Magnon-drag thermopile

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Thermoelectric effects in spintronics are gathering increasing attention as a means of controlling spin information by using heat flow. Thermal magnons (spin-wave quanta) are expected to play a major role, however, the coupling between electrons and magnons in ferromagnetic metals remains poorly understood. We demonstrate a conceptually new device that enables us to gather information on magnon-electron scattering and magnon-drag effects. The device resembles a thermopile formed by a large number of pairs of ferromagnetic wires placed between a hot and a cold source and connected thermally in parallel and electrically in series. By controlling the relative orientation of the magnetization in pairs of wires, the magnon drag can be studied independently of the electron and phonon drag thermoelectric effects. Measurements as a function of temperature reveal the effect on magnon drag following a variation of magnon and phonon populations. These results demonstrate the feasibility of directly converting magnon dynamics of nanomagnets into an electrical signal and could pave the way to novel thermoelectric devices for energy harvesting.

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