Seminar on Condensed Matter Theory

Group of Theoretical Physics at the Department of Condensend Matter Physics of Charles University has a pleasure to invite you to attend the seminar

on 29 November 2018 at 14:00

at Faculty of Mathematics and Physics of Charles University, Ke Karlovu 5, 121 16 Praha 2

Lecture Hall F2

Prof. Jens Paaske

Center for Quantum Devices, Niels Bohr Institute, University of Copenhagen, 2100 Copenhagen, Denmark

Yu-Shiba-Rusinov states in quantum dots

joined with Nanoseminar (note different time and place)

In the late 1960'ies, Yu, Shiba and Rusinov (YSR) independently showed that a magnetic impurity, exchange coupled to a superconductor, gives rise to a bound state inside the superconducting gap. At a critical exchange coupling the system undergoes a quantum phase transition, to a fully screened spin singlet ground state, which exhibits a smooth crossover into the better-known Kondo resonance, when closing the superconducting energy gap.

These YSR states have become common spectroscopic features in Scanning Tunneling Microscopies of superconducting surfaces hosting magnetic impurities, giving experimental access to many atomistic details regarding spin and orbital degrees of freedom of the magnetic adatom. Sorting out these spectra, however, is often a daunting task, involving a number of d-orbitals, spin-orbit coupling, and crystal-field splitting.

In this seminar, I will discuss our theoretical and experimental studies of YSR states arising in Coulomb blockaded quantum dots, which may be tuned electrically to host a perfect spin-1/2, thus providing for very simple and clear YSR-spectra. Transport experiments on double quantum dots are shown to exhibit YSR-(under)screening of a spin-1 state. The YSR bound-state spectra are shown to be captured remarkably well by a simple zero-bandwidth model, and the results are benchmarked against numerical renormalization group calculations.

[1] Yu-Shiba-Rusinov states in phase-biased S-QD-S junctions, Gediminas Kiršanskas, Moshe Goldstein, Karsten Flensberg, Leonid I. Glazman, Jens Paaske, Phys. Rev. B 92, 235422 (2015).
[2] Yu-Shiba-Rusinov screening of spins in double quantum dots, K. Grove-Rasmussen, G. Steffensen, A. Jellinggaard, M. H. Madsen, R. Žitko, J. Paaske, J. Nygård, Nature Communications 9, 2376 (2018).
[3] Supercurrent in a double quantum dot, J. C. Estrada Saldaña, A. Vekris, G. Steffensen, R. Žitko, P. Krogstrup, J. Paaske, K. Grove-Rasmussen, J. Nygård, arXiv:1808.05837

For more information follow: theory.kfkl.cz/seminars.php
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