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Superconducting triplet spin valve

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Abstract

We study the critical temperature Tc of SFF trilayers (S is a singlet superconductor, F is a ferromagnetic metal), where the long-range triplet superconducting component is generated at noncollinear magnetizations of the F layers. We demonstrate that Tc can be a nonmonotonic function of the angle α between the magnetizations of the two F layers. The minimum is achieved at an intermediate α, lying between the parallel (P, α = 0) and antiparallel (AP, α = π) cases. This implies a possibility of a "triplet" spin-valve effect: at temperatures above the minimum Tc Tr but below Tc P and Tc AP, the system is superconducting only in the vicinity of the collinear orientations. At certain parameters, we predict a reentrant Tc(α) behavior. At the same time, considering only the P and AP orientations, we find that both the "standard" (Tc P < Tc AP) and "inverse" (Tc P > Tc AP) switching effects are possible depending on parameters of the system.

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