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Cryptoferromagnetic-like effect in Gd/Nb superlattice

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The proximity effects in superconducting/ferromagnetic (S/F) systems are attracting nowadays great attention in basic and applied research due to the presence of unique properties. Typically the S/F systems consisted of F layers with rather strong exchange energy (100-1000K) in contact with much weaker (10-100K) superconductors. In this sense it is straightforward to expect strong influence of ferromagnetic ordering on superconductivity, starting from trivial pair-breaking to such intriguing effects like Larkin-Ovchinnikov-Fulde-Ferell state, π-type Josephson junctions, triplet superconductivity and more.

On the other hand, influence of superconductivity on ferromagnetic state is less expected due to the above mentioned strong difference in energies. One of such effects is cryptoferromagnetism. Essence of the effect in creation of domain structure with domain size less than correlation length of superconductivity ξ_F below the superconducting transition temperature Tc. Effect is predicted for the S/F systems with weakened ferromagnetic energy and enhanced superconducting energy. In this talk we present results of polarized neutron investigations of [Gd(d_F)/Nb(25nm)]$_{12}$ superlattices with d_F=1-5nm. We have observed suppression of magnetic ordering of Gd layers in superlattices with d_F<ξ_F. Relation of the experimental observation to cryptoferromagnetism is discussed.

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