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The one-dimensional antiferromagnetic S=1/2 Heisenberg chain in an applied magnetic field

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Almost a century ago, in 1931, Bethe provided an ansatz to find the exact eigenvalues and eigenvectors of the spin-1/2 Heisenberg Hamiltonian with antiferromagnetic nearest-neighbor interactions. In zero field, the ground state is a singlet, and the inelastic neutron spectrum is a continuum of pairs of topological excitations called spinons. In an applied magnetic field, longitudinal and transverse spin fluctuations are no longer equivalent. For intermediate magnetic fields, below the saturation field that overcomes the antiferromagnetic interaction, the spinon continuum splits into several continua associated with new types of quasi-particles. Here we present a very accurate quantitative study of such a system in applied magnetic field by means of time-of-flight neutron spectroscopy. Additional polarized triple-axis experiments allowed to distinguish longitudinal and various transverse contributions to the spectra.

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