セミナーのご案内

# SEMINAR

**August 26 (Fri.) 2022, 15:00 ~ 16:00**

Hybrid style (in-person + Zoom)

in-person: Auditorium, 1F, 2nd Bldg. IMR, Tohoku Univ.

（東北大学金属材料研究所 2 号館 1F 講堂）

## “Controlling magnetism and spin dynamics by carrier doping in van der Waals magnets”


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Two-dimensional (2D) van der Waals (vdW) materials have been intensively and extensively studied in the last two decades. A magnetic version of vdW systems has only gained attention since 2017 where a few mono-layers of exfoliated magnetic vdW ones were reported to sustain magnetism [1.2]. Since then, scientists started to seriously explore the physics and materials science of this new class of materials by applying their own research ideas and growth/measurement techniques. These material groups are ideal, for example, in studying magnetism and spin transport at the truly 2D limit, as well as unique responses to external stimuli, such as current-induced torques and electric field. These experiments will be further enriched by an unlimited combination of heterostructures with dissimilar properties, such as magnetism, ferroelectricity and superconductivity. In terms of spintronic functionality, inherent low symmetry nature of vdW materials will offer a wealth of spin-orbit Hamiltonians that are the backbone of current-induced magnetization switching research and future technologies [3].

In this presentation, I will start with a brief introduction of magnetic 2D vdW materials and then move on to our work of controlling magnetism (Curie temperatures and magnetic anisotropies) in $Cr_2Ge_2Te_6$ (CGT) by electric field [4] and chemical doping. Both doping techniques show the change of carrier density in CGT by orders of magnitude (from insulator to metallic). As a result, the exchange coupling strength has been greatly enhanced, leading to Curie temperature enhancement. The carrier doping also modifies the spin-orbit interaction within CGT which is measured by a significant change of the magnetic anisotropy parameters. These have been characterized by magneto-transport as well as spin dynamics techniques [5]. Furthermore, if time permits, I will also show our study of photon-magnon hybrid states between nm-thick CGT flakes and on-chip superconducting resonators [6].



[1] Gong et al. Nature 546 265 (2017). [2] Huang et al., Nature 546, 270 (2017). [3] H. Kurebayashi et al., Nat. Rev. Phys. 4, 150 (2022). [4] Verzhbitskiy et al., Nature Electron. 3, 460 (2020). [5] e.g. S. Khan et al., Phys. Rev. B 100, 134437 (2019). [6] C. W. Zollitsch et al., arXiv:2206.02460


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