Poster

ANOMALOUS PROXIMITY EFFECTS IN FERROMAGNET-SUPERCONDUCTOR $SrRuO_3$-$YBa_2Cu_3O_{7-\delta}$ BILAYERS

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The study of superconductor-ferromagnet proximity systems allows a direct investigation of the interplay between the two competing orders of superconductivity and ferromagnetism, and is relevant also to the field of spintronics. We applied cryogenic Scanning Tunneling Spectroscopy on bilayers of $YBa_2Cu_3O_{7-\delta}$ (YBCO), a *d*-wave superconductor, and the itinerant ferromagnet $SrRuO_3$ (SRO). Our data revealed two novel phenomena. 1. When the YBCO film is (100) oriented, we find localized regions, consisting of narrow stripes (~ 8 nm wide) along which the superconductor order-parameter penetrates the SRO to a distance significantly larger than expected. This behaviour is attributed to the crossed Andreev reflection process, an effect observed for the first time in our work, taking place in the vicinity of magnetic domain walls in the SRO. Here, an electron impinging in one magnetic domain is retro-reflected as a hole with opposite spin in an adjacent domain, effectively transferring a Cooper pair from the YBCO to the SRO layer. 2. When the YBCO film is oriented along the nodal (110) direction, our spectroscopy measurements reveal a penetration of the Andreev bound states into the ferromagnetic layer. The penetration is manifested in the density of states of the SRO as a split zero bias conductance peak with an imbalance between peak heights. Our data indicates that the splitting occurs at the superconductor side as a consequence of induced magnetization, while the imbalance results from the spin polarization in the ferromagnet.