

Magnonics as a promising concept for future computing?

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The increasing demand for energy from information technologies is often listed as one of the major challenges our society is facing, and as a result, various concepts of more sustainable electronics are being actively studied. One such concept is spintronics [1], which exploits the quantum property of electrons – their spins - to reduce energy costs. Spintronics has already found application in computer memories, where moving electrons carry the spin (as illustrated in Fig. 1a). However, the motion of electrons is also one of the major energy-consuming processes. In the last decade, an alternative concept has been actively discussed – one based on transporting spin momentum in the form of a wave (as illustrated in Fig. 1b), where no moving electrons are required. Such a wave is called a magnon and has given rise to a new research direction called magnonics [2].

In this student project, we aim to develop a device design and measurement algorithm to generate and detect magnons through all-electrical means [3]. We will test the design on a well-known ferromagnetic material initially, and if successful, we can use the same design for the emerging class of materials with compensated magnetic moments. The student will work at the Institute of Physics of the Czech Academy of Sciences, with the opportunity to consult the project with leading experts in the field of magnonics within the international network of the supervisor and advisor.

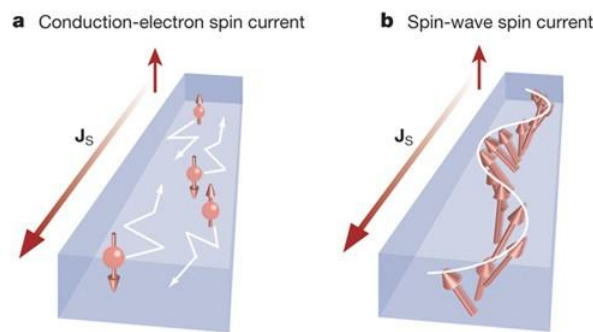


Figure 1: Schematic illustration of the conduction-electron spin current (a) and spin-wave spin current (b). [4]

References

- [1] <https://www.sciencecafe.cz/zaznamy/video/spintronika/>
- [2] Barman et al 2021 J. Phys.: Condens. Matter 33 413001 (2021), DOI 10.1088/1361-648X/abec1a
- [3] Schlitz et al. Phys. Rev. Lett. 126, 257201 (2021), doi.org/10.1103/PhysRevLett.126.257201
- [4] Kajiwara et al. Nature 464, 262–266 (2010), www.nature.com/articles/nature08876