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Longitudinal Spin Seebeck Effect

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The spin Seebeck effect (SSE) refers to the generation of a spin voltage as a result of a temperature gradient in magnetic materials [1-7]. Here, a spin voltage is a potential for electron spins to drive a nonequilibrium spin current; when a conductor is attached to a magnet with a finite spin voltage, it induces a spin injection into the conductor. The SSE is of crucial importance in spintronics and spin caloritronics, since it enables simple and versatile generation of a spin current from heat. The simplest and most straightforward setup of the SSE is the longitudinal configuration [4], in which a spin current flowing parallel to a temperature gradient is measured via the inverse spin Hall effect (ISHE). The longitudinal SSE device consists of a ferromagnetic or ferrimagnetic insulator (FI, e.g. YIG) covered with a paramagnetic metal (PM, e.g. Pt) film. When a temperature gradient is applied perpendicular to the FI/PM interface, an ISHE-induced voltage is generated in the PM layer. In this talk, we report the observation of the longitudinal SSE in various FI/PM systems and provide evidence that the longitudinal SSE is free from thermoelectric artefact [7], i.e., the anomalous Nernst effect caused by extrinsic magnetic proximity [8]. Then, we discuss the longitudinal SSE from an application point of view [6]. We thank E. Saitoh, S. Maekawa, G. E. W. Bauer, X.-F. Jin, H. Adachi, D. Hou, D. Tian, T. Kikkawa, A. Kirihara, and M. Ishida for their support and valuable discussions.

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