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The effective gluon mass and the gluon propagator form in the Landau gauge in SU(3) lattice QCD TAKUMI IRITANI, HIDEO SUGANUMA, Dept. of Phys., Kyoto Univ., HIDEAKI IIDA, RIKEN — We study the gluon propagator in the Landau gauge in SU(3) lattice QCD with $\beta = 5.7, 5.8$ and 6.0 at the quenched level in the region of $r = 0.1 \sim 1.0$ fm, which is relevant to quark-hadron physics. First, we evaluate the effective gluon mass in lattice QCD, since gluons have been conjectured to acquire large effective mass due to non-perturbative effects of QCD. The effective gluon mass is estimated to be about $400 \sim 600$ MeV in the Landau gauge in an infrared region of $r = 0.5 \sim 1.0$ fm. Next, we investigate the functional form of the gluon propagator in the Landau gauge. As a remarkable fact, the gluon propagator is found to be well reproduced by the simple Yukawa-type function e^{-mr}/r in the whole region of $r = 0.1 \sim 1.0$ fm in the four-dimensional Euclidean space-time. Note that this Yukawa-type propagator in four-dimensional space-time corresponds to a new-type propagator of $(p^2 + m^2)^{-3/2}$ in the momentum space. Based on the Yukawa-type gluon propagator obtained from lattice QCD, we also discuss a possible construction of the infrared effective theory such as a Nambu-Jona-Lasinio-type theory from QCD.

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