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# Asymptotic freedom in the Hamiltonian approach to binding of colour

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The renormalization group procedure for effective particles (RGPEP) has been developed during the last years as a non-perturbative tool for constructing bound-states in quantum field theories [1]. It stems from the similarity renormalization group procedure (SRG) [2] and introduces the concept of effective particles, which differ from the point-like canonical, bare ones by having a finite size $s$. The effective particles in the Fock space build the hadronic eigenstates of a family of effective Hamiltonians H_s depending on the size s as the RGPEP scale parameter. We apply the RGPEP to QCD using an expansion in powers of the coupling constant up to third order. The Hamiltonian running coupling, $g_s$, is extracted from the interaction terms in $H_s^{QCD}$ [3]. We thus demonstrate that the RGPEP passes the test of describing asymptotic freedom, which is a precondition for any approach aiming at using QCD for explaining hadrons in the Minkowski space-time, especially for tackling nonperturbative issues, such as the ones that emerge when one allows effective gluons to have masses [2]. Applications of this method beyond the leading order are under way and it is hoped that the interaction terms relevant to understanding of confinement will be gradually determined.

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## Summary

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