AKPhil 7: Interpretations of Quantum Theory 2

Zeit: Donnerstag 16:45–18:15 Raum: KIP SR 3.401

AKPhil 7.1 Do 16:45 KIP SR 3.401

Classical physics and classical logic in Quantum Mechanics — •Manuel Bächtold — Institut für Philosophie, Fakultät 14, Dortmund Universität, D-44221 Dortmund

Are the measurement outcomes in microphysics "classical"? If yes, in which sense? In this talk, I will come back to Niels Bohr's interpretation of quantum mechanics and his claim that every measurement outcomes have to be described by means of classical physics. Carl Friedrich von Weizsäcker's transcendental version of this claim and its recent justification provided by Brigitte Falkenburg will also be discussed. I will then support the idea that a measurement outcome in microphysics cannot be considered as "classical" because its occurrence would be governed by the deterministic laws of classical physics (indeed, in the general case, it can only be predicted in a probabilistic manner by quantum mechanics). It can be considered as "classical", I will argue, only by reference to classical logic. It is true, when no measurement is performed, the structure of propositions expressing all the possible events conforms to a kind of quantum logic (e.g. partial Boolean algebra or orthomodular lattice). However, if considering a performed measurement, the propositions expressing its possible outcomes (i.e. "possible" according to the predictions of quantum mechanics) are characterized as follows: at the end of the measurement (i) each of these propositions is either true or false (principle of bivalence), and (ii) only one of these propositions is true (principle of mutual exclusiveness).

AKPhil 7.2 Do 17:15 KIP SR 3.401

Unschärferelationen und Extra-Dimensionen — •Christian Ythier — Faculte des Sciences, Universite de Nice, France

Könnten die Unschärferelationen der Quantentheorie [1] mit Extra-Dimensionen etwas zu tun haben ? Könnten diese Relationen eine tiefere Begründung haben, wenn die Zeit nicht eindimensional sondern dreidimensional [2] wäre ? 1. W. Heisenberg, Zeitschr.f. Phys. 43 (1927) 172; 2. G. Mouze und C. Ythier, DPG- Verhandl. 2006, vol.3 ,HK 56-5 .

AKPhil 7.3 Do 17:45 KIP SR 3.401

Can Quantum Mechanics be Shown to be Incomplete in Principle? — •Carsten Held — Universität Erfurt, Wissenschaftsphilosophie, Postfach 900221, 99105 Erfurt, Germany

Given four plausible principles, quantum mechanics (QM) can be shown to contradict the standard expression of completeness, the eigenstate-eigenvalue link (EE). Consider:
(P0) If, for a proposition A (describing a possible event), a theory T yields another proposition $p(A) > 0$, then it is not the case that T, $A \vdash \perp$.
(P1) A QM probability, being of the form $p([A] = a_i) = Tr(W(t)P(a_i))$, is to be interpreted as $p([A] = a_i(t))$ ("the probability that S has a_i of A at t").
(P2) There is a parameter t within QM such that the expression $[A] = a_i$ is read as $[A] = a_i(t)$("S has a_i of A at t").
(P3) Function $P : S(H) \to [0, 1]$ (collecting the QM probabilities for some suitable Hilbert space H) can be defined as a generalised probability function.
It is easy to show, for a non-eigenstate of some observable A and QM probabilities interpreted as prescribed by (P1), that (EE) transforms QM into a theory contradicting (P0). But (P0) is eminently plausible, so the defender of (EE) will naturally reject (P1). It can now be shown that retaining (P0) entails the rejection of all of (P1)-(P3).