Functional integral approach in the theory of color superconductivity

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Abstract: In this series of lectures, we present the functional integral method for studying the superconducting pairing of quarks with the formation of diquarks, as well as the quark-antiquark pairing in dense QCD. The dynamical equations for the superconducting order parameters are the nonlinear integral equations for the composite quantum fields describing the quark-quark and quark-antiquark systems. These composite fields are bilocal fields if the pairing is generated by the gluon exchange, while for the instanton induced pairing interactions they are the local ones. The expressions of free energy densities are derived. The binding of three quarks is also discussed.

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References:

• Barrois, B.C., (1977) Nucl. Phys. B, 129, p. 390

• Frautschi, C., (1978) Proc. Workshop on Hadronic Matter at Extreme Energy Density, , Cabibbo, N., Ed., Erice, Italy

• Bailin, D., Love, A., (1981) Nucl. Phys. B, 190, p. 175

• (1981) Nucl. Phys. B, 190, p. 751

• (1982) Nucl. Phys. B, 205, p. 119

• Donoghue, J.F., Sateesh, K.S., (1988) Phys. Rev. D, 38, p. 360

• Iwasaki, M., Iwado, T., (1995) Phys. Lett. B, 350, p. 163

• Alford, M., Rajagopal, K., Wilczek, F., (1998) Phys. Lett. B, 422, p. 247

• (1999) Nucl. Phys. B, 537, p. 443

• Schäfer, T., Wilczek, F., (1999) Phys. Rev. Lett., 82, p. 3956

• (1999) Phys. Lett. B, 450, p. 325

- Rapp, R., Schäfer, T., Shuryak, E., Velkovsky, M., (1998) Phys. Rev. Lett., 81, p. 53
- Evans, N., Hsu, S., Schwetz, M., (1999) Nucl. Phys. B, 551, p. 275
- (1999) Phys. Lett. B, 449, p. 281
- Son, D.T., (1998) Phys. Rev. D, 59, p. 094019
- Carter, G.W., Diakonov, D., (1999) Phys. Rev. D, 60, p. 01004
- Rapp, R., Schäfer, T., Shuryak, E., Velkovsky, M., (1999) Preprint IASSNS-HEP-99/40, , Princeton, hep-ph/9904353
- Chodos, A., Minakata, H., Cooper, F., (1999) Phys. Lett. B, 449, p. 260
- Pisarski, R.D., Rischke, D.H., (1999) Phys. Rev. D, 60, p. 094013
- Schäfer, T., Wilczek, F., (1999) Phys. Rev. D, 60, p. 074014
- (1999) Phys. Rev. D, 60, p. 114033
- Miransky, V.A., Shovkovy, I.A., Wijewardhana, L.C., (1999) Phys. Lett. B, 468, p. 270
- Casalbuoni, R., Gatto, R., (1999) Phys. Lett. B, 464, p. 111
- Hong, D.K., Rho, M., Zahed, I., (1999) Phys. Lett. B, 468, p. 261
- Rho, M., Shuryak, E., Wirzba, A., Zahed, I., hep-ph/0001104Manuel, C., Tytgat, M.H.G., hep-ph/0001095Brown, W., Liu, J.T., Ren, H.C., hep-ph/0003199Berges, J., Rajagopal, K., (1999) Nucl. Phys. B, 358, p. 215
- Harada, M., Shibata, A., (1998) Phys. Rev. D, 59, p. 014010
- Pisarski, R.D., Rischke, D.H., (1999) Phys. Rev. Lett., 83, p. 37
- Van Hieu, N., (1999) Basics of Functional Integral Technique in Quantum Field Theory of Many-Body Systems, , Hanoi: VNUH
- Van Hieu, N., Tuong, L.T., (1998) Commun. Phys., 8, p. 129
- Van Hieu, N., Son, N.H., Van Thanh, N., Thang, H.B., (2000) Adv. Nat. Sci., 1, p. 61. , hep-ph/0001251
- Van Hieu, N., Long, H.N., Son, N.H., Viet, N.A., (1999) Proc. 24th Conf. in Theoretical Physics, p. 1. , Samson, hep-ph/0001234
- Van Hieu, N., (1994) Computational Approaches for Novel Condensed Matter Systems, pp. 194-234. , Mukunda Das, Ed., New York: Plenum
- Van Hieu, N., (1997) Aust. J. Phys., 50, p. 1035