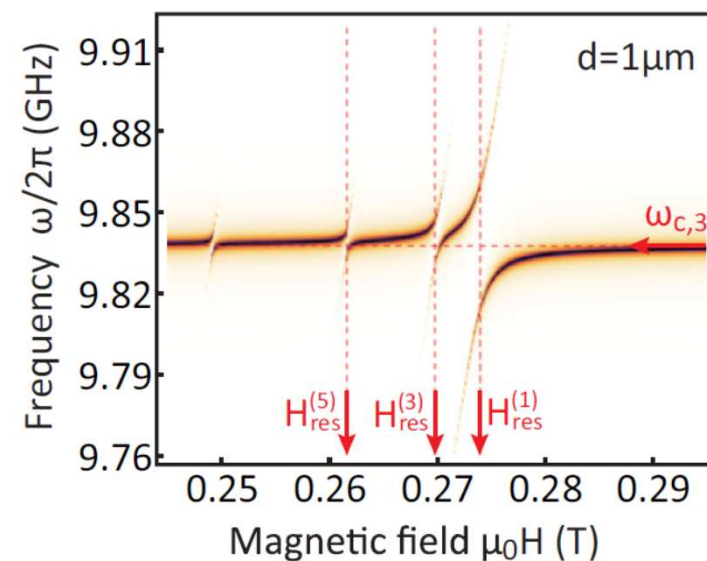


研究プロジェクト名: Cavity-optomagnonics with YIG

概要: Several groups in the world recently realized strong coherent coupling of photons to the ferrimagnet yttrium iron garnet (YIG) in microwave cavities. These studies provide a bridge between the fields of quantum information and spintronics. We will study the theory of the coupled dynamics of electromagnetic fields (visible and microwaves) and the magnetization in YIG spheres and structured thin films.

コアメンバー: Blanterグループ (TU Delft); 宇佐見グループ (東大); Yanグループ (电子科技大学); Bauerグループ (東北大).

期待される研究成果: Our study will lead to better understanding of the electrodynamics of magnetic insulators when strongly coupled to photons and phonons. We will assess the conditions to reach the non-linear regime for high-quality magnets, which would open interesting consequences for quantum manipulation. The electric readout of the strongly coupled magnetization dynamics will be addressed as well.

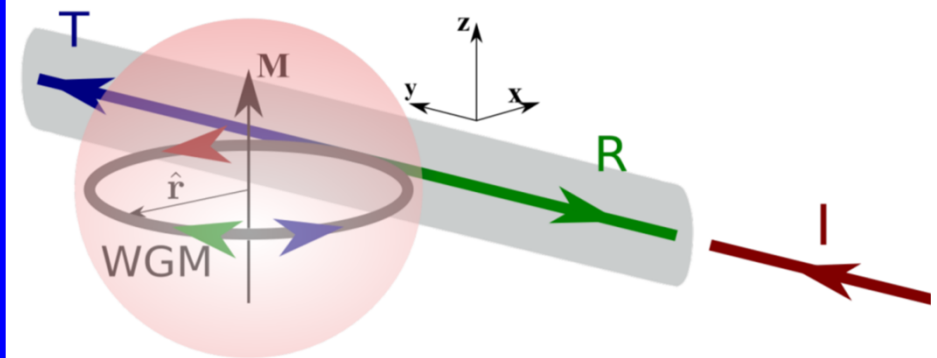


Calculated spin wave resonances of a YIG film with thickness d in a planar microwave cavity.

研究プロジェクト名: Cavity optomagnonics with YIG

概要: Magnets are potential transducers of quantum information between superconducting qubits and light. In the search for strong coupling we addressed the theory of ferrimagnet yttrium iron garnet (YIG) spheres interacting with whispering gallery modes (WGM) of light.

研究成果(実施状況): We studied the spectra of light in optical fibers coupled magnetic spheres. We predict that the chiral magnetic surface (Damon Eshbach) modes cause back-reflection of light with perfect selectivity between Stokes and anti-Stokes scattering. WGMs may be used for an efficient optical cooling of the magnetic order.



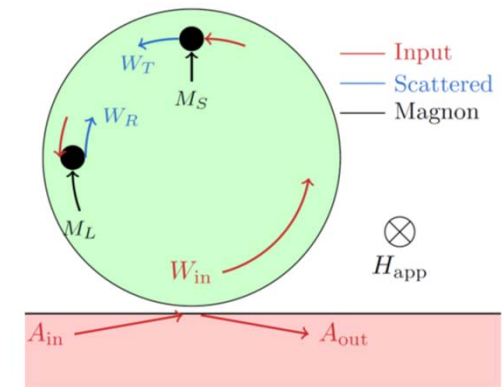
The input light I couples to the whispering gallery modes (WGM) in a dielectric magnetic sphere causes forward (T) and backward (R) inelastic scattering by magnons

主要発表論文等: S. Sharma, Y. M. Blanter, and G. E. W. Bauer, *Light scattering by magnons in whispering gallery mode cavities*, arXiv:1706.04106v1.
K. Usami, G.E.W. Bauer, S. Sinova, SPICE International Workshop on Spin Cavitronics, <https://www.spice.uni-mainz.de/spin-cavitronics-2018/>.

研究プロジェクト名: Cavity-optomagnonics with YIG

概要: Magnets are potential transducers of quantum information between superconducting qubits and light. In the search for strong coupling we addressed the theory of ferrimagnet yttrium iron garnet (YIG) spheres interacting with whispering gallery modes (WGM) of light.

研究成果(実施状況): We model the cooling of a YIG sphere using a monochromatic laser source. When the magnon lifetimes are much larger than the optical ones, we can treat the latter as a Markovian bath for magnons. The steady-state magnons are canonically distributed with a temperature that is controlled by the light intensity. We predict that with state-of-the-art technology such a cooling process can significantly reduce the temperature of the magnetic order.



主要発表論文等:

- S. Sharma, Y. M. Blanter, and G. E. W. Bauer, *Light scattering by magnons in whispering gallery mode cavities*, Phys. Rev. B **96**, 094412 (2017).
- S. Sharma, Y. M. Blanter, and G. E. W. Bauer, *Optical cooling of magnons*, arXiv:1804.02683.
- J. A. Haigh, N. J. Lambert, S. Sharma, Y. M. Blanter, G. E. W. Bauer, and A. J. Ramsay, *Selection rules for cavity-enhanced Brillouin light scattering from magnetostatic modes*, arXiv:1804.00965.
- K. Usami, G.E.W. Bauer, S. Sinova, *SPICE International Workshop on Spin Cavitronics*, <https://www.spice.uni-mainz.de/spin-cavitronics-2018>