Probing Odd-Triplet Contributions to the Proximity Effect by Scanning Tunneling Spectroscopy

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Abstract. In this talk we will address the superconducting proximity effect between a superconductor (S) and a normal metal (N) linked by a spin-active interface. With the help of a low-temperature scanning tunneling microscope [1,2] we study the local density of states of trilayer systems. The first example consists of aluminum (S), the ferromagnetic insulator (FI) EuS, and the noble metal silver (N) for varying thickness of the FI. In several recent studies it has been shown that EuS acts as ferromagnetic insulator with well-defined magnetic properties down to very low thicknesses [3]. For very thin FI with d_{FI} = 2 nm we find a strong enhancement of the induced minigap at the normal side. For intermediate thickness we observe pronounced subgap structures that vary from contact to contact. For d_{FI} = 10 nm the spectra are in agreement with the diffusive theory for S/N structures (without FI) as confirmed in earlier studies [2]. We discuss our findings in the light of recent theories of odd-triplet contributions created by the spin-active interface [4,5,6].

The second example uses the ferromagnetic metal (FM) Ho between niobium (S) and gold (N) [7]. These measurements reveal pronounced changes to the Nb sub-gap superconducting density of states on driving the Ho through a metamagnetic transition from a helical antiferromagnetic to a homogeneous ferromagnetic state for which a conventional BCS gap is recovered. The results directly verify odd frequency spin-triplet superconductivity at superconductor / inhomogeneous magnet interfaces [8].

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