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Localization of Spinons in Random Majumdar-Ghosh Chains
GUILLAUME ROUX, ARTHUR LAVARELO, LPTMS, Univ. Paris Sud, CNRS, UMR8626, F-91405 Orsay, France — We study the effect of disorder on frustrated dimerized spin-1/2 chains at the Majumdar-Ghosh point. Using variational methods and density-matrix renormalization group approaches, we identify two localization mechanisms for spinons which are the deconfined fractional elementary excitations of these chains. The first one belongs to the Anderson localization class and dominates at the random Majumdar-Ghosh point. There, spinons remain gapped and localize in Lifshitz states whose localization length is analytically obtained. The other mechanism is a random confinement mechanism which induces an effective interaction between spinons and brings the initially gapped antiferromagnetic chain into a gapless and partially polarized phase for arbitrarily small disorder. This Imry-Ma mechanism induces domains which statistics is analyzed. Last, the connection to the real-space renormalization group method suited for the strong disorder limit is discussed.

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