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Spin transport in the Neel and collinear antiferromagnetic phase of the two dimensional spatial and spin anisotropic Heisenberg model on a square lattice[1] TRINANJAN DATTA, Augusta State University, ZEWEI CHEN, DAO-XIN YAO, State Key Lab of Optoelectronic Materials and Technologies, School of Physics and Engineering, Sun Yat-sen University — We analyze and compare the effect of spatial and spin anisotropy on spin conductivity in a two dimensional S=1/2 Heisenberg quantum magnet on a square lattice. We explore the model in both the Neel antiferromagnetic (AF) phase and the collinear antiferromagnetic (CAF) phase. We find that in contrast to the effects of spin anisotropy in the Heisenberg model, spatial anisotropy in the AF phase does not suppress the zero temperature regular part of the spin conductivity in the zero frequency limit - rather it enhances it. In the CAF phase (within the non-interacting approximation) the zero frequency spin conductivity has a finite value which is suppressed as the spatial anisotropy parameter is increased. Furthermore, the CAF phase displays a spike in the spin conductivity not seen in the AF phase. We also explore the finite temperature effects on the Drude weight in the AF phase (within the collision less approximation). We find that enhancing spatial anisotropy increases the Drude weight value and increasing spin anisotropy decreases the Drude weight value. Based on these studies we conclude that antiferromagnets with spatial anisotropy are better spin conductors than those with spin anisotropy at both zero and finite temperatures.

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