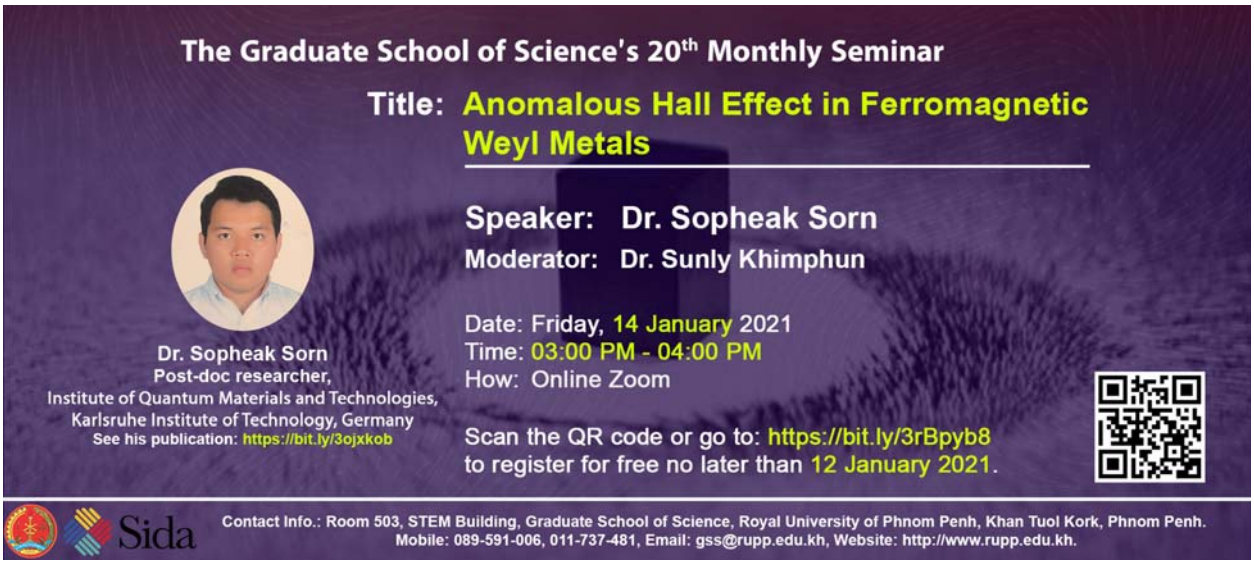

Summary of the Talk:

Hall effect occurs when a Hall voltage is generated perpendicular to the direction of an applied current in a system. Magnetic systems, with spontaneous magnetization such as iron and nickel, can exhibit a large Hall effect. A huge proportional of this, however, cannot be accounted by the classical Hall effect from Lorentz force. This is known as the anomalous Hall effect(AHE.) Hall effect has been intensely studied due to a fundamental connection with topology in condensed matter physics. In two-dimensional topological Chern insulators, experimentally measurable Hall conductivity is directly related to the Chern-number topological invariants of the electronic bands. In this talk, I will focus on AHE in three-dimensional topological Weyl metals hosting pairs of Weyl nodes in the band structure, and I will discuss a recent work which introduces a new microscopic setting where the AHE can arise from domain-wall skew scattering.

Sopheak Sorn

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Education

2016-2021:	University of Toronto, Ontario, Canada PhD in Theoretical Condensed Matter Physics
2015-2016:	University of Waterloo, Ontario, Canada MSc in Physics, Perimeter Scholars International Program
2011-2015:	Hong Kong University of Science and Technology, Hong Kong BSc in Physics and Mathematics, First class honour

Research Experience

2021-now:	Postdoctoral researcher Principal investigator: Professor Markus Garst, Karlsruhe Institute of Technology Studying dynamics of magnetic skyrmions and impacts of dynamical magnetic fluctuations in chiral magnets
2016-2021:	PhD in Physics Advisor: Professor Arun Paramekanti, Department of Physics, University of Toronto Thesis: "Topology and magnetism in correlated matter" Studied the interplay of magnetism and topology in the context of correlated Chern insulators, skyrmions, and Kerr/Hall effects in Weyl metals. Supervising experience: mentored one undergraduate student and one masters student.
2015-2016:	MSc student Advisor: Professor Yong-Baek Kim, Physics, University of Toronto Research essay: Used projective symmetry group analysis to classify symmetry-unbroken wavefunctions for studying spin liquid phases in an anisotropic Kagome spin system. Results were published in PRB. (see Publications)

