

# Thermo- and magneto-electric Effects in Superconducting Nanostructures

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The main focus of this talk is on superconductors with a spin-split density of states due to, either an external field, or the proximity of a magnetic insulator. The interplay between the superconducting state and spin-splitting fields leads to striking transport phenomena[1] and devices that are discussed in this talk. These include:

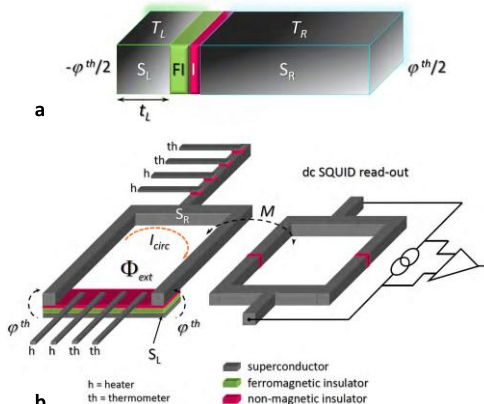
- (i) a thermoelectric transistor based on ferromagnetic insulator- superconductor bilayers [1] ,
- (ii) the occurrence of a thermophase in S-FI-S structures [2],
- (iii) the possibility of using FI-S in high sensitive detectors and thermometers[3], and
- (iv) a heat valve based on a ferromagnetic Josephson junction [4].

In addition I will also discuss first experiments in this field that basically shows the feasibility of such devices[5].

## References

- [1] A. Ozaeta et al, Phys. Rev. Lett. 112, 057001 (2014); F. Giazotto et al, Appl. Phys. Lett. 105 062602 (2014).
- [2] F. Giazotto, T. T. Heikkilä, and F. S. Bergeret, Phys. Rev. Lett. 114, 067001 (2015).
- [3] F. Giazotto, P. Solinas, A. Braggio, and F. S. Bergeret, *Physical Review Applied*, 4(4), 044016 (2015).
- [4] F. Giazotto and F. S. Bergeret, Appl. Phys. Lett. 102, 132603 (2013).
- [5] S. Kolenda et al, Phys. Rev. Lett. 116, 097001 (2016).

## Figures



**Figure 1:** a) Josephson junction between two superconductors and a ferromagnetic insulating layer. b) Setup for measuring the thermophase induced by the temperature difference between the superconducting arms on the left loop. The generated supercurrent can be measured with the help of a second SQUID (right loop).