Abstracts

As for the CAT, models and interpretations of Quantum Mechanics

Valia Allori (University of Bergamo, Italy)

Who should and should not care about the Schrödinger cat problem

A scientific realist is one according to which our best scientific theories can reliably provide us with a picture of reality. Quantum mechanics is notoriously difficult to understand from a realist perspective, as, for one thing, it seems that sometimes waves behave like particles, and particles behave like waves. This has driven many to anti-realism, namely to think that quantum mechanics is merely an effective tool for reproducing experimental results. Instead, others have argued that one could make the theory compatible with realism by solving the measurement problem, also known as the Schrödinger cat problem. In contrast, I argue that the cat problem is a problem for the anti-realism, because it is supposed to show that quantum theory is empirically inadequate. Rather, I maintain, realists have a different problem to solve: assuming that to explain a phenomenon is to account for it in terms of the dynamics of the fundamental constituents of matter, then realists need to complete quantum mechanics with some microscopic spatiotemporal quantity (what philosophers call, an ontology). From this it follows that any solution of the cat problem which does not complete quantum mechanics in these terms is unsatisfactory for the realist, as it explains the phenomena like an anti-realist would. I conclude by showing how the most natural solution of the completeness problem is given by the pilot-wave theory.

Angelo Bassi (University of Trieste, Italy)

The quantum measurement problem

Quantum mechanics, one of the fundamental theories of modern physics, presents numerous challenges, including the well-known measurement problem. This problem raises crucial questions regarding the nature of reality and the interaction between the observed and the observer. In our seminar, we will explore the challenges posed by the measurement problem: we will start with an overview of the foundations of quantum mechanics, examining the mathematical formalism and the key experiments that highlight the peculiarity and complexity of the problem. We will discuss how the measurement problem challenges the fundamental principles of physics and our conceptions of reality and determinism. We will conclude by exploring the implications of these challenges for the future of quantum physics research and the potential impact on new technologies.

Dirk A. Deckert (Ludwig Maximilian University Munich, Germany)

The measurement problem and its absence in Bohmian Mechanics

I will review the measurement problem, give a brief introduction into Bohmian Mechanics, discuss the absence of the measurement problem in this theory, and illustrate how the ad hoc rules of the standard quantum practitioner's framework can be turned into mathematical proofs.

Matteo Carlesso (University of Trieste, Italy)

Collapse models as a solution to the measurement problem

A possible solution to the quantum measurement problem is provided by models of spontaneous collapse of the wavefunction, or simply collapse models. These modify the Schrödinger equation so that the predictions from quantum mechanics and collapse models are the same at the microscopic scale, while diverge at the macroscopic level. This allows to test collapse models vs quantum mechanics. In the last decade, the experiments finally gained the required accuracy. I will illustrate how one can test collapse models or at least pose experimental bounds on their parameters.

Dustin Lazarovici (Israel Institute of Technology, Israel)

What's wrong with Many-Worlds?

The talk will provide an introduction to the Many-Worlds interpretation of quantum mechanics. It will explain the Everettian solution to the measurement problem and discuss the main conceptual challenges that the Many-Worlds interpretation still faces today:
How does the wave function or quantum state make contact with the physical reality that we experience? What characterizes a "world" within the Everettian multiverse? And how to make sense of the probabilistic predictions of quantum mechanics given that, according to the Many-Worlds interpretation, all possible outcomes actually occur?
Finally, we will use the extended Wigner's friend thought experiment of Frauchiger and Renner (2018) to illustrate a key charge that Everettians make against Bohmian mechanics, namely that Bohmian mechanics is really just a many-worlds theory "in a state of chronic denial" (David Deutsch).