

Electrically driven magnetic dynamics

J. Barnaś

Faculty of Physics, Adam Mickiewicz University, ul. Umultowska 85, 61-614 Poznań, Poland

KEY WORDS: Spin waves, magnetization dynamics, ferromagnetic resonance

One of key issues in current spintronics/magnonics is all-electrical control of magnetic (spin) states, and electrically driven magnetic dynamics. This can be achieved by several different methods. Some of the possibilities of electrically driven magnetic dynamics will be briefly discussed in the context of recent theoretical and experimental achievements. This includes spin wave excitation in magneto-electric crystals, where a dynamical electric field can excite spin waves owing to magneto-electric interactions. Another possibility of electrical excitation of magnetic dynamics is due to spin transfer torque and/or spin-orbit torque exerted on a magnetic moment when a current flows through the system. The former torque appears due to absorption of spin current, while the latter torque is a result of current-induced polarization of electrons in the presence of spin-orbit interaction. Both these methods require either charge current or spin current. A pure spin current can be generated for instance due to spin Hall effect in heavy metals (strong spin-orbit coupling). An interesting option appears when magnetic system is on an insulating piezoelectric substrate. Magnetic dynamics can be then excited by a dynamical electric field without accompanying electric current.

References

- [1] L. Liu, Phys. Rev. Lett. 106, 036601 (2011).
- [2] I. M. Miron et al, Nature 476, 189 (2011).
- [3] M. Gmitra, J. Barnaś, Phys. Rev. Lett. 99, 097205 (2007).
- [4] A. Dyrdał, J. Barnaś, Phys. Rev. B 92, 165404 (2015).
- [5] S. Ziętek et al., Appl. Phys. Lett., 109, 072406 (2016).