Elementary Excitations in an S=1/2 Antiferromagnetic Chain $KCuGaF_6$

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The field theoretical approach demonstrated that the S=1/2 antiferromagnetic Heisenberg chain in an external magnetic field can be mapped onto the quantum sine-Gordon (SG) model when the staggered field is induced perpendicular to the external field [1]. The elementary excitations of the quantum SG model are composed of massive solitons and breathers, which are bound states of soliton and antisoliton. Spin-1/2 antiferromagnetic chain $KCuGaF_6$ with J/k_B=103 K is a model system described by the quantum SG model in magnetic fields [2]. To investigate elementary excitations in $KCuGaF_6$, we performed neutron scattering experiments using AMATERAS at J-PARC in zero magnetic field and RITA-II at PSI in magnetic fields. Figure 1 shows contour map of scattering intensity along the chain direction measured at zero field. The lower bound of magnetic excitations is well described by the des Cloizeaux and Pearson (dCP) mode [3]. This result together with the spinon continuum observed above the dCP mode guarantees good one-dimensionality of $KCuGaF_6$.

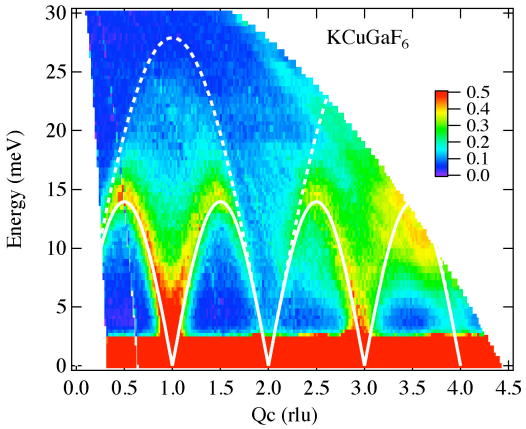

Fig. 1: Contour map of scattering intensity along Q_c. Solid and dashed lines denote the dCP dispersion relation and the upper bound of spinon continuum, respectively, calculated with J/k_B=103 K.

References

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