The Calculation of Vacuum Properties from the Global Color Symmetry Model

abstract A modified method for calculating the non-perturbative quark vacuum condensates from the global color symmetry model is derived. Within this approach it is shown that the vacuum condensates are free of ultraviolet divergence which is different from the previous studies. As a special case the two quark condensate $\langle \bar{q}q \rangle$ and the mixed quark gluon condensate $g\langle \bar{q}G_{\mu\nu}\sigma^{\mu\nu}q \rangle$ are calculated. A comparison with the results of other nonperturbative QCD approaches is given.

Key-words: Non-perturbative methods in QCD, GCM, Vacuum condensate.

E-mail: zonghs@chenwang.nju.edu.cn.

PACS Numbers: 24.85.+p, 12.38.Lg, 12.38.-t, 11.15Pg
\[ \sigma_A(s) = \frac{A(s)}{A_A^2(s)s + B_A^2(s)} \]

(For gluon propagator \( g^2D^{(1)} \))
\[ \sigma_A(s) = A(s)/(A^2(s)s + B^2(s)) \]
\[ \sigma_B(s) = \frac{B(s)}{A^2(s)s + B^2(s)} \]

set 1 (\(\Delta = 0.2\text{GeV}^2\), \(\chi = 1.65\text{GeV}\))

set 2 (\(\Delta = 0.02\text{GeV}^2\), \(\chi = 1.55\text{GeV}\))

set 3 (\(\Delta = 0.02\text{GeV}^2\), \(\chi = 1.45\text{GeV}\))
\[ \sigma_B(s) = \frac{B(s)}{A(s)s + B^2(s)} \]

- Set 1 (\( \Delta = 10^{-1} \text{GeV}^4 \), \( \chi = 1.83 \text{GeV} \))
- Set 2 (\( \Delta = 10^{-4} \text{GeV}^4 \), \( \chi = 1.02 \text{GeV} \))
- Set 3 (\( \Delta = 10^{-7} \text{GeV}^4 \), \( \chi = 0.83 \text{GeV} \))