

Confinement of Many-body Bethe Strings

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Based on Bethe-ansatz approach and inelastic neutron scattering (INS) experiments, we reveal evolution of confinement of many-body Bethe strings in ordered regions of quasi-one-dimensional antiferromagnet YbAlO₃. In the antiferromagnetic phase, the spin dynamics is dominated by the confined length-1 Bethe strings, whose dominance in the high-energy branch of the spin dynamics yields to the confined length-2 Bethe strings when the material is tuned to the spin-density-wave phase. In disordered region, the confinement effect disappears, and the system restores the physics of the one-dimensional Heisenberg model. The distinctive many-body excitations appearing in different phases of the material imply rich spin dynamics, which not only bring in deeper understanding beyond static order parameters but can also serve as unique dynamical features to characterize different phases. Based on confinement of Bethe strings our results establish a unified dynamic picture for different magnetic phases, and thus provides profound insight into the many-body quantum magnetism.

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