Critical Current in Nb-Cu-Ni-Cu-Nb Junctions

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We present the experimental evidence of oscillatory behavior of the critical current *vs*. thickness variation of ferromagnetic Ni layer. We also show a reasonable agreement between our data and the theories[1,2] in the appropriate limit.

We have studied temperature and thickness dependence of the critical current in Nb-Cu-Ni-Cu-Nb junctions. The junctions with 10x10 μm^2 area were fabricated using standard photolithography techniques. Niobium films were sputtered using a magnetron gun and *in-situ* covered with the Cu layer by thermal evaporation, in order to prevent Nb oxidation. The ferromagnetic layers of Ni were e-gun evaporated in a separate vacuum chamber, and subsequently covered *in-situ* by Cu. It is important to emphasize that all samples were prepared simultaneously. The variation of Ni thickness was obtained by a specially designed shutter, which exposed the samples in sequence, so that every sample was exposed to the evaporating Ni for additional fragments of time. This method guaranteed that all the interfaces between each layer in our multilayer structure are identical, and the only difference between the samples is their Ni thickness. Figure 1 shows the oscillations and the decay of the critical current in the junctions upon the increase of the thickness of the Ni layer.

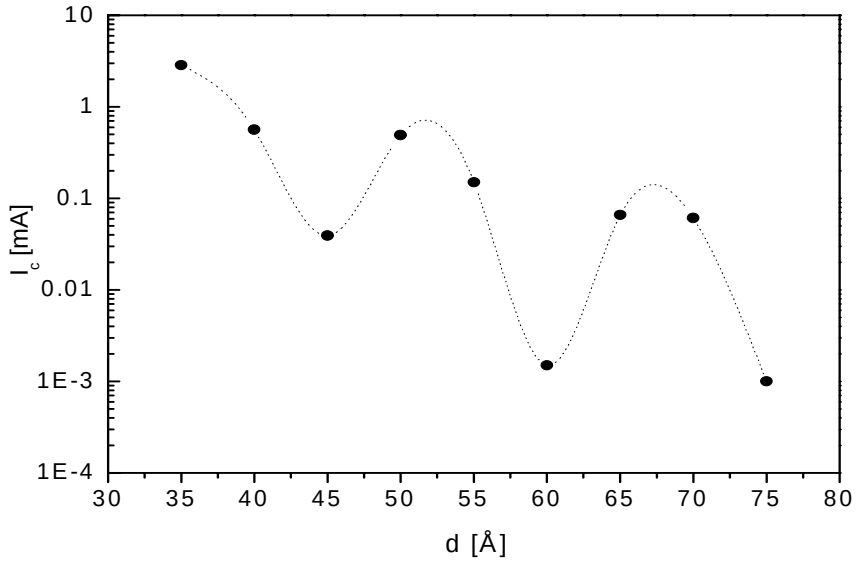

Fig. 1: Critical current of the junctions as a function of Ni layer thickness *d* at 4.2K

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[1] A. I. Buzdin, L. N. Bulaevskii, and S. V. Panyukov, *JETP Lett*. **35**, 178 (1982).

[2] F. S. Bergeret, A. F. Volkov, and K. B. Efetov, *Phys. Rev. B* **64,** 134506 (2001).