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Nonperturbative applications of the functional renormalization group

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The functional renormalization group is a nonperturbative semi-analytic tool for continuum computations in quantum field theory and high energy theory, and I will present some illustrative examples of its modern applications. It has been quite successful in describing chiral symmetry breaking and quantum criticality in three dimensional fermionic systems, as I will briefly review with some remarks on the phenomenon of emergent supersymmetry. It is also extensively used to provide a first-principle account of the strongly interacting regime of QCD, although special care is required concerning the treatment of gauge symmetry in this formalism. I will shortly outline some ongoing work on this particular problem. Finally, it has been applied to the electroweak sector of the Standard Model, in the search for a more complete field-theoretical understanding of it. In particular, I will mention some results on the possible UV completion of the Standard Model through complete asymptotic freedom.

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