Publications

1. L. E. Chern, R. Schaffer, S. Sorn, Y.B. Kim, "Fermionic spin liquid analysis of the paramagnetic states in Volborthite", Phys. Rev. B, 96, 165117 (2017)

2. S. Sorn, "Bilayer Haldane model: from trivial insulator to fractionalized quantum anomalous Hall insulator", Phys. Rev. B, 98, 125145 (2018)
3. S. Sorn, S. Divic, A. Paramekanti, "Tuneable skyrmion crystals and topological quantum oscillations in magnetic metals", Phys. Rev. B, 100, 174411 (2019)
4. M. F. Bartram, S. Sorn, Z. Li, K. Hwangbo, S. Shen, F. Frontini, L. He, P. Yu, A. Paramekanti, L. Yang, "Anomalous Kerr effect in $SrRuO_3$ thin films", Phys. Rev. B, 102, 140408 (R) (2020).
5. S. Sorn, A. Paramekanti, "Domain-wall skew scattering in ferromagnetic Weyl metals", Phys. Rev. B, 103, 104413 (2021).
6. F. L. Buessen, S. Sorn, I. Martin, A. Paramekanti, "Nematic order driven by superconducting correlations", arXiv:2101.03174 (2021).
7. S. Sorn, L. Yang, A. Paramekanti, "Resonant optical topological Hall conductivity from skyrmions", Phys. Rev. B, 104, 134419 (2021).

Talks

- Presented at Skyrmionics Retreat Meeting 2021, Bad Honnef, Germany
  "Impacts of skyrmions on thermodynamic and optical properties of metallic magnets".

- Presented at APS March Meeting 2021 (virtual)
  "Anomalies in Kerr and Hall effect in $SrRuO_3$ thin films".

- Presented at Strongly Correlated System Conference 2019, Okayama, Japan
  "Topological Kerr effect".

- Presented at APS March Meeting 2019, Boston, US
  "Tuneable skyrmion crystals and topological quantum oscillations in magnetic metals".

- Presented a poster at Canadian Institute for Advanced Research Summer School 2019, Vancouver.
  "Tuneable skyrmion crystals and topological quantum oscillations in magnetic metals".

- Presented at Quantum Materials and Dynamics Seminar 2019, University of Toronto, Toronto.
  "Skyrmions: impacts of real-space topology on various electronic properties"

Related Experience

- Refereed manuscripts for PRL

- Attended the International Summer School in Computational Quantum Materials 2018, Quebec, Canada. Included topics: quantum Monte-Carlo, dynamical mean field theory, density functional theory, and their variants.

- Attended the Canadian Institute for Advanced Research Summer School 2019, Vancouver.

- Attended the Princeton Summer School on Condensed Matter Physics 2019: "Emergent Phenomena and Correlated Physics in Two-Dimensional Materials," Princeton University.

- Attended the Princeton Summer School on Condensed Matter Physics 2020: "Magnetism in Quantum Materials," virtual.

- Attended the 2021 Maglab Theory Winter School: "Modern Aspects of Quantum Condensed Matter", virtual.

Graduate Level Courses

At University of Toronto:

- Quantum field theory 1	Professor Michael Luke
- Advanced statistical mechanics	Professor Yong-Baek Kim
- Many-body physics	Professor Hae-Young Kee
- Quantum theory of solid 2	Professor Yong-Baek Kim

At Sherbrooke University:

- Specialised subjects in physics III: computational methods for quantum materials (summer school 2018)

At Perimeter Institute:

- Statistical physics	Professor Ganapathy Baskaran
- Quantum physics	Professor Joseph Emerson
- Quantum field theory 1	Dr. Tibra Ali, Dr. Dan Wohns
- Quantum field theory 2	Professor Francois David
- Condensed matter physics	Professor Oleg Tchernyshyov
- Relativity	Professor Neil Turok

Teaching Experience

- Teaching assistant: Thermal Physics, University of Toronto, 2018-now.
    - Tutored and led discussions in tutorial sessions.

- Teaching assistant: Introduction to Physics, University of Toronto, 2016-2020.
    - Tutored, monitored lab activities and led discussions in lab sessions.

References

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