SEMINAIRE ISMO

Charis QUAY

Laboratoire de Physique des Solides, ORSAY

Spin Dynamics in Out-of-Equilibrium Superconductors

Superconductors out-of-equilibrium have been extensively studied since the advent of thin-film technologies in the 1960s, with a recent revival of interest driven by "quasiparticle poisoning" phenomena in superconducting quantum circuits. Comparatively little attention has, however, been paid to the spin degree of freedom.

A few years ago, we and another group (at the Karlsruhe Institute of Technology) simultaneously demonstrated the existence of a long-lived (~10ns) almost-chargeless spin imbalance in the quasiparticle (excitation) population of a mesoscopic superconductor with a Zeeman-split density of states. This imbalance exists as a result of the dynamic equilibrium between spin injection (enabled by the Zeeman effect) and relaxation. We have since confirmed the spin imbalance lifetime independently in frequency-domain measurements.

Moving beyond the simple existence of spin imbalances, we have begun to look at the spin-dependent dynamics of quasiparticles – this will be the main focus of my talk, after an introduction to out-of-equilibrium physics and "spin statics" in superconductors.

Notably, we have demonstrated quasiparticle spin resonance in superconducting aluminium using two novel, on-chip microwave power meters. The quasiparticle spin decoherence time obtained (~100 ps), and its dependence on the sample thickness are consistent with Elliott-Yafet spin-orbit scattering as the main decoherence mechanism, and suggests that the spin imbalance lifetime is limited by inelastic processes.

I'll also discuss very recent results on the spin-dependence of the recombination dynamics of quasiparticles, yielding clues to the spin-dependent energy and spatial distribution of the out-of-equilibrium quasiparticles.

Mardi 13 juin 2017 à 11h

Bât. 210 – Amphi 1 (2ème étage)

Université Paris-Sud - 91405 ORSAY Cedex