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Field-Induced New Phases in the S=1/2 Three-Leg Spin Tube
TORU SAKAI, MASAHIRO SATO, Japan Atomic Energy Agency, YUICHI OTSUKA, Japan Science and Technology Agency, KOUICHI OKUNISHI, Niigata University, KIYOMI OKAMOTO, Tokyo Institute of Technology — The S=1/2 three-leg frustrated antiferromagnetic spin tube is investigated using the numerical diagonalization, density matrix renormalization group, and effective field theory techniques. Varing one of the three rung couplings, a quantum phase transition between the spin gap and gapless phases was predicted in our previous work[1]. The present phenomenological renormalization approach gives a phase diagram of the spin gap. In addition we study the magnetization process of the regular triangle spin tube. Our present effective field theory between the lower critical field where the spin gap vanishes, and the upper critical field where the magnetization is saturated, predicts two field-induced new phases appear; the one has the vector chiral order and the other has an inhomogeneous distribution of the magnetization. These two phases coexist with the Tomonaga-Luttinger liquid phase. The prediction is confirmed by the numerical diagonalization and finite-size scaling analyses.
[1] T. Sakai, M. Matsumoto, K. Okunishi, K. Okamoto and M. Sato: Physica E 29 (2005) 633.

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