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Magnetization dynamics under heat current in metallic spin valves and in insulators

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Spin caloritronics, an emerging branch of spintronics, studying the addition of thermal effects to the electrical and magnetic properties of nanostructures, has recently seen a rapid development. It has been predicted by Hatami et al. that a heat current can exert a spin torque on the magnetization in a nanostructure, analogous to the well-known spin-transfer torque induced by an electrical current. We provided the experimental evidence for the thermal spin-transfer torque effect in spin valves, showing the switching field change with heat current. I will present measurements of the second harmonic voltage response of Co-Cu-Co pseudo-spinvalves deposited in the middle of Cu nanowires. Both the magnitude of the second harmonic response of the spin valve and the field value of the maximum response are found to be dependent on the heat current. Both effects show that the magnetization dynamics of the pseudo-spinvalves is influenced by the heat current. Thus, the data provide a quantitative estimate of the thermal spin torque exerted on the magnetization of the Co layers. In addition, I will present recent study on the magnetization dynamics in a magnetic insulator YIG film under in-plane heat current. The ferromagnetic resonance linewidth is found to be tuned by the applied temperature gradient, i.e. narrowing and broadening. This suggests that the Gilbert damping parameter is compensated or reinforced by the applied temperature gradient in respective direction. These observations can be understood as a heat-driven spin torque in magnetic insulators.