

AGPhil 6: Quantum-Classical Divide IV

Time: Friday 10:15–13:15

Location: SPA SR22

Invited Talk AGPhil 6.1 Fri 10:15 SPA SR22
Asymptotic theory reduction, spontaneous symmetry breaking, and the measurement problem — ●KLAAS LANDSMAN — Radboud Universiteit Nijmegen

The issue of the classical/quantum divide is (re)formulated as a problem in asymptotic theory reduction. On this formulation, the measurement problem and the closely related problem of spontaneous symmetry breaking assume a particularly clear form and become well posed as mathematical problems. As such, we propose a mathematical mechanism for their solution within the confines of standard quantum mechanics. References: arXiv:1210.2353 (with R. Reuvers) and arXiv:1305.4473.

AGPhil 6.2 Fri 11:00 SPA SR22
In search of a primitive ontology for relativistic quantum field theory — ●VINCENT LAM — University of Lausanne, CH-1015 Lausanne, Switzerland

There is a recently much discussed approach to the ontology of quantum mechanics according to which the theory is ultimately about entities in 3-dimensional space and their temporal evolution. Such an ontology postulating from the start matter localized in usual physical space or spacetime, by contrast to an abstract high-dimensional space such as the configuration space of wave function realism, is called primitive ontology in the recent literature on the topic and finds its roots in Bell's notion of local beables. The main motivation for a primitive ontology lies in its explanatory power: the primitive ontology allows for a direct account of the behaviour and properties of familiar macroscopic objects. In this context, it is natural to look for a primitive ontology for relativistic quantum field theory (RQFT).

The aim of this talk is to critically discuss this interpretative move within RQFT, in particular with respect to the foundational issue of the existence of unitarily inequivalent representations. Indeed the proposed primitive ontologies for RQFT rely either on a Fock space representation or a wave functional representation, which are strictly speaking only unambiguously available for free systems in flat spacetime. As a consequence, it is argued that these primitive ontologies constitute only effective ontologies and are hardly satisfying as a fundamental ontology for RQFT.

15 min. break

AGPhil 6.3 Fri 11:45 SPA SR22
Symmetries and the philosophy of language — ●NEIL DEWAR — University of Oxford, Oxford, UK

This paper looks at how ideas from the philosophy of language can shed light upon the conceptual significance of symmetries in physics.

I begin by reviewing and summarising the case in the literature for believing that unless a quantity is invariant under such symmetries, it is epistemically undetectable. Then, I consider a novel adaptation of the permutation arguments of Quine and Putnam to raise concerns about how we could come to express the physical differences those

quantities supposedly signify. This argument also helps to clarify the structure of those permutation arguments, and plausibly provides a clearer example than those considered by Quine and Putnam.

Finally, I turn to the question of what we should say instead. I reject the consensus view that we must seek an alternative theory in which those quantities do not figure; rather, I claim, it is appropriate simply to stipulate that the theory is to be interpreted so that such models are taken to represent the same physical state of affairs. The remainder of the paper is given over to a defence of this claim against objections; and in particular, to exploring an intriguing analogy between models related by a symmetry transformation and synonymous sets of sentences.

AGPhil 6.4 Fri 12:15 SPA SR22
On the Invariance Principle — ●THOMAS MOLLER-NIELSEN — University of Oxford (graduate student), UK

Physicists and philosophers have long claimed that the symmetries of our physical theories — roughly speaking, those transformations which map solutions of the theory into solutions — can provide us with genuine insight into what the world is really like. According to this 'Invariance Principle', only those quantities which are invariant under a theory's symmetries should be taken to be physically real, while those quantities which vary under its symmetries should not. Physicists and philosophers, however, are generally divided (or, indeed, silent) when it comes to explaining how such a principle is to be justified. In this paper, I attempt to spell out some of the problems inherent in other theorists' attempts to justify this principle, and sketch my own proposed general schema for explaining how — and when — the Invariance Principle can indeed be used as a legitimate tool of metaphysical inference.

AGPhil 6.5 Fri 12:45 SPA SR22
The Internal/External Distinction in the Light of Supersymmetry — ●RADIN DARDASHTI — Munich Center for Mathematical Philosophy, Munich, Germany

Several physicists in the 1960s tried to combine internal symmetries with external or spacetime symmetries in a non-trivial way leading to many theorems culminating in the famous Coleman-Mandula theorem of 1967. The theorem proves the impossibility, under certain physical and mathematical assumptions, of combining internal and spacetime symmetries in any but the trivial way, i.e. as a direct product. However, allowing for spinorial generators one can generalize the theorem (Haag-Lopuszanski-Sohnius theorem) leading to Supersymmetry as the only possible extension of the algebra. Although the result is mathematically clear one finds many differing statements regarding the interpretation and consequence of this result for the relation between internal and external symmetries.

We will discuss both the historical and conceptual issues involved in the discussion of the internal/external distinction in the light of supersymmetry and its relevance for the philosophy of physics literature on symmetry.