

# Physics and Physical Oceanography Seminar

## Topological Hall effect in the Shastry-Sutherland lattice

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**DATE:** Thursday, Nov 12, 2020

**TIME:** 3:30 pm

**Place:** Webex (link will be sent out)

**ABSTRACT:** We study the classical Heisenberg model on the geometrically frustrated Shastry-Sutherland (SS) lattice with additional Dzyaloshinskii-Moriya (DM) interaction in the presence of an external magnetic field. We show that several noncollinear and noncoplanar magnetic phases, such as the flux, all-in / all-out, 3in-1out / 3out-1in, and canted-flux phases are stabilized over wide ranges of parameters in the presence of the DM interaction. We discuss the role of DM interaction in stabilizing these complex magnetic phases. When coupled to these noncoplanar magnetic phases, itinerant electrons experience a finite Berry phase, which manifests in the form of topological Hall effect, whereby a non-zero transverse conductivity is observed even in the absence of an external magnetic field. We study this anomalous magneto-transport by calculating the electron band structure and transverse conductivity for a wide range of parameter values, and demonstrate the existence of topological Hall effect in the SS lattice. We explore the role of the strength of itinerant electron-local moment coupling on electron transport and show that the topological Hall features evolve significantly from strong to intermediate values of the coupling strength, and are accompanied by the appearance of a finite spin Hall conductivity.

ALL ARE WELCOME!