin, E., eds., *Philosophical Consequences of Quantum Theory: Reflections on Bell's Theorem*, Notre Dame, IN: University of Notre Dame Press, 1989, 154-174.

- 1997 "Nonlocal Character of Quantum Theory," *American Journal of Physics* 65 (1997), 300-304.
- Teller, P.
- 1995 *An Interpretive Introduction to Quantum Field Theory*, Princeton, NJ: Princeton University Press, 1995.
- Ulfbeck, O. and Bohr, A.
- 2001 "Genuine Fortuitousness: Where Did That Click Come From?" *Foundations of Physics* 31 (5) (2001), 757-74.
- Van Fraassen, B. C.
- 1991 *Quantum Mechanics: An Empiricist View*, Oxford: Clarendon, 1991.
- Van der Waerden, B. L., ed.
- 1968 *Sources of Quantum Mechanics*, Toronto: Dover, 1968.
- Von Neumann, J.
- 1961-1963 *Methods in Physical Sciences*, in *Collected Works of John von Neumann*, vol. 6 (Oxford: Pergamon Press, 1961-63).
- 1983 *Mathematical Foundations of Quantum Mechanics*, trans. Beyer, R.T., Princeton, NJ: Princeton University Press, 1983.
- Weinberg, S.
- 2005 *The Quantum Theory of Fields, Volume 1: Foundations*, Cambridge: Cambridge University Press, 2005.
- Weyl, H.
- 1918 *The Continuum: A Critical Examination of the Foundation of Analysis*, trans. Pollard, S. and Bole, T., New York: Dover, rpt. 1994.
- 1924 *Space Time Matter*, trans. Brose, H. L., New York: Dover, rpt. 1952.
- Wheeler, J. A.
- 1983 "Law without Law," in Wheeler, J. A. and Zurek, W. H. *Quantum Theory and Measurement*, Princeton, NJ: Princeton University Press 1983, 182-213.
- 1990 "Information, Physics, Quantum: The Search for Links," in Zurek, W. H. ed., *Complexity, Entropy and the Physics of Information*, Redwood, CA: Addison-Wesley, 1990, 3-28.
- Wheeler, J. A. and Zurek, W. H.
- 1983 *Quantum Theory and Measurement*, Princeton, NJ: Princeton University Press, 1983.

Wilczek, F.

2005 "In Search of Symmetry Lost," *Nature* 423 (2005), 239-247.

Wittgenstein, L.

1985 *Tractatus Logico-Philosophicus*, trans. C. K. Ogden, Routledge: London, 1985.

Zee, A.

2003 *Quantum Field Theory in a Nutshell*, Princeton: Princeton University Press, 2003.

Zeilinger, A., Weith, G., Jennewein, T., and Aspelmeyer, M.

2005 "Happy Centenary, Photon," *Nature* 433 (2005), 230-238.

Zurek, W. H.

2003 "Decoherence, Einselection and the Quantum Origin of the Classical," *Review of Modern Physics* 75 (3) (2003), 715-775.

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