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Chiral Spin Textures in a Frustrated Kondo Lattice Model

The spin-charge coupled systems arranged on geometrically frustrated lattices stabilize chiral configurations of localized spins that drive unconventional transport phenomenon such as topological Hall Effect. We investigate Shastry-Sutherland Kondo lattice model (SS-KLM) with localized spins extensively in different parameter regimes for the ground state phases with unique topological properties using suite of numerical methods. We present the results for IQHE on Shastry-Sutherland lattice and discuss the role of frustration, disorder potential and temperature on Hall and longitudinal conductivities. We establish the existence of several non-coplanar ground states focusing on previously unknown canted-Flux state in the phase diagram of SS-KLM using variational ansatz at $T = 0$. Using unbiased Monte Carlo method we show that this complex ground state is stabilized against thermal fluctuations for $n_e = 1/2$. Moreover, the non-coplanarity of such chiral spin textures can be tuned using magnetic field. We also demonstrate that non-coplanar ground states are stabilized for $n_e = 1/4$ and $3/4$ against thermal fluctuations. Tuning the strength of frustration and magnetic field is shown to drive the system through different topologically non-trivial states. Our results are crucial in understanding the magnetic and electronic properties of the rare earthtetraboride family of frustrated metallic magnets.