作成者：　LAU Yong Chang（東北大金研）

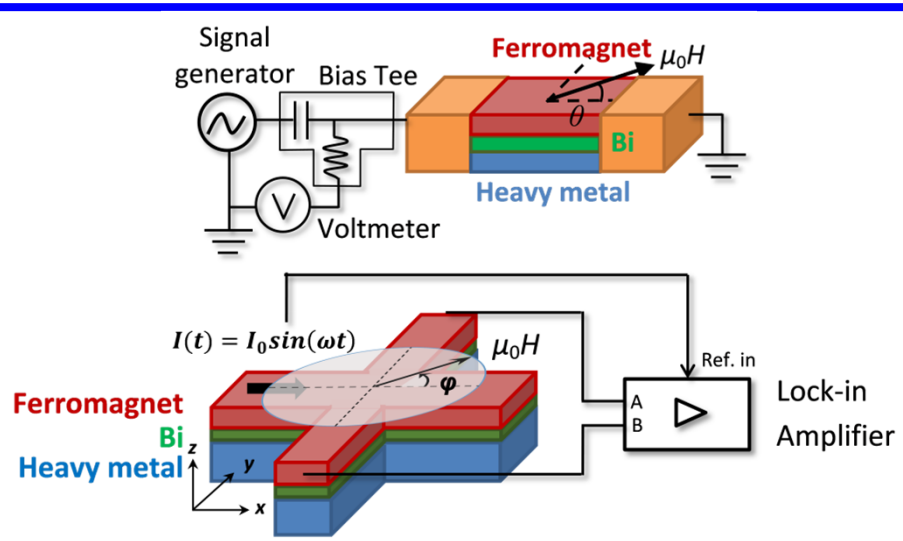
研究プロジェクト名：
Spin transport in Bismuth-based heterostructures

概要：Bismuth (Bi) is one of the heaviest elements in nature with strong spin-orbit coupling. However, the spin Hall angle of elemental Bi is relatively small compared to many 5*d* transition metals (*e.g.* Pt, Ta and W). It remains an open fundamental question whether the low charge-spin conversion efficiency in Bi is inherent to its intrinsic properties or is due to the poor spin transparency at the interface. In this project, we combine spin-torque FMR and harmonic Hall techniques to characterize the spin transport in Bi-based heterostructures. Samples will be grown in The University of Tokyo, and measurements will be mostly done in IMR, Tohoku University.

コアメンバー：Lau・高梨Gr（東北大金研）、林Gr（東京大学）

期待される研究成果：

- Understand the spin transport across interfaces containing Bi
- Evaluate the spin diffusion length in Bi
- Measure the intrinsic spin Hall angle of Bi and Bi-based alloys
- Reveal the origin of the spin Hall effect in Bi and Bi-based alloys



Schematic illustrations of experimental setup: Spin-torque FMR (top) and harmonic Hall (bottom)

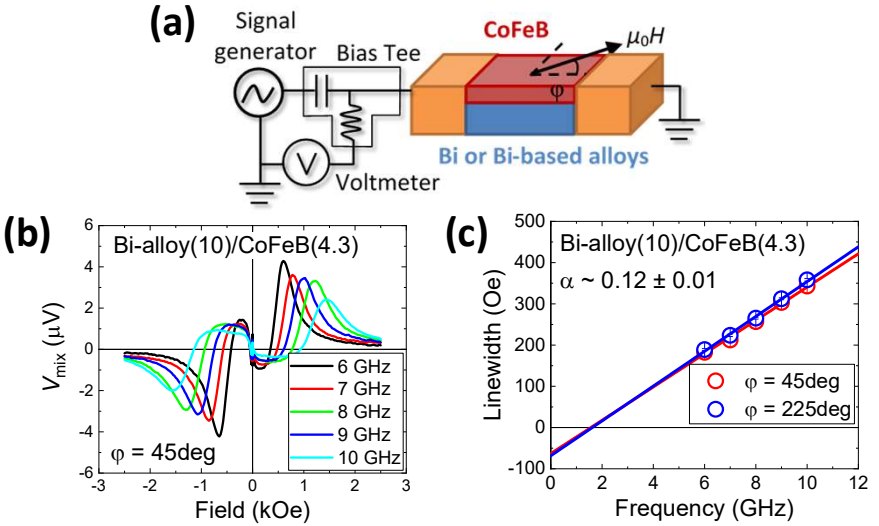
作成者：LAU Yong Chang（東北大金研）

研究プロジェクト名：Spin transport in Bismuth-based heterostructures

概要：We have combined spin-torque ferromagnetic resonance (ST-FMR) and harmonic Hall techniques to characterize the charge-to-spin conversion in heterostructures containing elemental Bismuth (Bi) or Bi-based alloys. We have also investigated the thermo-electric properties of the heterostructures by intentionally applying a thermal gradient.

研究成果（実施状況）：

- **Demonstrate efficient charge-to-spin conversion in electron and hole-doped Bi/CoFeB bilayers**
- **Spin Hall angle quantification using ST-FMR and harmonic Hall technique yields consistent results**
- **Discover large Gilbert damping (>0.1) in heterostructures containing elemental Bi or Bi-based alloys**



(a) Schematic illustration of the ST-FMR experiment. (b) Typical ST-FMR spectra for Bi-alloy/CoFeB bilayer. (c) Evaluation of Gilbert damping from the FMR linewidth against frequency plot.

主要発表論文等：[1] Z. Chi, Y.-C. Lau, et al. (In preparation).