

String Correlation Functions of Spin-1/2 Heisenberg XXZ chain

Masahiro Shiroishi

*Institute for Solid State Physics, University of Tokyo,
Kashiwanoha 5-1-5, Kashiwa-shi Chiba 277-8581, Japan*

Recent developments of the exact calculation of the correlation functions for spin-1/2 Heisenberg XXZ chain have taught us lots of new features of the model especially at the ground state. Among them, we have found that a certain kind of string correlation functions $\mathcal{O}(n, \theta)$ can be evaluated exactly in the thermodynamic limit. These string correlation functions were originally introduced by den Nijs-Rommelse ($\theta = \pi$) and Oshikawa ($\theta =$ general) as possible order parameters to characterize the Haldane state of integer spin Heisenberg XXX chains. The same string correlation functions was considered by Hida as well as Lou *et al* for spin-1/2 systems. In particular Hida has found the asymptotic form of $\mathcal{O}(n, \pi)$ is given by $\sim n^{-1/4}$ by use of the bosonization method, which is remarkably slower than the usual spin-spin correlation functions. More recently the asymptotic formula was generalized to $\mathcal{O}(n, \theta) \sim n^{-\theta^2/4\pi^2}$ by Lou *et al*. In this work, we have generalized these asymptotic formulas to general XXZ chain with the anisotropy parameter Δ in the critical region and compared with some exact results for $\Delta = 1, 1/2$ and numerical data for other Δ [1]. In the special case $\Delta = 0$, the Fisher-Hartwig conjectures for Toeplitz determinant can be applied to obtain both exact short range values and asymptotic formulas. We have also studied the massive case $\Delta > 1$ by numerical diagonalization.

This is a joint work with J. Sato and M. Bortz.

[1] M. Bortz, J. Sato and M. Shiroishi, J. Phys. A: Math. Theor. **40** (2007) 4253.