Yuki Itahashi[1]
Yu Saito[1], Toshiya Ideue[1], Tsutomu Nojima[2], Yoshihiro Iwasa[1,3]
[1]Department of Applied Physics, The University of Tokyo, Tokyo 113-8656, Japan
[2]Institute for Materials Research, Tohoku University, Sendai 980-8577, Japan
[3]RIKEN Center for Emergent Matter Science (CEMS), Wako 351-0198, Japan
itahashi@mp.t.u-tokyo.ac.jp

Quantum and classical vortex ratchets in a trigonal 2D superconductor MoS_2

One of the unique features of recently emerging 2D superconductors is the quantum metallic state, which is a temperature-independent finite resistive state that appears once finite magnetic field is switched on [1, 2]. This quantum metallic state exhibits a sharp contrast with the conventional superconductor-insulator transition in 2D systems, where the metallic state appears only at a single critical point. To investigate the vortex dynamics which governs the resistance in the quantum metallic state, we have investigated the nonreciprocal transport in gated MoS_2, an archetypal noncentrosymmetric 2D superconductor with trigonal symmetry. We found that the second harmonic resistance $R_{xx}^{2\omega}$ appears when the vortex motion is controlled by the classical vortex flow, while $R_{xx}^{2\omega}$ is substantially suppressed when the vortex motion is in quantum creep region. The present result indicates that the trigonal 2D superconductor is a new model system for investigation of quantum and classical ratchets.

References

[1] Y. Saito *et al., Science.* **350**, 409–413 (2015).
[2] A. W. Tsen *et al., Nat. Phys.* **12**, 208–212 (2016).

Figures

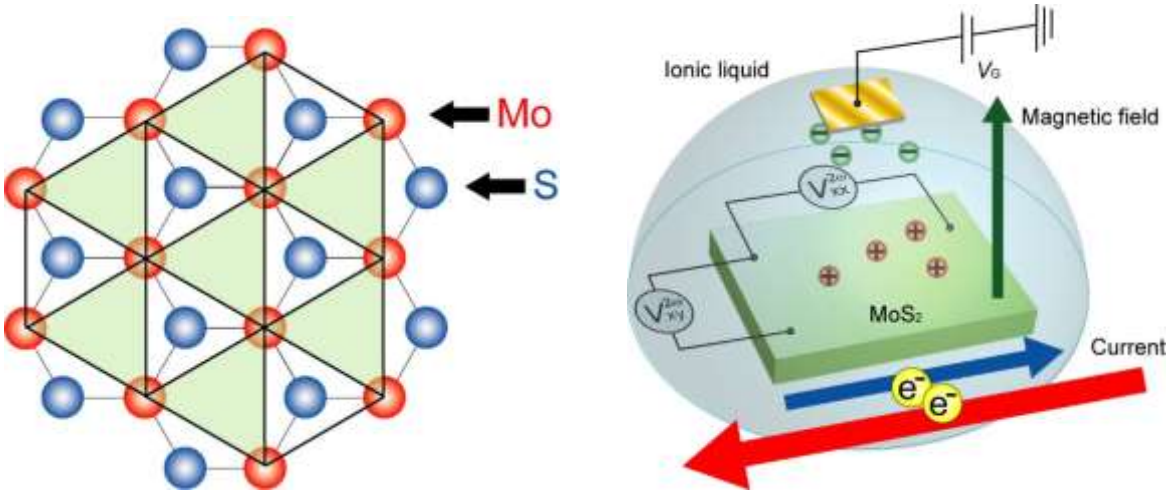

Figure 1: Trigonal crystal structure of MoS_2 and measurement setup.