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String solutions and Mott physics in quasi-one-dimensional antiferromagnets MASANORI KOHNO, WPI Center for Materials Nanoarchitectonics, NIMS, Japan — Mott insulators are caused by repulsive interactions between electrons, whereas band insulators are due to full filling of a single-particle band. In the one-dimension (1D) Hubbard model, the upper Hubbard band (UHB) has been identified with k-Λ string solutions [1]. Similarly, in the 1D spin-1/2 antiferromagnetic Heisenberg model, the high-energy magnetic excitations in a magnetic field have been identified primarily with 2-string solutions [2]. We can intuitively understand the correspondence between the high-energy states and the UHB, by mapping the Heisenberg model to the hard-core boson model with repulsive interactions. Furthermore, noting that the high-energy states persist in anisotropic triangular antiferromagnets [3], we can interpret the high-energy magnetic excitations observed in quasi-1D antiferromagnets such as Cs_2CuCl_4 and $CuCl_2{\cdot}2N(C_5D_5)$ in a magnetic field in the context of the Mott physics: the high-energy magnetic excitations, whose origin can be traced back to the string solutions, are due to repulsive interactions between hard-core bosons (down-spins) mapped from the Heisenberg model. [1] M.K., Phys. Rev. Lett. 105, 106402 (2010). [2] M.K., Phys. Rev. Lett. 102, 037203 (2009). [3] M.K., Phys. Rev. Lett. 103, 197203 (2009).

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