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be suggested that the proper mechanism of the influence of the heat treatment changes at $T = 660 - 580$ K and $p(O_2) = 5\sigma10^5$ Pa. In this case, the increase of T_c and of the orthorhombic distortion $x_{(b-a)}$ occurs as a result of a contribution of the Cu(1) $O_{1-\delta}$ chain layers to the electron density of states at the Fermi level. The Cu(1) $O_{1-\delta}$ chain layers can be superconducting, which enables the existence in them of induced superconductivity due to the tunnelling of the Cooper pairs from the Cu(2) O_2 planes.

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Fluxon Scattering as a Tool for Detection and Manipulations with Flux Qubit States

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We have considered relativistic fluxon dynamics governed by the sine-Gordon equation and affected by short spatial inhomogeneities of the driving force and thermal noise. Developed analytical and numerical methods for calculation of fluxon scattering at the inhomogeneities allowed us to examine the scattering as a measurement tool for sensitive detection of superconducting flux qubit states. Different measurement schemes based on the scattering were optimized for signal-to-noise ratio maximization. The scattering was also considered as a tool for manipulation with the qubit states. Analysis of this type of manipulations with qubit states was performed in the frame of fully quantum description both analytically and numerically. In terms of the simplest model of two-level system with magnetic moment we analyzed the possibility of fast magnetization reversal on the picosecond timescale induced by unipolar magnetic pulse. In addition, consideration of the magnetization reversal is fulfilled in the framework

of the macroscopic theory of the magnetic moment allowing the comparison and the explanation of quantum and classical behavior.

Vortices at the Surface of a Normal Metal Coupled by Proximity Effect to a Superconductor

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We report the experimental observation of vortices on the surface of a 50nm-thick layer of Cu in the hybrid structure Cu/Nb with ultra-low temperature Scanning Tunneling Spectroscopy (STS). In the studied samples the non-superconducting Cu-layer acquires superconducting correlations due to the proximity e ect with 100 nm-thick superconducting Nb. To avoid the oxidation at Cu-surface and allow STS, the samples were ex-situ grown on SiO_2/Si in the inversed order, i.e. Cu was deposited directly on the substrate, Nb was deposited on Cu. Then the samples were introduced to the UHV STM chamber and cleaved in-situ. The structural analysis showed that upon cleavage the samples break at Cu/SiO_2 interface, thus exposing fresh Cu surface. The presence of the proximity effect at the Cu film surface was first evidenced by observation of a proximity gap in the tunneling conductance spectra $dI(V)/dV$, in clear relation to the value of the superconducting gap of bulk Nb. The evolution of the proximity spectra with temperature was also studied in the range (0.3-4.2) K. Upon application of an external magnetic field, spatial variations of the tunneling conductance spectra were observed. These variations appear in the detailed STS maps as round nm-size spots, in the centers of which the proximity gap vanishes. The density of spots rises continuously with magnetic field; it corresponds perfectly to the expected density of Abrikosov vortices in Nb. We identify the observed spots as proximity induced vortices in the normal Cu. On the basis of our STS data, we have determined the size and shape of the proximity vortex cores, and evaluated the coherence length in Cu.