AGPhil 4: Quantum Theory 3

Time: Wednesday 14:00–16:00 Location: H8

AGPhil 4.1 Wed 14:00 H8

On the objectivity of measurements — •Elias Okon — UNAM (Mexico)

Recent arguments, involving entangled systems shared by sets of Wigner*s friend arrangements, allegedly show that the assumption that the experiments performed by the friends yield definite outcomes is incompatible with quantum predictions. From this, it is concluded that the results of (at least some) quantum measurements, cannot be thought of as being actual or objective. Here, I will show that these arguments depend upon a mistaken assumption, regarding the correlations between the results of "the friends" and those of "the Wigners," which leads to invalid predictions. It is not, then, that the assumption of definite outcomes leads to trouble, but that the results derived with such an assumption are contrasted with faulty predictions. I will trace these inadequate predictions to a lack of recognition i) that hidden variables, with their inevitable contextual and non-local nature, are being (implicitly) postulated, and ii) that, in spite of such features, signaling is fully avoided. As for the "correct" predictions for the scenarios under consideration, I will show that the proposed experiments would allow for an empirical discrimination between hidden-variable and objective collapse models. Along the way, I will illustrate my claims with explicit calculations in the context of pilot-wave theory.

AGPhil 4.2 Wed 14:30 H8

The Wave-Function Must Be Psi-Ontic — •Mario Hubert — California Institute of Technology

The PBR-theorem aimed at proving that the wave-function has to represent objective features of a single physical system. There have been many attempts to interpret the wave-function as not representing the objective physical state of a quantum system by abandoning one of the two explicit assumptions of the PBR-theorem: (i) the existence of objective physical states and (ii) preparation independence. I argue that each theory that violates either of these assumptions meets unsurmountable problems. Although these alternative theories are physically possible, they are for several reasons implausible or problematic. I, therefore, advocate to search for quantum theories that fulfill the assumptions of the PBR-theorem.

AGPhil 4.3 Wed 15:00 H8

Temporal global correlations in time symmetric collapse models — •Pascal Rodríguez — Utrecht University

We propose that time symmetric collapse models require the existence of temporal global correlations across histories. We elaborate on a recent discussion regarding whether time-symmetric quantum mechanics requires retrocausality (Price, 2012; Leifer and Pusey 2017), spooky-action-at-temporal-distance (Adlam 2018), or neither of them. The moral is that quantum theories meeting certain assumptions either violate time-symmetry or imply retrocausality. Adlam argues we should give up the assumption that every quantum correlation is λ-mediated, meaning that there is spooky-action-at-temporal-distance. We consider that both proposals are metaphysically strong, although the point needs to be taken seriously. We suggest an analysis of time-symmetric collapse models, in which the wave-function is taken as a temporally asymmetric predictive tool to make the theory Markovian (Bedingham and Maroney 2017). We propose that the model does not require retrocausality since not every correlation is mediated by an ontic state. Nevertheless, we show that it does not need action-at-temporal-distance either; the temporal correlations exhibited violate temporal outcome independence (TOI) across histories. Analogously to the spacelike case, these TOI should not be interpreted as action-at-temporal-distance, but as temporal global correlations. We conclude with remarks about whether these correlations involve violations of Measurement Independence in an EPRB-scenario.

AGPhil 4.4 Wed 15:30 H8

On the Explanatory Power of the Hidden Variables Hypothesis — •Louis Vervoort — School of Advanced Studies, University of Tyumen, Russian Federation

In the debate whether 'hidden variables' could exist underneath quantum probabilities, the 'no hidden-variables' position is at present favored. However, if the hidden variables are allowed to be superdeterministic, the hidden-variables hypothesis can answer three foundational questions, whereas the opposing thesis ('no hidden variables') remains entirely silent for them. These questions are: 1) How to interpret probabilistic correlation in a coherent way in the classic and quantum domain ?; 2) How to interpret the Central Limit Theorem ?; and 3) Are there degrees of freedom that could unify quantum mechanics and general relativity, and if so, can we (at least qualitatively) specify them ? As I will show in this talk, it appears that only the hidden-variables hypothesis can provide coherent answers to these questions; answers which can be mathematically proven in the deterministic case. This suggests that the hidden-variables hypothesis has the greater explanatory strength, and that, to the least, an open-minded attitude towards it is recommendable.