

## CONDENSED MATTER THEORY SEMINAR

Subject: **Strongly Spin-Dependent Scattering at Superconductor-Ferromagnet Interfaces**

Speaker: **Prof. Dr. Wolfgang Belzig, Universität Konstanz**

Date & time: **Friday, January 18<sup>th</sup>, 2019 at 3.15 p.m.**

Venue: **Seminar room 1.114**

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Superconductor-Ferromagnet heterostructures are of interest due to numerous phenomena related to the **spin-dependent interaction** of Cooper pairs with the magnetization. We address several effects of a **magnetic insulator** on a superconductor based on the recently developed boundary condition for strongly spin-dependent interfaces. [1] We show that the boundary to a magnetic insulator has a similar effect like the presence of magnetic impurities. [2] In particular, we find that the old problem of strongly scattering localized impurity spins leading to the formation of **Shiba bands** can be mapped onto the boundary problem. Remarkably, also **antiferromagnets** can have a strong magnetic proximity effect, depending on the interface symmetries [5] Based on this observation, we study the effects of Zeeman-splitting on the thermoelectric properties of an SF bilayer with a metallic ferromagnet. We have predicted a **giant thermopower** [3], which is attributed to spin-dependent particle-hole asymmetry and spin-split tunnelling density of states in the S/F heterostructure. Furthermore, we find that spin-flip scattering **strongly enhances** the thermoelectric performance of the system in the low-field and low-temperature regime. [4] For **non-collinear** magnetic configurations, the Cooper pairs can become spin-full and carry a (spin-)supercurrent. We present combined experimental and theoretical evidence for these **equal-spin Cooper pairs** through spectroscopic signatures. [6]

### References

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- [2] W. Belzig and D. Beckmann, *J. Magn. Magn. Mat.* **459**, 276 (2018).
- [3] P. Machon, M. Eschrig, and W. Belzig, *Phys. Rev. Lett.* **110**, 047002 (2013).
- [4] A. Rezaei, A. Kamra, P. Machon, and W. Belzig, *New. J. Phys.* **20**, 073034 (2018).
- [5] A. Kamra, A. Rezaei, and W. Belzig, *Phys. Rev. Lett.* **121**, 247702 (2018).
- [6] S. Diesch, P. Machon, M. Wolz, C. Sürgers, D. Beckmann, W. Belzig, and E. Scheer, *Nat. Commun.* **9**, 5248 (2018).