HPS/PHIL 93872 **Spring 2006**

Historical Foundations of the Quantum Theory

Don Howard, Instructor

Required Readings:

Topic:	**Readings:**
Planck and black-body radiation.	Martin Klein. "Planck, Entropy, and Quanta, 19011906." *The Natural Philosopher* 1 (1963), 83-108.
Einstein and the photo-electric effect.	Martin Klein. "Einstein's First Paper on Quanta." *The Natural Philosopher* 2 (1963), 59-86.
The Bohr model of the atom and spectral series.	Max Jammer. "Regularities in Line Spectra"; "Bohr's Theory of the Hydrogen Atom." In *The Conceptual Development of Quantum Mechanics*. New York: McGraw-Hill, 1966, pp. 62-88.
The Bohr-Sommerfeld "old" quantum theory; Einstein on transition probabilities.	Max Jammer. "The Older Quantum Theory." In *The Conceptual Development of Quantum Mechanics*. New York: McGraw-Hill, 1966, pp. 89-156.
The Bohr-Kramers-Slater theory.	Max Jammer. "The Transition to Quantum Mechanics." In *The Conceptual Development of Quantum Mechanics*. New York: McGraw-Hill, 1966, pp. 157-195.
Bose-Einstein statistics.	Don Howard. "'Nicht sein kann was nicht sein darf,' or the Prehistory of EPR, 1909-1935: Einstein's Early Worries about the Quantum Mechanics of Composite Systems." In *Sixty-Two Years of Uncertainty: Historical, Philosophical, and Physical Inquiries into the Foundations of Quantum Mechanics*. Arthur Miller, ed. New York: Plenum, 1990, pp. 61-111.
Schrödinger and wave mechanics; Heisenberg and matrix mechanics.	Max Jammer. "The Formation of Quantum Mechanics." In *The Conceptual Development of Quantum Mechanics*. New York: McGraw-Hill, 1966, pp. 196-280.
De Broglie and the origins of pilot-wave theory.	James T. Cushing. "Early Attempts at Causal Theories: A Stillborn Program." In *Quantum Mechanics: Historical Contingency and the Copenhagen Hegemony*. Chicago: University of Chicago Press, 1994, pp. 124-143.
Complementarity and the indeterminacy principle.	Niels Bohr. "The Quantum Postulate and the Recent Development of Atomic Theory." *Nature* (Suppl.), 121 (1928): 580-590. Reprinted in *Atomic Theory and the Description of Nature*. Cambridge: Cambridge University Press, 1934, pp. 52-91.
	Mara Beller. "The Dialogical Birth of Bohr's Complementarity." In *Quantum Dialogue. The Making of a Revolution*. Chicago: University of Chicago Press, 1999, pp. 117-144.

The Einstein-Podolsky-Rosen argument and Bohr's reply.	Albert Einstein, Boris Podolsky, and Nathan Rosen. "Can Quantum-mechanical Description of Physical Reality Be Considered Complete?" *Physical Review* 47 (1935), 777-780. Niels Bohr. "Can Quantum-mechanical Description of Physical Reality Be Considered Complete?" *Physical Review* 48 (1935), 696-702.
The invention of the "Copenhagen Interpretation."	Don Howard. "Who Invented the Copenhagen Interpretation? A Study in Mythology." *PSA 2002*. Part II*, Symposium Papers*. Proceedings of the 2002 Biennial Meeting of the Philosophy of Science Association, Milwaukee, Wisconsin, November 7-9, 2002. A special issue of *Philosophy of Science* 71 (2004). (Forthcoming.)
Von Neumann and the axiomatization of quantum mechanics. London and Bauer on measurement theory.	John von Neumann. "The Measruing Process. In *Mathematical Foundations of Quantum Mechanics*. Robert T. Beyer, trans. Princeton, NJ: Princeton University Press, 1955, pp. 417-445. Originally published as *Mathematische Grundlagen der Quantenmechanik*. Berlin: Julius Springer, 1932. Fritz London and Edmond Bauer. "The Theory of Observation in Quantum Mechanics." Abner Shimony et al., trans. In John Archibald Wheeler and Wojciech Hubert Zurek, eds. *Quantum Theory and Measurement*. Princeton, NJ: Princeton University Press, 1983, pp. 217-259. Originally published as *La théorie de l'observation en mécanique quantique*. Actualités scientifiques et industrielles, no. 775. Paris: Hermann, 1939.
Relativistic quantum mechanics, second quantization, and the origins of quantum field theory.	Silvan S. Schweber. "The Birth of Quantum Field Theory" and "The 1930s." In *QED and the Men Who Made It: Dyson, Feynman, Schwinger, and Tomonaga*. Princeton, NJ: Princeton University Press, 1994, pp. 1-129.
Ballentine and the statistical ensemble interpretation.	L. E. Ballentine. "The Statistical Interpretation of Quantum Mechanics." *Reviews of Modern Physics* 42 (1970), 358-381.
Bohm and the revival of hidden variables theories. Gleason, Kochen and Specker, and the no-go theorems.	David Bohm. "A Suggested Interpretation of the Quantum Theory in Terms of 'Hidden' Variables. I and II." *Physical Review* 85 (1952),166-193.
Bell's theorem and the Jarrett analysis.	James T. Cushing. "A Background Essay." In *Philosophical Consequences of Quantum Theory: Reflections on Bell's Theorem*. James T. Cushing and Ernan McMullin, eds. Notre Dame, IN: University of Notre Dame Press, 1989, pp. 1-24.
Everett,Wheeler, DeWitt and the relative state interpretation.	Hugh Everett. "'Relative State' Formulation of Quantum Mechanics." *Reviews of Modern Physics* 29 (1957), 454-462.

Omnès, Zurek, and decoherence.	Wojciech Zurek. "Decoherence and the Transition from Quantum to Classical—Revisited." (2002). Originally published as: "Decoherence and the Transition from Quantum to Classical." *Physics Today* 44, no. 10 (October 1991), 36-44. Wojciech Zurek. "Decoherence, Einselection, and the Quantum Origins of the Classical." *Reviews of Modern Physics* 75 (2003), 715-775.
Van Fraassen and the modal interpretation.	Michael Dickson. "The Modal Interpretations of Quantum Theory." *The Stanford Encyclopedia of Philosophy* (Winter 2002 Edition), Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/win2002/entries /qm-modal/>.
Quantum computing, quantum information theory, and quantum cryptography.	Charles Bennett. "Quantum Information and Computation." *Physics Today* 48, no. 10 (October 1995), 24-30.
Quantum field theory and the quantum information loss paradox. Algebraic quantum field theory.	Gordon Belot, John Earman, and Laura Ruetsche. "The Hawking Information Loss Paradox: The Anatomy of a Controversy." *British Journal for the Philosophy of Science* 50 (1999), 189-229.