APR11-2011-000208

Abstract for an Invited Paper
for the APR11 Meeting of
the American Physical Society

**New Perspectives on Condensates in Quantum Chromodynamics and the Cosmological Constant**[1]

STANLEY J. BRODSKY, SLAC National Accelerator Laboratory, Stanford University

The conventional concept of QCD vacuum condensates is in direct conflict with the measured value of the cosmological constant by approximately 45 orders of magnitude. In our recent papers, Craig Roberts, Robert Shrock, Peter Tandy and I have reanalyzed QCD condensates from the standpoint of light-front quantization and the Bethe-Salpeter/Dyson-Schwinger approach for bound states. We show that, because of color confinement, quark and gluon QCD condensates are associated with the internal dynamics of hadrons, not the vacuum; in particular, the quark condensate underlying the Gell-Mann–Oakes–Renner formula can be understood as a property of hadronic Bethe-Salpeter or light- front wavefunctions. Chiral symmetry is thus broken in a limited domain of the size of the inverse pion mass, in analogy to the limited physical extent of superconductor phases. The resulting "in-hadron" QCD condensates give zero contribution to the cosmological constant, since all of their gravitational effects are already included in the normal contribution associated with hadron masses.

[1]Research supported by the Department of Energy, contract DE–AC02–76SF00515.