UNIVERSITY OF NOTRE DAME

HPS/PHIL 687
Historical Foundations of the Quantum Theory
TTh 11:00-12:15
347 DeBartolo

Fall 2003

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Office Hours: TTh 1:00-2:00

Text: There is no required text for this course. All readings will be distributed individually in class.

Requirements: Each student will be required to do two presentations to the class, on topics to be chosen from the syllabus in consultation with the instructor. Each of these presentations will be worth 20% of the final course grade. 10% of the final course grade will be based on class participation. A term paper (minimum fifteen pages) worth 50% of the course grade will complete the requirements for the course, the term paper topic also to be chosen in consultation with the instructor.

Schedule:

Date:	**Topic:**	**Readings:**
26 Aug.	Introduction–The Place of History in Foundational Studies. Empirical and theoretical preliminaries	
28 Aug.	Planck and black-body radiation.	Martin Klein. "Planck, Entropy, and Quanta, 1901-1906."
2 Sep.	Einstein and the photo-electric effect.	Martin Klein. "Einstein's First Paper on Quanta."
4 Sep.	The Bohr model of the atom and spectral series.	Max Jammer. "Regularities in Line Spectra"; "Bohr's Theory of the Hydrogen Atom."
9 Sep.	The Bohr-Sommerfeld "old" quantum theory; Einstein on transition probabilities.	Max Jammer. "The Older Quantum Theory."
11 Sep.	The Bohr-Kramers-Slater theory.	Max Jammer. "The Transition to Quantum Mechanics."
16 Sep.	Bose-Einstein statistics.	Don Howard. "'Nicht sein kann was nicht sein darf,' or the Prehistory of EPR, 1909-1935."
18 Sep.	Heisenberg and matrix mechanics.	Max Jammer. "The Formation of Quantum Mechanics," §§ 5.1-5.2.
23 Sep.	Schrödinger and wave mechanics.	Max Jammer. "The Formation of Quantum Mechanics," § 5.3.

25 Sep.	De Broglie and the origins of pilot-wave theory.	James T. Cushing. "Early Attempts at Causal Theories: A Stillborn Program."
30 Sep.	Complementarity and the indeterminacy principle.	Niels Bohr. "The Quantum Postulate and the Recent Development of Atomic Theory."
2 Oct.		Mara Beller. "The Dialogical Birth of Bohr's Complementarity."
7 Oct. (*14 Oct.*)	The Einstein-Podolsky-Rosen argument and Bohr's reply.	Albert Einstein, Boris Podolsky, and Nathan Rosen. "Can Quantum-mechanical Description of Physical Reality Be Consdiered Complete?"
9 Oct. (*15 Oct.*)		Niels Bohr. "Can Quantum-mechanical Description of Physical Reality Be Consdiered Complete?"
14 Oct. (*16 Oct.*)	Von Neumann and the axiomatization of quantum mechanics. London and Bauer on measurement theory.	John von Neumann. "The Measruing Process"; Fritz London and Edmond Bauer. "The Theory of Observation in Quantum Mechanics."
16 Oct. (*28 Oct.*)	The invention of the "Copenhagen Interpretation."	Don Howard. "Who Invented the Copenhagen Interpretation? A Study in Mythology."
20-24 Oct.	***Fall Break***	
28 Oct. (*29 Oct.*)	Relativistic quantum mechanics, second quantization, and the origins of quantum field theory.	Silvan S. Schweber. "The Birth of Quantum Field Theory" and "The 1930s."
30 Oct.	Early QFT continued	
4 Nov.	Ballentine and the statistical ensemble interpretation.	L. E. Ballentine. "The Statistical Interpretation of Quantum Mechanics."
6 Nov.	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."
11 Nov.	Bell's theorem and the Jarrett analysis.	James T. Cushing. "A Background Essay."
13 Nov.		

18 Nov.	Everett,Wheeler, DeWitt and the relative state interpretation.	Hugh Everett. "'Relative State' Formulation of Quantum Mechanics."
20 Nov.	Omnès, Zurek, and decoherence.	Wojciech Zurek. "Decoherence and the Transition from Quantum to Classical—Revisited"; Wojciech Zurek. "Decoherence, Einselection, and the Quantum Origins of the Classical."
25 Nov.		
27 Nov.	***Thanksgiving Holiday***.	
2 Dec.	Van Fraassen and the modal interpretation.	Michael Dickson. "The Modal Interpretations of Quantum Theory."
4 Dec.	Quantum computing, quantum information theory, and quantum cryptography.	Charles Bennett. "Quantum Information and Computation."
9 Dec.	The quantum information loss paradox.	Gordon Belot, John Earman, and Laura Ruetsche. "The Hawking Information Loss Paradox: The Anatomy of a Controversy."
15 Dec.	***Term Papers Due***	