Field-Induced Gap in Quantum Spin-1/2 Chains in Strong Magnetic Fields

S.A. Zvyagin[a], M. Ozerov[a], J. Wosnitza[a], E. Čižmár[b], R. Feyerherm[c], S.R. Manmana[d], and F. Mila[e]

[a]Dresden High Magnetic Field Laboratory (HLD), Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden, Germany
[b]Centre of Low Temperature Physics, P.J. Šafárik University, Košice, Slovakia
[c]Helmholtz-Zentrum Berlin für Materialien und Energie, Berlin, Germany
[d]JILA, Department of Physics, University of Colorado, Boulder, Colorado, USA
[e]Institute of Theoretical Physics, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

The low-temperature excitation spectrum in copper pyrimidine dinitrate, a spin-1/2 antiferromagnetic chain with alternating g-tensor and Dzyaloshinskii-Moriya interactions that exhibits a field-induced spin gap, is probed by means of ESR spectroscopy in magnetic fields up to 63 T. In particular, we report on a minimum of the gap in the vicinity of the saturation field $H_{sat} = 48.5$ T associated with a transition from the sine-Gordon region (with soliton-breather elementary excitations) to a spin-polarized state (with magnon excitations). This interpretation is fully confirmed by the quantitative agreement over the entire field range of the experimental data with the DMRG calculations for spin-1/2 Heisenberg chain with a staggered transverse field.[1]

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