Abstract of Thesis

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Title	Scalar diquark mass and quark-diquark potential from lattice QCD with a static quark （静的クォークを使った格子QCDによるスカラーダイクォーク質量とクォーク・ダイクォークポテンシャル）

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This thesis investigates the scalar diquark mass and the quark–diquark interaction in lattice QCD using a HAL QCD-inspired potential method applied to a baryonic system composed of a scalar diquark and a static quark. The scalar diquark mass is determined self-consistently by requiring that the P-wave baryonic spectrum obtained from lattice two-point correlation functions be reproduced within the potential framework. Numerical calculations are performed using (2+1)–flavor gauge configurations with $L^3 \times T = 32^3 \times 64$ generated by the PACS-CS Collaboration with $m_\pi \approx 702$ MeV and $m_N \approx 1.583$ GeV. This setup corresponds to a lattice spacing of $a \simeq 0.0907(13)$ fm ($a^{-1} \approx 2.176(31)$ GeV), a spatial lattice extent of $La = 32a \approx 2.902$ fm. Two-point correlation functions are analyzed to determine the baryonic spectrum, while equal–time Nambu–Bethe–Salpeter (NBS) wave functions extracted from the four-point correlation function are used to construct the quark–diquark potential. The scalar diquark mass is extracted by solving the Schrödinger equation with the potential and demanding consistency with the lattice spectrum. We obtain a scalar diquark mass of $m_D = 0.931(7)$ GeV, which is consistent with the naïve constituent-quark estimate $2m_N/3$. The resulting quark–diquark potential exhibits the Cornell form, consisting of a short-range Coulomb interaction and a long-range linear confining term. Furthermore, the extracted string tension is consistent with that obtained from the static quark–antiquark potential extracted from the Wilson loop.