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Hydrodynamics and its prediction on electron spin resonance of the interacting spinon liquid in the antiferromagnetic Heisenberg spin-½ chains

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Elementary excitations of the quantum spin-½ chain are represented by neutral spin-½ spinons. Recently, the magnitude of the marginally irrelevant interaction between spinons was determined from the electron spin resonance (ESR) experiments (1) on the magnetized spin-1/2 chain with the uniform Dzyaloshinskii-Moriya (DM), with the magnetic field oriented along the DM vector.

Here, we present a simple hydrodynamic approach (2) to dynamical spin susceptibilities of the interacting spinon liquid that allows us to describe the general case of the arbitrary angle between the magnetic field and the DM vector. The approach is based on the Kac-Moody algebra of spin currents and a simple mean-field approximation that takes into account “molecular” fields due to the backscattering interaction between spinons. The obtained results reproduce the old ones (3) in the limiting cases and are in good agreement with the DMRG simulations.

We show that the interaction between spinons influences the angular dependence of the resonant magnetic fields of the DM-induced doublet and compare our theory to the existing ESR data (4), thereby providing additional evidence in favor of the interacting spinon liquid picture.

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[1] K. Yu. Povarov, T. A. Soldatov, Ren-Bo Wang, A. Zheludev, A. I. Smirnov, O. A. Starykh, Phys. Rev. Lett. 128, 187202 (2022)
[2] Ren-Bo Wang, Anna Keselman, and Oleg A. Starykh, Phys. Rev. B 105, 184429 (2022)
[3] A. Keselman, L. Balents, and O. A. Starykh, Phys. Rev. Lett. 125, 187201 (2020).
[4] A. I. Smirnov, T. A. Soldatov, K. Yu. Povarov, M. Hälg, W. E. A. Lorenz, and A. Zheludev, Phys. Rev. B 92, 134417 (2015).