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Symmetry Improved CJT Effective Potential

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The formalism introduced by Cornwall, Jackiw and Tomboulis (CJT) provides a systematic analytic approach to consistently describing non-perturbative effects in Quantum Thermal Field Theory. One major limitation of the CJT effective action is that its loopwise expansion introduces residual violations of possible global symmetries, thus giving rise to massive Goldstone bosons in the spontaneously broken phase of the theory. In my talk I will present a novel symmetry-improved CJT formalism which consistently encodes global symmetries in a loopwise expansion. Unlike other methods, I will illustrate how the symmetry-improved CJT effective action satisfies a number of important field-theoretic properties, such as the masslessness of the Goldstone boson and the fact that the phase transition is of second order in O(N) theories, already in the Hartree-Fock approximation. After taking the sunset diagrams into account, I show how the symmetry-improved CJT approach properly describes the threshold properties of the massless Goldstone boson and the Higgs particle within quantum loops. Finally, I will briefly outline the derivation of a symmetry-improved CJT effective potential, in which new topologies of infinite class of graphs can be resummed that go well beyond the standard Coleman–Weinberg effective potential. [This presentation is based on my paper with Daniele Teresi, Nucl. Phys. B874 (2013) 594.]

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