

XXV International Baldin Seminar on High Energy Physics Problems
"Relativistic Nuclear Physics and Quantum Chromodynamics"



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Relativistic Nuclear Physics & Quantum Chromodynamics
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Light quark masses in the $1/N_c$ Nambu–Jona-Lasinio model

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The mass formulas and decay constants of electrically charged and strange pseudoscalar mesons are analyzed within the combined framework of Nambu – Jona-Lasinio model and the $1/N_c$ expansion up to $\mathcal{O}(1/N_c^2)$. The light quark masses explicitly violating $SU(3)_L \times SU(3)_R$ chiral symmetry of the strong interactions are taken to be of order $\mathcal{O}(1/N_c)$. The Fock-Schwinger proper-time method and the Volterra series are used to derive the effective action. A set of sum rules is obtained that relates the phenomenological values of the masses of pseudoscalar mesons to the mass ratios of light quarks. It is shown that combining the new sum rules with the experimental data on the decay width $\eta \rightarrow 3\pi$ allows to establish limits for the ratios: $0.47 < m_u/m_d < 0.59$ and $18.60 < m_s/m_d < 19.66$. A comparison with the results of similar calculations in $1/N_c$ chiral perturbation theory is made.

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