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JOHANNES GUTENBERG UNIVERSITÄT MAINZ

Theory of Condensed Matter: Hard Condensed Matter

Oct. 30, 2018 at 10 a.m.
Galileo Room, 01-128

Imke Schneider
Technical University Kaiserslautern

Impurities and disorder in one-dimensional quantum systems

The effects of impurities in quasi one-dimensional quantum systems are recently experiencing a renewed interest due to experimental realizations in solid state systems and ultra-cold gases. Due to spatial confinement impurities have strong impact on the magnetic excitation spectrum and transport properties in one dimension. Already the smallest generic scatterer can block the electric or magnetic conductance which leads to effectively isolated finite chain segments with discrete energies and characteristic boundary correlations. Surprisingly, relatively little is known about impurity effects on the momentum- and frequency resolved dynamical response functions as for example the dynamical structure factor in spin-1/2 Heisenberg chains. Using bosonization and the numerical Density Matrix Renormalization Group we provide detailed quantitative predictions for the momentum and energy resolved structure factor in doped spin chains. Due to the impurities, spectral weight is shifted away from the antiferromagnetic wave-vector $k = \pi$ into regions which normally have no spectral weight in the thermodynamic limit. As another example of impurity physics in one dimension we consider simple intersections between one-dimensional quantum wires. These can act as coherent beam splitters for non-interacting electrons. Here we examine how coherent splitting at such quantum wire crossings is affected by inter-particle interactions.

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