Found Phys
DOI 10.1007/s10701-009-9357-y

Physics and Causation

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Received: 22 August 2009 / Accepted: 30 September 2009

Abstract The paper makes a case for there being causation in the form of causal properties or causal structures in the domain of fundamental physics. That case is built in the first place on an interpretation of quantum theory in terms of state reductions so that there really are both entangled states and classical properties, GRW being the most elaborate physical proposal for such an interpretation. I then argue that the interpretation that goes back to Everett can also be read in a causal manner, the splitting of the world being conceivable as a causal process. Finally, I mention that the way in which general relativity theory conceives the metrical field opens up the way for a causal conception of the metrical properties as well.

Keywords Causal properties · Classical properties · Direction of time · Dispositions · Entanglement · Everett · GRW · Measurement problem · Metaphysics of science · Metrical field · Physical structures · Propensities · Quantum mechanics · Spontaneous localizations · State reductions

1 Introduction

Peter Mittelstaedt and I taught a course together at the University of Cologne in the winter term 2001/02, that course being centred on philosophical theories of causation. He repeatedly asked me what the physical foundations of causation were, and I was unable to answer that question at the time. In this paper, I would like to sketch out the way in which I tend to answer this question today (without expecting Peter

I am grateful to Paul Busch for helpful comments on the draft of this paper, to Mauro Dorato for discussions and common work related to GRW and causation, and to an anonymous referee for his or her suggestions.

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Published online: 09 October 2009