博士論文公聴会の公示（物理学専攻）

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論文題目：The Higgs decay and dark matter in the gauge-Higgs unification
（ゲージ・ヒッグス統一模型に於けるヒッグス粒子の崩壊と暗黒物質）

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論文要旨：

The scenario of gauge-Higgs unification solves the fine-tuning problem associated with the Higgs boson mass. In particular, the $SO(5)\times U(1)$ gauge-Higgs unification is phenomenologically viable. The Higgs boson is unified with the gauge bosons as the fifth-dimensional component of the gauge fields. The Higgs boson appears as a fluctuation mode of the Wilson line phase θ_H along the fifth dimension. The observed Higgs boson with mass 125 GeV is realised with $SO(5)$-spinor fermions in addition to the $SO(5)$-vector quark-lepton multiplets. The constraint for this model is obtained from the Z' signals at the LHC in dilepton events. Candidates for the Z' are the first Kaluza-Klein modes of Z, Z_R and γ and the allowed region of Z' mass is found to be $4 \sim 9$ TeV for θ_H from 0.2 to 0.07. The model possesses the universality under which various physical quantities such as the Kaluza-Klein scale and the Higgs self couplings are determined by θ_H.

In this thesis, the Higgs boson decay and the dark matter candidate in this model are studied. The decay processes $H \to \gamma\gamma$ and $H \to Z\gamma$ occur at the one-loop level. In spite of the presence of an infinite number of the Kaluza-Klein modes in the loops, the corrections turn out finite and the deviations of these decay rates from the standard model become approximately $O(1)\%$. The branching ratios of the Higgs boson are consistent with the standard model. The lowest mode of the $SO(5)$-spinor fermions, which couples to $SU(2)_L$ very weakly and is stable, becomes a candidate for the dark matter. The observed relic density of the dark matter is reproduced with the Breit-Wigner enhancement in the annihilation processes. From the direct detection experiments, the allowed region of their mass is from 2.6 to 3.1 TeV, which corresponds to $0.07 < \theta_H < 0.09$ ($9.0 < m_{\rm KK} < 10.4$ TeV).