A PROCESS MODEL OF QUANTUM FIELD THEORY

Hans H. Diel[1,2]

Diel Software Beratung und Entwicklung, 71067 Sindelfingen, Germany
(diel@netic.de, http://www.hans-diel.de)

Theories on physics areas may be understood as models of real world phenomena. They explain a large part of the reality, but they usually do not achieve to explain all details and all aspects of the subject. The type of model chosen for the formulation of a theory determines largely the kind of questions which can be answered by the theory. As an example, the inability to provide a satisfactory answer to the Quantum Theory (QT) measurement problem (or the denial of the problem) is claimed to be largely a consequence of the fact that the present standard model of QT does not support the terms and concepts required for a proper formulation of the problem.

This paper describes a process model for QT with emphasis on Quantum Field Theory (QFT). A process model describes how things work. Usually this implies the chronological order in which things happen. With quantum theory there are many questions which cannot be answered by the present theory or its model. It is claimed that a process model of QT is (a) not yet available, and (b) a prerequisite for solutions to certain open problems of QT, such as the measurement problem.

The model is based on QFT with the perturbation (Feynman) approach. Key features of the proposed process model are

(1) discrete representation of the QT observables (momentum, position, spin) and of the paths resulting from an interaction

(2) particle/wave fluctuations taking the role of virtual particles

(3) transition from probabilities to facts which is not tied to measurements

(4) path collections in support of entanglement.

In contrast to the standard theory of QT/QFT, process models are hard to describe in terms of the purely axiomatic mathematics and hard to evaluate by only derivations of mathematical formulas. In order to enable an evaluation of the proposed process model, including showing compatibility with the predictions of standard QFT, a computer program has been implemented which supports both, standard QFT and the proposed process model.

[1] H.Diel: A Computer Model of Basic Quantum Physics, in Proceedings of the Workshop on Physics and Computer Science, Heidelberg, 1999

[2] H.Diel: A Process Model of Quantum Field Theory,
http://www.hans-diel.de/QFTPM10.pdf, 2012