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Vortex Berry phases and the magnetization of quantum magnets AKIHIRO TANAKA, National Institute for Materials Science, KEISUKE TOTSUKA, Yukawa Institute of Theoretical Physics, Kyoto University, XIAO HU, National Institute for Materials Science — We revisit the magnetization process of quantum antiferromagnets subject to an external magnetic field, and show how an interpretation in terms of Berry phases emerges. First we develop a continuum variant of the Lieb-Schulz-Mattis- type approach to the 1d problem, and find that the well-known commensurability condition of Oshikawa et al derives from the Berry-connection theory of the crystal momentum of a magnet first suggested by Haldane. Building on the physical picture which arises from this analysis, we then go on to formulate an effective field theory which can deal with the higher dimensional cases. We show that a topological term associated with vortices of the XY-like slowly varying fields controls the behavior of the system. Finally we utilize this new framework to discuss possible occurrences of fractionalized states.

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