AGPhil 5: Quantentheorie

Zeit: Mittwoch 16:45–18:15 Raum: M014

AGPhil 5.1 Mi 16:45 M014

Quantum Completeness and Consistent Histories — •Carsten Held — Universität Erfurt

The different versions of the Kochen-Specker Theorem show that quantum mechanics (QM) cannot be supplemented by hidden variables given two plausible constraints. This collection of results is generally interpreted as showing that QM is complete in the following way. Consider that a QM system's state allows calculating probabilities for the possession of values of observables. Then the system has only those values for which the state delivers probability 1. For a positive probability different from 1 the system is then thought to adopt a value as a result of the measurement interaction. But this interpretation is fundamentally problematic. In particular, it can be easily brought into contradiction with QM itself, given two very general principles concerning probabilities in a physical theory. This difficulty which may be called the completeness problem is seldom noticed. A notable exception is the consistent histories interpretation (CHI) of QM. The CHI points out the problem and proposes a solution. Here I investigate the proposal. I argue that the CHI can avoid contradiction only at the cost of distorting the original sense of the completeness assumption and prohibiting the hidden-variables question itself. Hence, its attempt to overcome the problem is implausible.

AGPhil 5.2 Mi 17:15 M014

Copenhagen Reloaded — •Helmut Fink — Institut für Theoretische Physik, Universität Erlangen-Nürnberg, Germany

The spirit of Copenhagen seems to have lost its convincing power over the past decades, mainly due to its dubious concepts of "measurement" and "observer". Quantum universalists, on the other side, claim to describe the transition from quantum to classical behaviour in purely quantum-theoretical terms. The quantum logic approach is often considered as corroborating this view, because classical structures can be embedded into quantum structures.

Nevertheless, the universalistic turn is misguided: There is a *semantic discontinuity* between quantum states and classical facts. Decoherence does not solve the measurement problem. Unsharp properties don't either. The concept of classical limit is of course useful, but not for this purpose.

Our conclusion is inconvenient: There is a clash of ontologies. The best way out is offered by accepting the legitimacy of both quantum and classical ontology. Classical ontology sets the stage for the quantum play. With this idea in mind, we promote a fresh look at the quantum interpretation debate, from a *Neo-Copenhagen* perspective, and without "observers".

AGPhil 5.3 Mi 17:45 M014

The Physical Selection Principle: An Ontological Hypothesis — •Ernst-Walther Stachow — Vorgebirgstraße 35, 50677 Köln

The position observable of a quantum physical system either may be assumed to be objective, but then Einstein locality does not hold, or to be non-objective in which case Einstein locality does hold. The first case gives rise to non-local hidden variable interpretations like Bohm's, theory, whereas the second case forms the basis for widely accepted non-objectivity interpretations. These interpretations, however, have to deal with the problem of objectivation if it is assumed that objectivation occurs for instance in a measuring process.

For a possible solution to this problem, we postulate the existence of elementary selection acts deciding (and only then distinguishing) between two alternative worlds W1 and W2 with tendencies p(W1) and p(W2). Each world selected by a selection act gives rise to a subsequent selection act. These acts are unanalyzable, are not presupposed to occur in space-time and to be caused by objects, and, hence, for given worlds and p(W1), p(W2), are indistinguishable. Space and time are derivable from the universal summetry group of an elementary selection act, and objects from tensor product representations of compositions of elementary selection acts.