Minicolloque n° 27 ☑ **Oral** ☐ **Poster**

Disentangling contributions to the ultrafast spin-to-charge conversion: Experimental approach

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Spintronics is the new thriving field that aims to exploit electron spin degree of freedom for potential applications in computing, storage, and fundamental science. Spintronic devices are promising in terms of lower power consumption, higher information density, and non-volatility compared to conventional electronics. To utilize the electron spin to its fullest potential, one should answer the question about efficient generation and detection of the transfer of the electron's intrinsic angular momentum without accompanying motion of charge, thus generating pure spin-current.

Over the last three decades, academic community and industry have learned to control the solid state's spin degrees of freedom in the static regime[1]. The breakthrough in transient spintronics can be attributed to the detection of the terahertz (THz) radiation, emitted as consequence of an ultrashort spin-current burst injection from ferromagnet into metallic layer[2]. In addition to beforementioned Inverse Spin-Hall (ISHE) spin-to charge conversion mechanism, it has been demonstrated that transient charge current can be generated via Inverse Rashba-Edelstein[3,4] (IREE) and Anomalous Hall[5] (AHE) effects.

We use 165 femtosecond, 805 nm laser pulses to generate the ultrafast spin-current burst in 5 and 20 nm thick ferromagnet FeCoB. Non-zero net spin current then gets converted into charge current within ferromagnet itself (AHE), at the MgO interface (IREE) or inside the 3 nm thick Pt layer (ISHE) separately deposited onto the FeCoB. With comparative analysis we try to uncouple ISHE, IREE and AHE that contribute to the emitted THz as a result of ultrafast spin-to-charge conversion.

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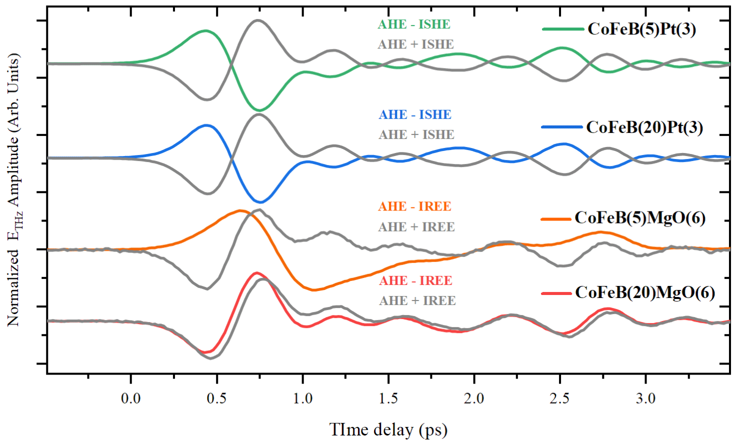

Figure 1: Transient THz waveform emitted from the MgO- and Pt-based heterostructures with different thickness of FeCoB layer. Gray color corresponds to the laser excitation from the opposite face of the sample. All graphs are normalized to 1.