The Magnon Boltzmann Transport Methods with three Magnons Scattering[1] TAO LIU, YUHENG LI, JIANWEI ZHANG, School of Physics, Tongji University, SPIN TRANSPORT THEORY GROUP, TONGJI UNIV. TEAM — With rising of magnonic, the transport properties of magnon have been attracted great interests in both scientific and industry field. The magnon drag phenomenon [1,2] indicate that magnon not only can transport the coherent information with low dissipation, but also can exchange non-equilibrium magnon's current with spin current. In this work, we invent a new magnon Boltzmann equation that is derived from quantum density matrix formulas, with full magnon-magnon scattering in the scattering terms. Beside two magnons and four magnons scattering, we found that three magnons scattering act important role in magnon relaxations, since collapsing of a higher energy magnon into two lower energy magnon is described only by this three magnons process. We found that in magnetic thin film, dipole-dipole interaction, that is the causation of three magnons scattering, can be as strong as exchange interaction due to strong shape demagnetizing energy. In our theory, we found three magnons scattering engender a novel collective dynamic of magnon, which is the extending of global decay length magnon due to correlation of magnetization by short range dipole-dipole interaction. And we also study how a local magnetic field can adjust the magnon distribution by affecting diffusing length.

[1]Tianyu Liu, G. Vignale, MichaelFlatte, Phys. Rev. Lett. 116, 237202 (2016)
[2] Steven S.L. Zhang and Shufeng Zhang, Phys. Rev. Lett. 109, 096603 (2012)

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