Spin waves in insulating magnets are ideal carriers for spin currents with low energy dissipation. An electric field can modify the dispersion of spin waves, by directly affecting, via spin-orbit coupling, the electrons that mediate the interaction between magnetic ions. Our microscopic calculations based on the superexchange model indicate that this effect of the electric field is sufficiently large to be used to effectively control spin-wave spin currents. We apply these findings to the design of spin-wave phase shifter, and a spin-wave interferometric device, which acts as a logic inverter and can be used as a building block for room-temperature, low-dissipation logic circuits. This part of work has been published in Phys. Rev. Lett. and J. Appl. Phys..

Besides the magneto-electric effect, we also study the magneto-thermal effect that couples the spin-wave spin current to the thermal current. In analogy to Coulomb-drag effect, we propose a spin-wave drag effect due to magnetic dipolar interaction in a ferromagnetic bilayer system. Compared with Coulomb drag effect in electron gas bilayer, we find that here the interlayer transport coefficients abnormally increase as the temperature decreases because of bosonic statistics of magnons. Besides, the coefficients show an angular dependence on the angle between saturation magnetization and spin-wave spin current.