Quantum Information & Foundations Group
Instituto de Física Fundamental
Consejo Superior de Investigaciones Científicas
y
Grupo de Investigación de la UCM
Métodos de Inferencia Causal y Representación Científica
Complutense Research Group
Methods of Causal Inference and Scientific Representation

CAUSALITY IN QUANTUM PHYSICS:

PHILOSOPHERS AND PHYSICISTS SHARE THEIR VIEWS

Monday 9 March, 2009
11:00 hrs – 17:00 hrs

Seminario A217
Facultad de Filosofía, Edificio "A"
Universidad Complutense de Madrid

Información y Confirmación:
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11:00 Juan León

(Instituto de Física Fundamental,
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http://www.imaff.csic.es/pcc/QUINFOG/,

Energy transfer between separated atoms, is it causal?

The role of causality in the energy transfer between a pair of atoms is an old and much debated problem with contradictory answers. In this talk I will discuss the following situation: At t=0 one atom A is excited and other atom B is in its ground state. Initially there are no photons. We will analyze whether the probabilities of the following cases are causal or not:

- At time t atom A has decayed to the ground state and the emitted photon has been absorbed by the other atom B which is excited.
- At time t atom A has decayed to the ground state and atom B is excited.
- At time t atom B is excited.

Only the probability of the last case is causal and only its specification is local.

12:00 Carlos Sabín

(Instituto de Física Fundamental,
Quantum Information & Foundations Group,
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http://www.imaff.csic.es/pcc/QUINFOG/,

Entanglement and the light cone in atomic systems

In this talk we will consider a system consisting in a pair of atoms with two energy levels, interacting with the quantized electromagnetic field. We will explain the different ways in which quantum correlations can be generated between the atoms. In principle, entanglement may show up while one atom is outside the light cone of the other. We will discuss the physical origin of this phenomenon.

13:00-15:00 Lunch

15:00 Iñaki San Pedro

(Centre for Philosophy of Natural and Social Science,
London School of Echonomics and Political Sciencies)

**Common Cause Dependence is not Conspiracy:
A Common Cause Model for EPR Correlations**

In this paper I revise the adequacy of generic no-conspiracy conditions which happen in the usual derivations of the Bell inequality in relation to EPR correlations. First, I look at EPR-like correlations from a purely phenomenological point of view and claim that common cause explanations of these can not in principle be ruled out. I argue that an appropriate common cause explanation requires that no-conspiracy conditions are re-interpreted as mere common cause-measurement independence conditions. Violation of measurement independence, I suggest, needs not entail any kind of conspiratorial behaviour (and neither backwards in time causation). This new reading of measurement dependence further provides the grounds for an explicitly non-factorizable (in the sense of Bell's factorizability) common cause model for EPR. The proposed model, however, will force an ontological revision in the interpretation of the postulated common causes. In particular, common causes will need to be interpreted either as non-localised events with local causal powers or, alternatively, as localised events that exert non-local causal influences.

16:00 Joseph Berkovitz

(University of Toronto)

On Predictions and Explanations in Retro-causal Interpretations of Quantum Mechanics

Abstract. The curious correlations between distant events in quantum phenomena suggest the existence of non-local influences. Indeed, as John Bell demonstrated in his celebrated theorem, granted some plausible premises any quantum theory will predict the existence of such non-local influences. One of the theorem's premises is that the probability distribution of states that systems may assume is independent of the measurements that they undergo at a later time. Retro-causal interpretations of quantum mechanics postulate backward influences from the measurement events to the state of systems at an earlier time, and accordingly violate this premise. We argue that due to these influences, retro-causal interpretations predict the existence of closed causal loops, which pose challenges for the predictive and explanatory power of these interpretations.