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Formalism of Spin and Energy Conductivity in Magnetic Insulators[1] YURIKA KUBO, Department of Physics, Waseda Univ., Tokyo and Okinawa Institute of Science and Technology, SUSUMU KURIHARA, Department of Physics, Waseda Univ. — One of the main aspects for spintronics is manipulating spin currents. However, theoretical studies on spin and energy transports in magnetic insulators are rather restricted to systems where spins and fields are collinear [1]. To open the possibility for realization of spintronics, we need a theoretical basis. We define spin current operators [2] and energy current operators in magnetic insulators, which are applicable for systems with conserved magnetization. Then, we develop formalism of the spin and energy conductivity, using linear response theory [3]. Calculated integrated intensities of conductivity are shown to satisfy f-sum rules. This strongly indicates reliability of our formalism [2, 4]. [1]M. Sentef et al., Phys. Rev. B **75**, 214403 (2007), F. Heidrich-Meisner, et al., Phys. Rev. B **71**, 184415 (2005). [2] Y. Kubo and S. Kurihara, J. Phys. Soc. Jpn. **82** , 113601 (2013). [3] G. D.Mahan: Many-Particle Physics (Plenum Press, New York, 2000) 3rd ed., p. 160. [4] Y. Kubo and S. Kurihara in preparation.

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