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Energy gap of 3-leg spin tube TORU SAKAI, Tohoku University, MUNEHISA MATSUMOTO, Tohoku University, KOICHI OKUNISHI, Niigata University, KIYOMI OKAMOTO, Tokyo Institute of Technology, MASAHIRO SATO, Tokyo Institute of Technology — Recently some quantum spin systems on tube lattices, so called spin nanotubes, have been synthesized. They are expected to be interesting low-dimensional systems like the carbon nanotubes. As the first step of theoretical study on the spin nanotube, we investigate the S=1/2 three-leg spin tube, which is the simplest one, using numerical analyses of finite clusters and a finite-size scaling technique. The spin gap, which is one of the most interesting macroscopic quantum effects, was revealed to be open for any finite rung exchange couplings, in contrast to the three-leg spin ladder system which is gapless. It is consistent with the previous effective Hamiltonian approach.[1] We also found a new quantum phase transition caused by an asymmetric rung interaction. When one of the three rung coupling constants is changed, the spin gap would vanish. The present size scaling analysis indicated that the region of the ratio of two rung couplings where the spin gap is open, decreases abruptly with increasing system size. It implies that this novel and exotic quantum phase transition would be observed in some nano-scale systems. [1] K. Kawano and M. Takahashi, J. Phys. Soc. Jpn. 66 (1997) 4001.

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