Mathematical Physics

Thermodynamic limit of particle-hole form factors in the massless XXZ Heisenberg chain

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We study the thermodynamic limit of the particle-hole form factors of the XXZ Heisenberg chain in the massless regime. We show that, in this limit, such form factors decrease as an explicitly computed power-law in the system-size. Moreover, the corresponding amplitudes can be obtained as a product of a "smooth" and a "discrete" part: the former depends continuously on the rapidities of the particles and holes, whereas the latter has an additional explicit dependence on the set of integer numbers that label each excited state in the associated logarithmic Bethe equations. We also show that special form factors corresponding to zero-energy excitations lying on the Fermi surface decrease as a power-law in the system size with the same critical exponents as in the long-distance asymptotic behavior of the related two-point correlation functions. The methods we develop in this article are rather general and can be applied to other massless integrable models associated to the six-vertex R-matrix and having determinant representations for their form factors.

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