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# Low energy dynamics of spin chains: beyond the Tomonaga-Luttinger liquid approach

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The longitudinal spin structure factor for the  $XXZ$ -chain at small wave vector  $q$  is obtained using Bethe ansatz, field theory methods, and the density matrix renormalization group. It consists of a peak with a peculiar, non-Lorentzian shape and a high-frequency tail. We show that the width of the peak is proportional to  $q^2$  for finite magnetic field compared to  $q^3$  for a zero field. For the tail we derive an analytic formula without any adjustable parameters and demonstrate that the integrability of the model directly affects the line shape.