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Quasi-one-dimensional Fulde-Ferrell-Larkin-Ovchinnikov-like state in $Nb/Cu_{0.41}Ni_{0.59}$ bilayers

Sidorenko A. S., Zdravkov V. I., Kehrle J., Morari R., Obermeier G., Gsell S., Schreck M., Müller C., Kupriyanov M. Yu., Ryazanov V. V., Horn S., Tagirov L. R., Tidecks R.

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Abstract

In a ferromagnet (F) being in contact with a superconductor (S) an unconventional finite-momentum pairing of electrons forming Cooper pairs occurs. As a consequence, interference effects of the pairing wave function, leading to an oscillation of the critical temperature for increasing F-layer thickness in S/F bilayers, including extinction and recovery of the superconducting state, were predicted by theory. We observed experimentally all types of this behavior, calculated theoretically, in Nb/Cu1 – xNixbilayers (x = 0.59) of nanometer film thickness, prepared by magnetron sputtering (utilizing a moving magnetron deposition technique to provide a superb homogeneity of the ultrathin Nb layers), including a double extinction of superconductivity, giving evidence for a multiple reentrant state.