Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Generation of chiral solitons in antiferromagnetic chains by a quantum quench[1] BARBARA BRAVO, ARIEL DOBRY, Instituto de Fisica Rosario, DIEGO MASTROGIUSEPPE, Ohio University, CLAUDIO GAZZA, Instituto de Fisica Rosario — In classical nonlinear physics, solitons are peculiar solutions which can be characterized by constant velocity and shape. In a recent paper [1], pursuing the understanding of the extension of the soliton concept to the quantum regime, the easy-axis ferromagnetic XXZ model was chosen to analyze the evolution of a localized wave packet. It was shown that, besides the delocalization due to the uncertainty principle, they are in qualitative agreement with their classical counterparts. Following the objective of deciphering the quantum soliton term, we analyze the time evolution of a magnetic excitation in a spin-$\frac{1}{2}$ antiferromagnetic Heisenberg chain after a quantum quench. By a modulation of the magnetic exchange, we prepare a static soliton of total spin $\frac{1}{2}$ as an initial state. Using bosonization and a time dependent density matrix renormalization group algorithm, we show that the excitation evolves to a state composed of two counter-propagating chiral states, which interfere to yield $<S^z>= \frac{1}{4}$ for each mode. These dynamically generated states remain considerably stable in time. We propose spin-Peierls materials and ultracold-atom systems as experimental scenarios to conduct and observe this mechanism. [1] Phys. Rev. B 85, 184433 (2012).

[1]Supported by CONICET Argentina, NSF-MWN/CIAM and NSF-PIRE

Diego Mastrogiuseppe
Ohio University

Date submitted: 14 Nov 2013 Electronic form version 1.4