School of Quantum Foundations: Speakable and Unspeakable

Program

	18th	19th	20th	21st	22nd	25th	26th	27th
	Mon	Tue	Wed	Thu	Fri	Mon	Tue	Wed
10:00		W.S. 1	M.C. 2	W.S. 3	S.D. 1	A.B. 2	S.D. 3	A.B. 3
11:00		Coffee	Coffee	Coffee	Coffee	Coffee	Coffee	Coffee
11:30		M.C. 1	W.S. 2	M.C. 3	A.B. 1	S.D. 2	T.M. 2	T.M. 3
12.30		Lunch	Lunch		Lunch	Lunch	Lunch	
13:30		Tutorial	Tutorial		D.S. 1	C.H. 1	Tutorial	
14:30		Coffee	Coffee		Coffee	Coffee	Coffee	
15:00		Tutorial	Tutorial		D.S. 2	Tutorial	Tutorial	
16:30	T.M. 1	End	End		End	End	End	

Angelo Bassi (A.B.)

Lecture 1. Ways to modify the Schrödinger equation - how the no-signaling condition constraints the dynamics.
Lecture 2. The GRW model of spontaneous wave function collapse - definition and main properties.
Lecture 3. Interferometric and non-interferometric tests of collapse models: Cold atoms, spontaneous photon emission, optomechanical systems.

Matteo Carlesso (M.C.)

Lecture 1. Introduction to optomechanics: What is an optomechanical system: concept and examples.
Lecture 2. Making it cold - Ground state cooling mechanisms.
Lecture 3. Testing quantum mechanics: Optomechanical systems as position and force sensors.

Sandro Donadi (S.D.)

Lecture 1. Introduction to Open Quantum Systems - Density matrix, reduced density matrix, intuition of decoherence.

Lecture 2. Evolution of the statistical operator - CPTP maps and Kraus representation, examples of maps on a qubit: spin flip, pure dephasing, amplitude damping, Lindblad master equation.
Lecture 3. Decoherence in collapse models - Decoherence in the CSL and DP models, amplification mechanism, the role of decoherence in the measurement problem.

Carl Hoefer (C.H.)

Talk 1: Scientific realism, sociology, and Bell inequality violations.

Tim Maudlin (T.M.)

Lecture 1. Theory and Phenomena in Quantum Mechanics. One of the main goals of any physical theory is to be “empirically adequate” or to “save the phenomena”. That is, the theory postulates an ontology and dynamics with the intention that it be able to predict and explain certain facts about the world that we think we know by observation. In the case of quantum mechanics, there are some iconic phenomena that are always referred to, including two-slit interference, the disappearance of interference when the “particles” are monitored, and violations of Bell’s Inequality. I will quickly sketch some of these phenomena, with emphasis on Bell’s Inequality, and also quickly sketch different approaches to the theoretical explanation of them.
Lecture 2. Non-Locality in Ontology and Dynamics. Pilot wave theories and spontaneous collapse theories call on different resources in accounting for violations of Bell’s Inequality. We will consider these different approaches and the different stories they tell, with particular attention to the role of entanglement between distant systems. We will also try to sort out exactly how a Many Worlds approach might be used to account for these phenomena, i.e., where non-locality might appear in such a theory.
Lecture 3. Theoretical and Empirical Possibilities and Open Questions. Current research on non-locality confronts several open and highly controversial questions. One is whether the theoretical account of non-locality either requires or can most easily be provided by a theory which postulates an objective foliation of space-time, and therefore rejects Relativity. Another is whether—if such a foliation exists—it can be empirically determined. A third is whether the non-locality in a theory can be exploited to send superluminal signals. I will provide an overview of the landscapes of these problems.

Ward Struyve (W.S.)

Lecture 1. Introduction to Bohmian mechanics: Motivation, dynamics, the Born statistics, classical limit, practical applications.
Lecture 2. Non-locality and relativity: Treatment of spin, non-locality, relativistic Bohmian mechanics, Lorentz invariance.
Lecture 3. Bohmian quantum field theory and quantum gravity: Extensions to quantum field theory, application to quantum gravity, problem of time, problem of singularities.

Daniel Sudarsky (D.S.)

Talk 1. The neutron’s electric dipole moment, a case study on "quantum fluctuations”
Talk 2. The black hole information puzzle and dynamical collapse theories