

学習院大学物性物理セミナー

“Triplon Hall effect in the Shastry Sutherland material”

講演者: Karlo Penc 教授

The Institute for Solid State Physics and Optics, Wigner Research Centre for
Physics, Hungarian Academy of Sciences

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$\text{SrCu}_2(\text{BO}_3)_2$ is the archetypal quantum magnet with a gapped dimer-singlet ground state and triplon excitations. It serves as an excellent realization of the Shastry Sutherland model, up to small anisotropies arising from Dzyaloshinskii Moriya (DM) interactions. We demonstrate that the DM couplings in fact give rise to topological character in the triplon band structure. The triplons form a new kind of a Dirac cone with three bands touching at a single point, a spin-1 generalization of graphene. An applied magnetic field opens band gaps leaving us with topological bands with Chern numbers ± 2 . $\text{SrCu}_2(\text{BO}_3)_2$ is thus a magnetic analogue of the integer quantum Hall effect and supports topologically protected edge modes. At a critical value of the magnetic field set by the strength of DM interactions, the three triplon bands touch once again in a spin-1 Dirac cone, and lose their topological character. We predict a strong thermal Hall signature in the topological regime.

責任者 (物理学科: 宇田川 将文)