

# On-line SPICE-SPIN+X Seminars



**Wednesday, 21st July 2021, 15:00 (German Time)**

The seminar will be via Zoom ([Meeting ID: 891 7981 3272](#)) and live streamed in the SPICE YouTube Channel.



**Shunsuke Fukami**

*Tohoku University*

## **Electrical manipulation of non-collinear antiferromagnet**

Electrical manipulation of magnetic materials has been of paramount interest in the spintronics research for the last quarter of a century, and many interesting phenomena have been revealed, offering various opportunities of applications. Non-collinear antiferromagnet with chiral-spin structure is an attractive system showing intriguing properties that had been believed to be inherent to ferromagnets, such as the anomalous Hall effect [1]. A recent study demonstrated an electrical switching of chiral-spin structure in the same protocol with magnetization switching in ferromagnets [2].

In this seminar, I will show a new phenomenon unique to the non-collinear antiferromagnet, i.e., chiral-spin rotation [3]. We use Hall-bar devices with an epitaxial stack consisting of non-collinear antiferromagnetic Mn<sub>3</sub>Sn and heavy metals with large spin-orbit coupling [4,5]. An unconventional response of the Hall resistance under current applications is observed, which can be attributed to the continuous rotation of chiral-spin structure in Mn<sub>3</sub>Sn driven by the spin-orbit torque. We also find that the efficiency to manipulate the magnetic structure through this scheme is much higher than that in collinear ferromagnets and ferrimagnets.

[1] S. Nakatsuji et al., *Nature* 527, 212 (2015).

[2] H. Tsai et al., *Nature* 580, 608 (2020).

[3] Y. Takeuchi et al., *Nature Materials*, advanced online publication (2021). <https://doi.org/10.1038/s41563-021-01005-3>.

[4] J.-Y. Yoon et al., *Appl. Phys. Express*, 13, 013001 (2019); J.-Y. Yoon et al. *AIP Adv.* 11, 065318 (2021).