

# XVth Quark Confinement and the Hadron Spectrum



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## An Almost Complete Yang-Mills Calculation

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In this talk, we report on new results for  $SU(N)$  Yang-Mills theory in four dimensions in the continuum formulation. Using the background field method, we find that the notorious infrared divergences of the effective action cancel between gauge and matter sectors for QCD if the number of massless quark flavors is exactly  $N_f = 4N$ , but not if  $N_f=0$ . Improving the calculation for pure Yang-Mills by including fluctuations around the background field, we use well-developed techniques to go beyond one-loop order to calculate non-perturbative contributions from the quartic interactions. It has been claimed by Savvidy and others that non-perturbative contributions from quartic interactions will regulate the IR divergences found in one-loop calculations of the Yang-Mills vacuum, potentially making it possible to calculate the Yang-Mills mass gap. We report on the status of this claim in this talk.

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