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Bulk Spin Pumping and Bulk Spin Transfer Torque in Two-band Magnetic Conductors[1] WAYNE SASLOW, Texas A&M University — For non-magnetic materials, irreversible thermodynamics shows that thermal conduction and electrical conduction have a new and independent cross-coupling that yields a thermoelectric and an electrothermal effect. All of these terms are dissipative. However, for nonuniform two-band conducting magnets (e.g., within domain walls), electrical conduction and magnetization dynamics are cross-coupled by the up-band and down-band conductivities, without a need for a new cross-coupling. This yields both a bulk spin pumping term driving the current and a bulk spin transfer torque term driving the magnetization. Adiabatic in space, these terms are dissipative. In addition to these spin transfer and spin pumping terms corresponding to existing transport coefficients, for each spin component there are two types of additional transport coefficients. One type modifies the dissipative conductivity-driven terms in spin pumping and spin transfer torque, and itself is dissipative. The other type, non-adiabatic in space, is non-dissipative. We consider the situation where there is a spin current but no net current. Thermal effects are also considered, with temperature gradients having the same symmetry as gradients in the up and down spin electrochemical potentials.

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