AGPhil 9: Quantum Foundations 5

Time: Thursday 14:00–16:00 Location: JAN/0027

AGPhil 9.1 Thu 14:00 JAN/0027

Transcendental dimensions of epistemic networks in the foundations of quantum mechanics — •Alex Seuthe — TU Dortmund University, Dortmund, Germany

The tool of social network analysis has been translated into the history and philosophy of science as epistemic network analysis. According to Renn (cf. The evolution of knowledge, 2020), three dimensions can be assigned to these networks: the social, semiotic, and semantic. The social dimension encompasses social actors and structures, the semiotic dimension encompasses experiments, and representations. The semantic dimension encompasses cognitive structures, concepts, and mental models with two main aspects: 1) They gain meaning through their interpretation of experience and their relationships with one another. 2) They can only be inferred by the reconstructive analysis of social and physical representations. I want to discuss how this novel analysis strategy of epistemic complexes can be related to the philosophy of symbolic forms of Cassirer. This theoretical reflection can help to enrich the sole aggregation of empirical data, as it often can be seen in the social sciences, with theoretical and epistemological meaning. 1) I want to outline how Cassirer's functional concept formation is similar to Renn's understanding of networks of semantic structures. 2) According to Cassirer, the basic forms of thinking manifest themselves in the social and semantic expressions of culture. I will utilise studies about the foundations of quantum mechanics as a case study to develop and illustrate my arguments.

AGPhil 9.2 Thu 14:30 JAN/0027

Heterodox underdetermination: metaphysical options for discernibility and (non-)entanglement — •Maren Bräutigam — University of Cologne

There are largely three views on whether Leibniz's Principle of the Identity of Indiscernibles (PII) is violated by similar particles. According to the earliest view, PII is always violated (call this the no discernibility view). According to the more recent weak discernibility view, PII is valid in a weak sense. No and weak discernibility have been referred to as orthodoxy. Steven French has argued that although PII is violated, similar particles can still be regarded as individuals. However, as it is equally possible to regard them as non-individuals, French famously concluded that metaphysics is underdetermined by physics. Call this thesis orthodox underdetermination. Most recently, some authors have turned against orthodoxy by arguing that PII is valid in more than a weak sense. Call this the new discernibility view, also referred to as heterodoxy. As heterodoxy is backed up by physical considerations, metaphysics now seems to be determined by physics: physics indicates that PII is valid. In this talk, I argue that, despite appearances, heterodox metaphysics is just as underdetermined by the physics as orthodox metaphysics; in other words, I argue for heterodox underdetermination. Heterodox underdetermination is problematic because it leaves us with the choice between two crucially different understandings of entanglement, thereby preventing us from getting a clear metaphysical picture of this peculiar phenomenon.

AGPhil 9.3 Thu 15:00 JAN/0027

Perspectival Objectivity in Relational Quantum Mechanics — Noemi Bolzonetti and •Luca Gasparinetti — University of Italian Switzerland, Lugano, Switzerland

What if everything in the world we are living in could be defined only relative to something else? What if different observers might give different accounts of the same sequence of events? According to the relational interpretation of quantum mechanics (RQM) proposed by Carlo Rovelli (e.g., 1996), there is no "absolute", i.e., observer-independent, description of reality. On the contrary, as well as the notion of simultaneity in special relativity, values and states of quantum systems are always defined via a given perspective. Does this mean that RQM cannot be in any way objective? Very roughly speaking, objectivity can be established only when different observers ascribe their descriptions to their different perspectives. But what can be said to further articulate this rough sketch?

Based on recent development on this topic (Emily Adlam and Carlo Rovelli 2022), the aim of this talk is twofold: we (i) take into account Evans's notion of "intersubjective objectivity" (Peter W. Evans 2020) to better understand in which sense it is possible to recover objectivity in relational quantum mechanics and (ii) explore how perspectival objectivity can provide a philosophical foundation for RQM. Along with Evans, we conclude that we should "stop worrying and love observer-dependent reality" also in the context of relational quantum mechanics.

AGPhil 9.4 Thu 15:30 JAN/0027

The Foundations of the Measurement Problem — Diana Taschetto[1] and •Ricardo Correa da Silva[2] — [1]Philosophy Department, University of São Paulo — [2]Department of Mathematics, University of Erlangen-Nuremberg

The measurement problem is the most intensely investigated issue at the foundations of the quantum theory. Since what counts as a solution depends on how the problem is defined, a historical investigation of the development that has conditioned the standard formulation of the problem is most needful as a test of its adequacy. Quantum Mechanics is unique in the history of science in that it resulted from the axiomatized merging of two rival–yet putatively equivalent–theories, namely Matrix Mechanics and Wave Mechanics. In this talk, we shall present a new, detailed mathematical and conceptual analysis of the structures of Matrix and Wave Mechanics. It will follow that the measurement problem is a logical consequence of constructing Quantum Mechanics over a fabricated–and therefore fictitious–equivalence. Matrix and Wave Mechanics are not equivalent quantum theories, but their structures are related, in a way we shall demonstrate. The physical relevance of this relation, stated in exact mathematical terms, is that it gives us new insight into the nature of the measurement problem, enabling us to state it in a different, more general setting than it has been done heretofore, opening new paths in our search for solutions.