PHILOSOPHY 3320: PHILOSOPHY OF QUANTUM MECHANICS
T 12:30 - 2:30, Th 12:30 - 1:30; TC 340

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Office Hours: T 3-4, W 10-11

Course Description: Quantum mechanics is an incredibly successful physical theory, a major achievement of early 20th century physics that serves as the basis for our currently best-confirmed theories of matter and radiation. Despite this success, quantum mechanics has been beset with conceptual problems from its inception. Even today there is a scandalous lack of consensus regarding exactly how to interpret the theory. These problems have inspired extravagant and desperate philosophical moves, some of which we will examine. The goal of the course is to introduce the basics of quantum mechanics from a conceptual and mathematical perspective, and then to address the conceptual problems still lurking at the foundations of the theory and various attempted resolutions of them. This course is designed for students without prior exposure to quantum mechanics or the mathematics involved, but students will be expected to learn the basic technical features of the theory.

Evaluation

1. Homework Assignments (20 %): There will be six homework assignments throughout the term, roughly bi-weekly. Late homework assignments will not be accepted, but only five out of the six assignments count towards your grade.
2. Midterm Exam (35 %)
3. Paper (45 %): One paper (10-12 pages, double-spaced, one inch margins in a reasonable font such as 12 pt. Times New Roman). Topics and additional guidelines will be distributed well in advance of the due date. The paper should clearly state and argue for a thesis; a mere summary of existing literature or lecture notes will not be rewarded. Students are encouraged to consult with me while preparing the paper.

Required Texts: *Quantum Physics: Illusion or Reality?*, by Alastair Rae. Several *required* readings will be posted online.

Course Webpage: I will adjust the schedule and the reading assignments as the semester progresses. Check the course webpage for regular updates on the schedule and other class announcements. Any handouts or other materials distributed in class will be posted on the webpage, along with supplemental readings and links to other useful websites.

Books on Reserve at Weldon: Jeff Barrett, *The Quantum Mechanics of Minds and Worlds*; John S. Bell, *Speakable and Unspeakable in Quantum Mechanics*; Greenstein and Zajonc, *The Quantum Challenge*; R.I.G. Hughes, *Structure and Interpretation of Quantum Mechanics*; Tim Maudlin, *Quantum Non-Locality and Relativity*; Euan Squires, *The Mystery of the Quantum World*; Roberto Torretti, *Philosophy of Physics*

ARTICLES POSTED ONLINE

W 1 Lecture notes written by instructor (on various topics).

W 2 N. David Mermin, "Quantum Mysteries for Anyone," *Journal of Philosophy* **78** (1981): 397-408.

W 3 N. David Mermin, "Hidden Variables and the two theorems of John Bell," *Reviews of Modern Physics* **65** (1993): 803-815.

W 4 Jeff Barrett, "Everett's Relative-State Formulation," Stanford encyclopedia: http://plato.stanford.edu/entries/qm-everett/.

W 5 Jenann Ismael, "Quantum Mechanics," Stanford encyclopedia: http://plato.stanford.edu/entries/qm/.

W 6 Selections from Hughes, *Structure and Interpretation of Quantum Mechanics*.

W 7 Laura Ruetsche, "Interpreting Quantum Theories," in the *Blackwell Guide to the Philosophy of Science*, pp. 199 - 226.

W 8 Selections from Greenstein and Zajonc, *The Quantum Challenge*.

W 9 Sheldon Goldstein, "Bohmian Mechanics," Stanford encyclopedia: http://plato.stanford.edu/entries/qm-bohm/.

<div align="center">TENTATIVE SCHEDULE</div>

Date	Topic	Assigned Reading
Jan. 6	Course Introduction and Overview; Why the Quantum?	W 1
8 - 13	Properties in Classical and Quantum Mechanics	W 1, QP 1
15 - 20	Introducing the Formalism: Fun with Hilbert Space	W 1, W 5, W 6
22 - 27	Principles of Quantum Mechanics	W 1, W 6
	Hidden Variables and No-Go Theorems	
29 - Feb. 3	No Go Theorems, I: EPR and Bell's Theorem	QP 2, W 2
5 - 12	No Go Theorems, II: Kochen-Specker	W 3
	Interpreting Quantum Mechanics	
24	Review; The Interpretative Project	W 7
26	*Midterm Exam*	
Mar. 3 - 5	Copenhagen and the Measurement Problem	QP 3
10 - 12	Collapse Theories	QP 7, W 8
17 - 19	QM and Consciousness	QP 4
24 - 26	Many Worlds	QP 6, W 4
31 - April 2	Bohmian Mechanics	W 9
7	Overview and Conclusion	
7	*Paper Due*	

Note: QP = chapters in *Quantum Physics*, W = articles posted on the webpage.

Audit: Students wishing to audit the course should consult with the instructor prior to or during the first week of classes.

Incompletes: Incompletes are granted at the exclusive discretion of the Undergraduate Program Chair, and only on the basis of documented medical or compassionate grounds. If, during the course, you envisage any difficulty completing all the required work by the completion deadline, consult immediately with the instructor and the Undergraduate Program Chair.

The Department of Philosophy Policies which govern the conduct, standards, and expectations for student participation in Philosophy courses is available in the Undergraduate section of the Department of Philosophy website at http://uwo.ca/philosophy/undergraduate/proceduresappeals.html. It is your responsibility to understand the policies set out by the Senate and the Department of Philosophy, and thus cannot be used as grounds of appeal.