Bell's Theorem, Quantum Theory and Conceptions of the Universe.

edited by

Menas Kafatos
Department of Physics, George Mason University,
Fairfax, Virginia, U.S.A.

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BELL'S THEOREM: THE FORGOTTEN LOOPHOLE AND HOW TO EXPLOIT IT

P.J.WERBOS
Department of Energy
Forrestal EI-621
Washington D.C., 20585
U.S.A.

ABSTRACT. Bell's Theorem rules out local, causal realistic physical theories. This paper describes a class of neoclassical theories which are local and realistic but which violate "causality" as that term is defined by Bell et al. For simple model PDE, I have already shown that certain statistical quantities obey a true Schrodinger equation; in the "non-collapse" view of quantum measurement, this in itself should be enough to reproduce known measurement relations. Schrodinger equations derived in this way are also anomaly-free (because the statistics of PDE must obey the PDE symmetries), a feature which is both crucial and difficult to obtain otherwise in unified field theories (supersymmetry).

1. Introduction

Hooker, at this workshop, has reviewed the philosophical dilemmas posed by Bell's Theorem, and the various approaches now used to escape these dilemmas -- all of which he finds unsatisfactory. This paper proposes a different escape route which, though difficult, would resurrect many of the elegant, classical ideas of Einstein and de Broglie.

The idea is to develop systems of nonlinear partial differential equations (PDE), whose transformed statistical moments obey Schrodinger equations. This paper begins by explaining this idea in more concrete terms. Next it discusses the implications for Bell's Theorem and the debate on the collapse of the wave function. It concludes with a brief summary of the progress to date in developing the required mathematics.

2. Background

A classical field theory consists of a vector field $\phi(\underline{x},t)$, where ϕ is an N-dimensional vector, and a set of PDE which ϕ must satisfy. A statistical ensemble of solutions $\phi(\underline{x},t)$ may be characterized by the probability distribution $\Pr(\phi)$ or by the corresponding <u>statistical moments</u>, which are widely used and studied in applied physics:

$$u_n(\underline{x}_1,i1;\underline{x}_2,i2;\ldots;\underline{x}_n,in;t) = E(\phi_{i1}(\underline{x}_1,t)\phi_{i2}(\underline{x}_2,t)\ldots\phi_{in}(\underline{x}_n,t)),$$

where E refers to expectation value. The collection of functions u_n

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