Institut Ruđer Bošković
ZAVOD ZA TEORIJSKU FIZIKU
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SEMINAR ZAVODA ZA TEORIJSKU FIZIKU

(Zajednički seminari Zavoda za teorijsku fiziku,
Zavoda za eksperimentalnu fiziku IRB-a i Fizičkog odsjeka PMF-a)

Renormalization in Finite-Time-Path Out-of-Equilibrium ϕ^3 QFT

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Abstract:

This talk is based on work with Prof. Dr. D. Klabucar.

We formulate the perturbative renormalization for the out-of-equilibrium $g\phi^3$ quantum field theory in the formalism with the finite time path. We use the retarded/advanced basis of out-of-equilibrium Green functions. We use the dimensional regularization method and find the correspondence of diverging contributions in the Feynman diagrams and their counterparts in R/A basis.

1. The tadpole contributions are only partially eliminated by renormalization condition. But, finite tadpole contributions are vanishing as $t \to \infty$, in a good agreement with the renormalization condition $< 0|\phi|0 >= 0$ of the S-Matrix theory.

2. Renormalized finite part of retarded (advanced) self-energy $\Sigma_{\infty,R(A)}(p_0)$ is not retarded (i.e. not causal), as it is not vanishing when $|p_0| \to \infty$. The same happens in S-matrix theory, where $\Sigma_{\infty,F}(p_0)$ cannot be split into its retarded and advanced component. The problem is "avoided " by considering self-energy with legs $G_F(p_0)\Sigma_{\infty,F}(p_0)G_F(p_0)$, which can be split to R and A components. The same works in the Glaser-Epstein renormalisation approach. In the finite-time-path approach $G_R * \Sigma_R * G_R$ should be calculated at $D \neq 4$.

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