

AGPhil 8: Quantum Theory II

Time: Thursday 14:00–16:00

Location: H-HS III

AGPhil 8.1 Thu 14:00 H-HS III

Is there room for entanglement relations in the Humean mosaic? — ●LORENZO LORENZETTI — University of Lugano, Lugano, Switzerland

This paper concerns the notoriously difficult relationship between Humean Supervenience (HS) and quantum entanglement. The most conservative strategy to defend Humean Supervenience is to add the problematic entanglement relations to the supervenience basis, alongside spatiotemporal relations. In this paper I am going to present a novel argument against this strategy. I will analyse the thesis of HS and make explicit one necessary condition - concerning the nature of the relations in the mosaic - that has to be posited a priori to save HS from being trivial. I will then show how entanglement relations fail to satisfy that condition in some particular cases of tripartite entanglement states, i.e. GHZ states. These states are also critical for locality, one of the central tenets of HS. I conclude that the conservative move is untenable and the Humean is therefore forced to pursue more demanding and controversial strategies, e.g. claiming that the physical world is spatially 3N-dimensional.

AGPhil 8.2 Thu 14:30 H-HS III

Kurt Gödel on the interpretation of quantum mechanics — ●OLIVER PASSON — Bergische Universität Wuppertal

Kurt Gödel wrote in 1935/36 his only recently transcribed notebooks on quantum mechanics. They allow for a unique insight into Gödel's thoughts on the foundation of this theory. At that time the formalism of quantum mechanics had already reached an early maturity (as indicated e.g. by the publication of von Neumann's "Mathematische Grundlagen der Quantenmechanik" in 1932). This development brought the issue of the interpretation of the theory to the center of the debate, as indicated most notably by the famous EPR paradox (Einstein et al.) or the Schrödinger-cat thought experiment.

The talk will report on an early stage in the work to relate Gödel's thoughts on quantum theory to the different strands of this debate on quantum mechanics.

AGPhil 8.3 Thu 15:00 H-HS III

Inconsistencies in the foundations of relational quantum mechanics — ●ALISTAIR WHITTLE — University of Bristol

Carlo Rovelli claims that in quantum mechanics, two different observers can give different but nevertheless correct descriptions of the same sequence of events (1996: 1643). This main observation is used to propose a new interpretation of quantum mechanics, termed Relational Quantum Mechanics (RQM), in which the states and values of physical systems are indexed relative to different observers. This paper argues that the main observation that underpins RQM is inconsistent with two assumptions of its assumptions, namely, that interaction between systems is necessary for a system to have information about the other and that all physical systems are equivalent. As such, this paper argues that the main observation cannot sustain the relational interpretation of quantum mechanics that it originally motivated. However, in pointing out these inconsistencies, the paper argues that RQM can nevertheless be reinstated as a viable interpretation if we stay true to Rovelli's assumptions.

AGPhil 8.4 Thu 15:30 H-HS III

'Relational Einstein' - revisiting the relational EPR — ●MATTHIAS MARTIN ACKERMANN — University of Bristol, United Kingdom

Relational EPR (R-EPR) was initially proposed to dissolve the commonly assumed non-local implications of the original EPR-argument and claimed to restore locality in Quantum Mechanics (QM). In this paper I suggest two things: first of all, an exchange of the foundation of *R-EPR*'s analysis; meaning that I refer to Einstein's own incompleteness argument instead of EPR. The main reason behind this replacement is *R-EPR*'s explicit reference to 'Einstein's realism' while at the same moment developing the relational approach from the EPR. And secondly, based on the first step, I consider a reading of *Relational EPR*'s analysis as separable and local in the framework of Einstein's argument. However, widening the scope of the framework can turn *R-EPR*'s core strength - the de-objectivisation of reality in terms of observer-relativity - into a major drawback. All in all, in its current state, *Relational Quantum Mechanics* is unable to provide an unambiguous account of locality.