Highlights

Superconductivity - 2015

Resonant Andreev Spectroscopy in normal-Metal/thin-Ferromagnet/Superconductor Device: Theory and Application

F. Romeo[1], F. Giubileo[2], R. Citro[1,2], A. Di Bartolomeo[1], C. Attanasio[1,2], C. Cirillo[1,2], A. Polcari[3], P. Romano[3,2]

[1]Dipartimento di Fisica "E. R. Caianiello", Università di Salerno, Fisciano, Italy
[2]CNR-SPIN Salerno, via Giovanni Paolo II 132, Fisciano, Italy
[3]Dipartimento di Scienze e Tecnologie, Università del Sannio, Benevento, Italy

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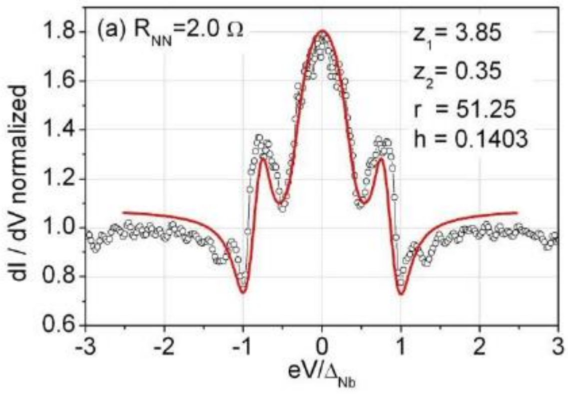
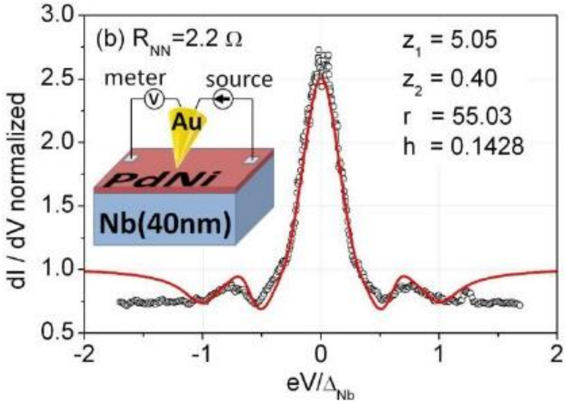
Using the Bogoliubov-de Gennes formalism, we studied the transport properties of normal-metal/ferromagnet/superconductor device (Figure) in which a thin ferromagnetic layer (of the order of ξ_F) is deposited on a superconducting electrode, realizing a double-barrier structure. The spectroscopic features (i.e. differential conductance spectra) calculated within the theoretical model show a sensitive dependence on the thickness and polarization of the ferromagnet. This peculiar behaviour, originated by the resonant proximity effect, suggests the possibility to use Resonant Andreev Spectroscopy on ferromagnet/superconductor bilayer as a powerful characterization method to precisely probe local ferromagnetic properties. As a preliminary test of the theoretical expectations, we realized point contact Andreev reflection spectroscopy experiment by pushing a metallic tip on PdNi/Nb bilayer. Differential conductance spectra for several contacts have been measured at low temperature, showing a variety of features (e.g. ZBCP, conductance dips at the gap edge, and subgap structures) not expected in single-barrier PCAR theories. Theoretical fittings allowed to consistently explain all measurements. The ferromagnet thickness and the polarization have been estimated.



Differential conductance curve (empty dots) and the theoretical fit (full red line). A ferromagnet polarization h of 14.03 % is deduced from the data.



Differential conductance measured in a different sample position; (inset) artist view of the experimental measuring setup.