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Beyond the Coleman--Weinberg Effective Potential

Content :

The Two-Particle-Irreducible (2PI) formalism as introduced by Cornwall, Jackiw and Tomboulis provides a systematic analytic approach to consistently describing non-perturbative phenomena in Quantum Field Theory. In spite of its great success, one major problem of the 2PI approach is that its loopwise expansion gives rise to residual violations of symmetries and hence to massive Goldstone bosons in the spontaneously broken phase of the theory. In my talk I will present a novel Symmetry-Improved 2PI formalism which consistently encodes global symmetries in a loopwise expansion, leading to massless Goldstone bosons within quantum loops and to a second order phase transition in $O(N)$ theories. In particular, I will outline the derivation of a Symmetry-Improved 2PI effective potential, in which new topologies of infinite series of graphs can be systematically resummed that allow to successfully address the Goldstone-boson IR problem of the fixed-order Coleman--Weinberg effective potential.

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