論文の内容の要旨

論文題目

Correlation Functions of $\mathcal{N} = 4$ Supersymmetric Yang-Mills Theory in $\mathbf{AdS_5/CFT_4}$ Correspondence – Perturbation and Integrability

(AdS_5/CFT_4 対応における
$\mathcal{N}$=4 超対称 Yang-Mills 理論の相関関数
– 摂動論と可積分性)

氏名

桐生 直輝

This dissertation is devoted to the study of AdS_5/CFT_4 correspondence, which is a duality between $\mathcal{N} = 4$ Supersymmetric Yang-Mills theory in four-dimensions and type IIB superstring theory on $AdS_5 \times S^5$. In particular, we focus on a fundamental physical quantity in $\mathcal{N} = 4$ supersymmetric Yang-Mills theory which is correlation functions. In this thesis, there are two main results for computations of correlators of operators on the 1/2 BPS Wilson loop. The first result is a proposal for a finite coupling expression of large-volume correlators by integrability-based approach. The second result is that we calculate finite-size corrections of the correlators at lower order from the perturbation.

After a general introduction, we begin with a brief review of the AdS_5/CFT_4 correspondence, and give generic preliminaries of correlators of $\mathcal{N} = 4$ supersymmetric Yang-Mills theory in Part I. The main text in this thesis is split into two parts explained in Part II and in Part III. Part II, the first part in this thesis, deals with the correlation functions of single trace operators, which correspond to an interaction process of closed strings. Then, we review several developments of integrability-based approaches for computations of correlators in a short course to explain a proposal for large-volume correlators with finite coupling.

As a natural question, it is interesting to consider an open string version of the finite coupling method. In Part III, which is the second and main part, we deal with correlation functions of operators inserted into the 1/2 BPS Wilson loop. Such configuration corresponds to open strings attached D3-brane in the dual AdS theory. Then, we explain integrability-based computations of the correlators at lower order, and then we propose large-volume correlators with finite coupling. In addition, we explain computations of finite-size corrections of the correlators at lower order from the perturbation. It is a significant advantage to consider the open string configuration.