


**Monday, 22 January 2024**

Lecture Hall N24/H13, at 16:15

Coffee and cookies will be served in front of the lecture hall from 16:00

**Quantum Phenomena in Few Level Systems formed  
by Magnetic Impurities on Superconductors****Dr. Ciprian Padurariu**

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 <https://www.uni-ulm.de/nawi/institute-for-complex-quantum-systems/welcome/>

Interacting superconducting bound states are a useful platform for realizing few-level fermionic systems for quantum information processing, quantum sensing, and for studying systems with nontrivial topology. An important category of such states are Yu-Shiba-Rusinov (YSR) states, localized to magnetic defects in superconductors.

In my talk, I review the quantum properties of a YSR state and introduce its characteristic quantum phase transition. Our collaboration has revealed the electronic transport signature of the quantum phase transition, both by measuring in an external magnetic field [1] and by revealing the supercurrent reversal through a YSR state [2]. I will then describe the electrical transport resonance that forms in junctions between YSR states and show how it helps to determine the local quasiparticle poisoning rate [3]. Finally, I will present our recent findings on Josephson transport between YSR states. By coupling the electronic and magnetic dynamics, the effect may provide means to control spins on superconductors using all-electrical schemes.

[1] S. Karan, H. Huang, A. Ivanovic, C. Padurariu, B. Kubala, K. Kern, J. Ankerhold, and C. R. Ast, *Tracking a spin-polarized superconducting bound state across a quantum phase transition*, arxiv:2304.02955, accepted to appear in Nat. Commun.

[2] S. Karan, H. Huang, C. Padurariu, B. Kubala, A. Theiler, A. M. Black-Schaffer, G. Morrás, A. Levy Yeyati, J. C. Cuevas, J. Ankerhold, K. Kern, and C. R. Ast, *Superconducting quantum interference at the atomic scale*, Nat. Phys. **18**, 893 (2022).

[3] H. Huang, C. Padurariu, J. Senkpiel, R. Drost, A. Levy Yeyati, J. C. Cuevas, B. Kubala, J. Ankerhold, K. Kern, and C. R. Ast, *Tunneling dynamics between superconducting bound states at the atomic limit*, Nat. Phys. **16**, 1227 (2020).

