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A new foundation for the quantization of field theory:why it is necessary and why it matters

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Abstract content
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It is generally believed that the techniques of quantum field theory (QFT) are well-established and that the successes of the Standard Model prove them to be correct. However, there are a number of principle shortcomings which show that QFT is incomplete. First,it is not possible for the classical world to emerge from QFT, as the state vectors do not contain any reference (direct or indirect) to the location of particles, an essential requirement to make contact with the classical macroscopic world. In this respect QFT is inferior to non-relativistic quantum mechanics (NRQM) where each particle is assigned a spatial coordinate in the (many-body) Hamiltonian, explaining why most efforts to study the quantum-classical transition are based on NRQM. Secondly, QFT does not incorporate the limit on time induced by the big bang. Thirdly, the Pauli Exclusion Principle cannot be extended to all particles in the universe as the space of quantum numbers is too restricted.

In this paper we suggest a generalization of the standard quantization which exploits gauge invariance to introduce phase factors in the quantum fields that link QFT to the environment without affecting the calculation of microscopic quantum processes. This amounts to the introduction of a new continuous positional quantum number that cannot be measured microscopically (i.e. is hidden), but emerges indirectly in a macroscopic context as a relative variable. Its presence also enables a universal formulation of the Pauli Principle. We show that this formulation can only be made consistent if we assume a unique origin of time. We realize this by embedding the quantum fields in a conformal cosmological background that observes the conservation of total energy of the universe and is dominated by dark (vacuum) energy. In this way a certain measure of unification of QFT with general relativity is accomplished. Various other elegant and desirable properties of this description are discussed. We suggest that the study of the quantum classical transition should now be carried out starting from this new formulation of QFT, rather than from NRQM.

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Primary author: Dr GREBEN, Jan (CSIR-retired)

Presenter: Dr GREBEN, Jan (CSIR-retired)

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