Abstract Submitted<br>for the MAR10 Meeting of The American Physical Society

Angular Dependence of the Superconducting Transition Temperature in Ferromagnet-Superconductor-Ferromagnet Trilayers JIAN ZHU, ILYA KRIVOROTOV, University of California, Irvine, KRIVOROTOV GROUP TEAM - The superconducting transition temperature, $\mathrm{T}_{\mathrm{c}}$, of a ferromagnet ( F ) - superconductor ( S ) - ferromagnet trilayer depends on the mutual orientation of the magnetic moments of the F layers. This effect has been previously observed in $\mathrm{F} / \mathrm{S} / \mathrm{F}$ systems as $\mathrm{T}_{\mathrm{c}}$ difference between parallel and antiparallel configurations of the F layers [1]. Here we report measurements of the angular dependence of $\mathrm{T}_{\mathrm{c}}$ in $\mathrm{CuNi} / \mathrm{Nb} / \mathrm{CuNi}$ trilayers. In our measurements, magnetization of one F layer is fixed by exchange bias while magnetization of the other F layer is rotated in the plane of the trilayer through 360 degrees, and $\mathrm{T}_{\mathrm{c}}$ is measured as a function of the angle between the F layer magnetizations. The observed angular dependence of $\mathrm{T}_{\mathrm{c}}$ depends on the thickness of the CuNi layers and it shows significant deviations from a simple cosine function for thin CuNi layers. The observed angular dependence is qualitatively similar to theoretical predictions taking into account odd triplet pairing in the non-collinear F/S/F geometry [2].
[1] J. Y. Gu, C.-Y. You, J. S. Jiang, J. Pearson, Ya. B. Bazaliy, and S. D. Bader, Phys. Rev. Lett. 89, 267001 (2002)
[2] Ya. V. Fominov, A. A. Golubov, and M. Yu. Kupriyanov, JETP Letters, Vol. 77, No. 9, 2003, pp. 510-515.

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