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Longitudinal and transverse heat transports of quantum spin liquids

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Study of disordered states of quantum spins in two-dimensions, so-called quantum spin liquids (QSLs), has been attracting attention because 2D QSL can be a new state of matter characterized by unknown quasiparticles. Recent discoveries of materials possessing an ideal 2D triangular or a kagomé lattice have spurred a lot of experimental pursuit to identify the ground state. Especially, identifying the elementary excitation characterizing the ground state has been the central focus of attention. In this presentation, I will present our transport studies of organic insulators with triangular lattices [1] and inorganic kagomé material Volborthite $Cu_3V_2O_7(OH)_2{\cdot}2H_2O$. From NMR studies of the slightly distorted kagomé material, multiple ordered phases have been found in low temperatures and under high fields [2]. Upon entering one of the ordered phases under field, we have found an increase of the thermal conductivity, showing an additional thermal transport due to spin wave excitations. Above the ordering temperature, we've found a finite transverse heat transfer in this transparent insulator. We will discuss origins of the thermal-Hall conductivity in terms of the spinon thermal-Hall effect [3].

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[2] M. Yoshida et al.: J. Phys. Soc. Jpn. **81** (2012) 024703.
[3] H. Katsura et al.: Phys. Rev. Lett. **104**, 066403 (2010).