Excitation structure of frustrated spin chains with dimerization and the description by the effective field theory\(^1\) SHINTARO TAKAYOSHI, MASAKI OSHIKAWA, Institute for Solid State Physics, University of Tokyo —

Heisenberg antiferromagnetic chain with alternating exchange interaction is an important model, which describes magnetic properties of real materials. Field theoretical approach is a powerful tool to investigate such kind of one-dimensional quantum magnets, and it is known that this lattice model is related with corresponding sine-Gordon effective field theory through the bosonization technique. We investigate the excitation spectrum and the correspondence between \(S = \frac{1}{2}\) and 1 frustrated chain with dimerization and their effective field theories by both analytical and numerical methods, focusing on the mass ratio \(r\) of second breather to soliton. In the result, the \(S = \frac{1}{2}\) and 1 cases are understood in a unified way. \(r\) becomes \(\sqrt{3}\), the value predicted from sine-Gordon model by the introduction of next-nearest neighbor coupling \(J_2 = J_{2c}\) where the marginal term in effective field theory vanishes. The universality class of transition is Tomonaga-Luttinger liquid and first order for \(J_2 < J_{2c}\) and \(J_2 < J_{2c}\), respectively. We also consider the effect of the marginal term on \(r\) quantitatively by using form factor perturbation theory and renormalization analysis.

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