

論文の内容の要旨

論文題目 On cognate integrable structure for
three-point functions in $\text{AdS}_5/\text{CFT}_4$ correspondence

($\text{AdS}_5/\text{CFT}_4$ 対応における 3 点関数の可解構造について)

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The discovery of the AdS/CFT correspondence, which is an unprecedented duality between a conformal field theory in d-dimension and a string theory on the maximally symmetric curved background with a negative cosmological constant, had a huge impact on theoretical physics. Although enormous studies have been done for two decades, we remain to reach the fundamental understanding for the underlying mechanism behind the duality.

In this doctoral dissertation, to deepen our understanding of the duality, we shall study the three-point functions in the context of $\text{AdS}_5/\text{CFT}_4$ using the integrability techniques since the three-point functions are quite important observables describing the dynamics.

The organization of this thesis is as follows. The part I is devoted to an introduction and reviews concerning the results obtained by the author. The two- and three-point functions are reviewed in chapter 3 and chapter 4 respectively. We will also make few comments on other observables in chapter 5.

The part II contains the author's main results. In chapter 6, we will present a novel formalism in which the tree-level three-point functions in the so-called $SU(2)$ subsector are studied and the result which has not been discussed in the literatures can be obtained. Furthermore, this novel construction allows us to derive the non-trivial identities so-called monodromy relations, which can be regarded as a collection of the Ward-Takahashi identities reflecting the hidden integrable structure.

In chapter 7, we generalize the results of the $SU(2)$ sector to the entire $PSU(2,2|4)$ sector.

Finally, in chapter 8 we develop a new method of computing three-point functions in the $SU(2)$ sector in the semi-classical regime at weak coupling, which closely parallels the strong coupling analysis. The structure threading two disparate regimes is the monodromy relation. As a result, compact semi-classical formulas are obtained for a general class of three-point functions at weak coupling including the ones whose semi-classical behaviors were not known before and it turns out that the results perfectly match with those in the strong coupling regime, after taking the Frolov-Tseytlin limit.

The part III is devoted to the summary and conclusions.