

*Causation, Propensities and Causal Inference in
Quantum Physics Research Project*

*Causalidad, Propensiones e Inferencia Causal en
Física Cuántica (DGICYT HUM2005-07187-C03-01)*

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*"On Causal Loops in Retro-
Causal Interpretations of
Quantum Mechanics"*

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*Place / Lugar: Seminario del Departamento de Lógica y
Filosofía de la Ciencia, Facultad de Filosofía "B",
Universidad Complutense de Madrid.*

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Science (CCCS): <http://www.ucm.es/info/metcausa/index.html>*

Abstract. In the quantum realm, there are curious correlations between distant events. A famous example is the Einstein-Podolsky-Rosen (EPR) experiment. In this experiment, pairs of particles are emitted from a source, and when they are distant from each other they undergo measurement of various quantities. The outcomes of these measurements are curiously correlated. These correlations strongly suggest the existence of non-local influences between the measurement events, which are difficult to reconcile with relativity. Indeed, in his celebrated theorem John Bell demonstrated that, granted some very plausible premises, any quantum theory will predicate the existence of such non-local influences. One of the theorem's premises is that the probability of the states that particle pairs may assume at the emission is independent of the type of the measurements that they may undergo later on. While this assumption is both very natural and common, some physicists and philosophers suggested that local quantum theories, i.e. theories that involve no non-local influences, would be possible if this assumption were violated. The main idea is that such theories account for the EPR correlations by postulating local causal influences from the measurement events *backwards* to the state of the pair at the emission, rather than by non-local influences between these events. I argue that in some experiments such local, retro-causal interpretations of quantum mechanics predicate the existence of closed causal loops (in which effects cause their causes). And while such loops need not be inconsistent, they may undermine their predictive power of these retro-causal interpretations.