Physikalisches Kolloquium

Universität Konstanz

Di 05.11.19
15:15 Uhr
14:45 Uhr, Kaffee/Tee
R 513

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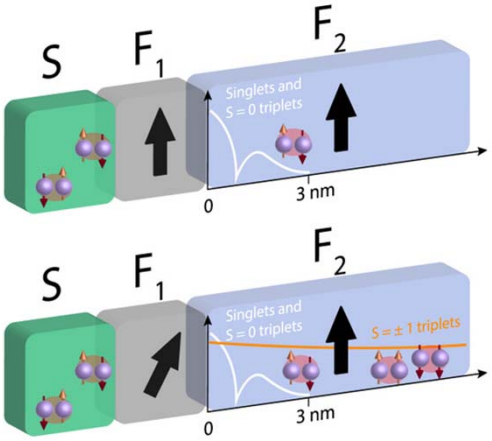
A paradigm shift towards energy-efficient computing: superconducting spintronics



The never-ending demand for smaller and faster electronic devices is challenging scientists to develop new technologies where the size of the active elements is comparable to that of single atoms and electrons. In this quantum regime, one of the emerging technologies is spintronics, where information is stored using the magnetic property called spin which each electron has in addition to its charge.
Spintronic devices, however, require very high input currents in order to operate which has been a major limitation for their applications. In recent years, however, it has been realised that this issue can be overcome by combining magnetic materials, which are key elements for the functioning of spintronic devices, with superconductors.
In this talk, I will illustrate some of the key experiments [1-4] that have demonstrated how superconductors and ferromagnets, which had been considered for decades incompatible, can instead be combined into energy-efficient spintronic devices. I will hence explain how the research field, which has emerged from these experiments and known as superconducting spintronics [5], it has the potential of revolutionising the future of large-scale computing and quantum technologies.

References

[1] A. Di Bernardo et al., Nature Commun. 6, 8053 (2015).
[2] A. Di Bernardo et al., Phys. Rev. X 5, 041021 (2015).
[3] A. Di Bernardo et al., Nature Commun. 8, 14024 (2017).
[4] A. Di Bernardo et al., Nature Mater. s41563 (2019).
[5] J. Linder et al., Nature Phys. 11, 307-315 (2015).