PROBABLE EXPLANATION of SPATIAL DEPENDENCE of STJ RESPONSE in EXPERIMENTS with LTSEM

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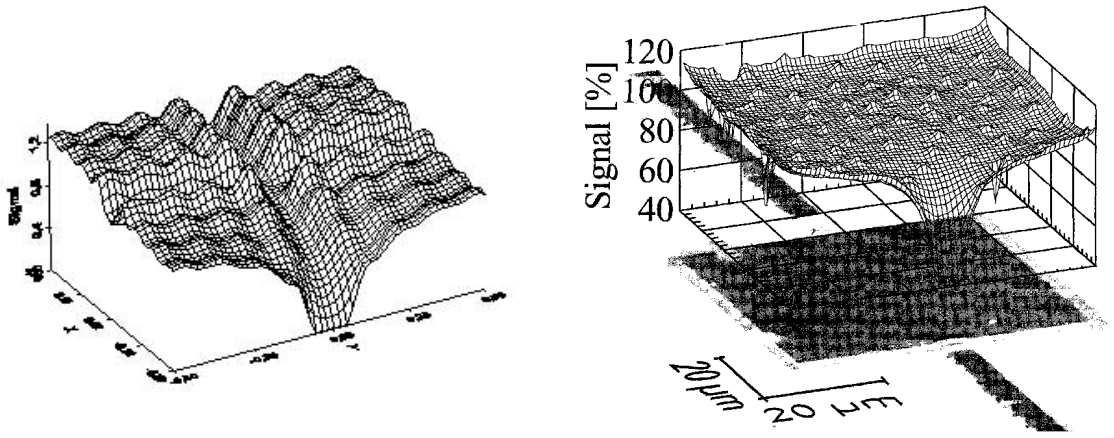
Two-dimensional signal distribution of STJs was investigated by S. Lemke, et al. [1,2] by means of low-temperature scanning electron microscope (LTSEM), in particular, position dependent response of Nb-Al-Ox-Al-Nb STJ detector, with the surface area of 50 μm x 50 μm, operating at 1.6 K [2]. Two-dimensional LTSEM surface scan demonstrates an almost regular array of points where signal is enhanced. So far satisfactory explanation of this phenomenon was not given.

One of possible explanations of detector response increase is connected with interaction of phonon modes with energies in a narrow band near the energy gap of a superconductor — 2Δ - phonons — resulting in occurrence of spatial structure similar to low oscillatory modes of two-dimensional membrane. The interaction of quasielectron and phonon subsystems results in mutual transitions of quasielectrons into Cooper pairs along with - 2Δ -phonons formation. As the signal of the detector contains the contribution of tunneled quasielectrons produced by transitions of phonons to quasielectrons, the spatial dependence of a signal of STJ must have a similar structure. The deviations from regular structure are probably caused by specific boundary conditions. Qualitative comparison of calculated and experimental data is shown below.



1. S. Lemke, et al., J. Low Temp. Phys., 93, 617, 1993.

2. S. Lemke, PhD Thesis University of Tubungen, 1995,
(See N.E. Booth, D.J. Goldie, Supercond. Sci. Technol., 9, 493, 1996.)