

# 固体物理セミナー

(令和二年度 第2回)

(インタラクティブ物質科学カデットプログラム講演会)

日時：12月7日(月) 15:10-16:40

場所：Zoomにて

<https://us02web.zoom.us/j/81052607625?pwd=VHRFYkJGT0d0TjVqYVkyY0gxMXkxZz09>

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題目：“Spins in Low-dimensional Materials Systems: Transport, Gatecontrol and Conversion”

要旨：Transport, control and conversion of spins in condensed matters have been pivotal concepts in spintronics. Spin transport is the most fundamental concept to realize spin-dependent phenomena, spin control mainly by gating enables information switching using a spin degree of freedom, and spin conversion allows detection of spins, a dissipative physical quantity. Whilst bulk metallic and semiconducting systems have been to date major material stages to realize the aforementioned concepts, low-dimensional materials systems such as atomically-flat two-dimensional materials [1-3], two-dimensional electron gases formed at an interface of a heterostructure [4,5], topologically-protected Dirac surface states in topological insulators [6,7] and ultrathin films [8] are becoming attractive materials stages to pursue novel spintronic concepts and phenomena. I will introduce the attractiveness of these new materials systems, cover an overview of the central achievements, and focus on recent investigation to pioneer novel spintronic physics in the low-dimensional materials systems.

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- [2] S. Dushenko, M. Shiraishi et al., “Gate-tunable spin-charge conversion and the role of spinorbit interaction in graphene”, *Phys. Rev. Lett.* 116, 166102 (2016).
- [3] A.W. Cummings, S. Roche et al., “Giant spin lifetime anisotropy in graphene induced by proximity effects”, *Phys. Rev. Lett.* 119, 206601 (2017).
- [4] R. Ohshima, M. Shiraishi et al., “Strong evidence for d-electron spin transport at room temperature at a LaAlO<sub>3</sub>/SrTiO<sub>3</sub> interface”, *Nature Mater.* 16, 609 (2017).
- [5] E. Lesne, M. Bibes et al., “Highly efficient and tunable spin-to-charge conversion through Rashba coupling at oxide interface”, *Nature Mater.* 15, 1261 (2016).
- [6] Y. Shiomi, E. Saitoh et al., “Spin-electricity conversion induced by spin injection into topological insulators”, *Phys. Rev. Lett.* 113, 196601 (2014).
- [7] Yuichiro Ando, M. Shiraishi et al., “Electrical detection of the spin polarization due to charge flow in the surface state of the topological insulator Bi<sub>1.5</sub>Sb<sub>0.5</sub>Te<sub>1.7</sub>Se<sub>1.3</sub>”, *Nano Lett.* 14, 6226 (2014).
- [8] S. Dushenko, M. Shiraishi et al., “Tunable inverse spin Hall effect in nanometer-thick platinum films by ionic gating”, *Nature Commun.* 9, 3118 (2018).

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- \* 固体物理セミナーは、物性・未来(物性系) M2必修科目「ゼミナールIV」に該当します。
- \* 今回の講演は2020年のIEEE(米国電気学会) Magnetics SocietyのDistinguished lectureです。