

432018 PHILOSOPHY OF PHYSICS (Spring 2002)

Lecture and Seminar Programme for Weeks 2-6

Set-text

The set-text for this course is the book:

Philosophy of Physics by Lawrence Sklar (OUP, 1992, reprinted 1995) from the Dimensions in Philosophy Series.

The preliminary readings for the lectures and seminars will be taken from this book and so you should try to get hold of a copy.

Lectures and Seminars

As the lectures and seminars are all on the same day, the structure of the course will be as follows:

- **Week 2:** An introduction to and reasons for studying the philosophy of physics.
- **Weeks 3-6:** The conceptual problems and philosophical implications of Quantum Mechanics.
- **Weeks 7-10:** The conceptual problems and philosophical implications of Relativity Theory.

A more detailed list of what we will be covering in the lectures and seminars (on a week by week basis) is given below. (Although, since it is quite hard to foresee how long we will need to spend on each topic, this list represents a 'best-case' scenario.) Preliminary reading from the set-text is also given, although other readings will be suggested as we go along.

Lecture programme

Week 2: Introduction

First lecture: Philosophical preliminaries.

The relationship between philosophy and physics. The need for a philosophy of physics. Summary of some relevant philosophical concepts. Reading: Sklar, pp. 1-10.

Second lecture: Physical preliminaries.

The 'classical' view of the world and some experiments that challenged this. The initial 'quantum' theories which were developed to account for the new phenomena. Reading: Sklar, pp. 157-64.

Week 3: An introduction to Quantum Mechanics

First lecture: The quantum description of reality.

The double-slit experiment and the introduction of the wavefunction. The nature of observables and measurement in QM. The postulates of QM. Reading: Sklar, pp. 164-72.

Second lecture: The projection postulate and the Copenhagen interpretation.

Von Neumann's 'projection' (or 'collapse') postulate. The Copenhagen interpretation of quantum mechanics. The perceived consequences of QM amongst philosophers and physicists. Reading: Sklar, pp. 172-9.

Week 4: The measurement problem and some other interpretations of QM

First lecture: The 'measurement problem'.

Schödinger's 'cat paradox' or the problem of quantum measurement. The role of the observer and the subjectivity of the projection postulate. The paradox of 'Wigner's friend'. Reading: Sklar, pp. 179-91.

Second lecture: Interpretations which deny that there are determinate outcomes.

The vices and virtues of the bare theory. The many worlds and many minds interpretations of QM. Reading: Sklar, pp. 193-5.

Week 5: Hidden variables and another interpretation of QM

First lecture: The problem of hidden variables and determinism.

Determinism and hidden variables. Arguments against hidden variables. Reading: Sklar, pp 200-12.

Second lecture: Interpretations which invoke incompleteness.

The vices and virtues of the Bohmian interpretation of QM. Reading: TBA.

Week 6: Non-locality and non-separability in QM

First lecture: EPR and the Bell inequalities.

The EPR paradox and the questions it raises for the completeness of QM. Bell's inequality. Reading: Sklar, pp. 213-25

Second lecture: Non-locality and non-separability in QM:

Aspect's experiment and the violation of Bell's inequality. The apparent need for superluminal signalling (or causation) and the apparent conflict with Special Relativity. Reading: As above.

Note: A programme of lectures for the second part of the course will be distributed nearer the time.

Seminar programme

Instructions for the seminars will be distributed in the lectures in the week prior to the seminar. (This gives us the option of discussing material from the previous week's lecture in the seminar if people found it difficult.)