Phase sensitive imaging of microwave signal propagation in superconductive circuits

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The central idea of this project is to develop a novel, more powerful type of LSM depicting the signal phase information. A fast optical modulator will be used to synchronize the oscillations of the laser intensity with the frequency of the probing microwave signal. The loss induced in laser illuminated area of superconductive circuit will be strongly dependent on the phase difference of the RF probing signal and the phase of the laser beam modulation. In experiment, the laser modulation frequency may be set with a small offset in respect to the microwave signal frequency, and the useful measurement signal can be detected at the differential (beating) frequency. The phase of the beating signal carries information on the phase of the microwave signal over illuminated spot. The frequency mixing is performed in the laser illuminated area, similarly to the high frequency superconductive bolometric mixers. The experimental work will be concentrated at the Laser Scanning Microscope installation at KIT in Germany. First, the necessary new components and the software modifications will be identified. Then, it is planned to upgrade the LSM installation, verify the principle of operation, and calibrate the measuring system using reference samples of the superconductive circuits. Finally, based on the experience the detection modes and data reduction in modified LSM will be optimized, and the phase-sensitive imaging of the resonance modes of the large arrays of the RF SQUIDs will be conducted.

Projektbeteiligte

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Phase-Sensitive Imaging of Microwave Currents in Superconductive Circuits
Imaging the Paramagnetic Nonlinear Meißner Effect in Nodal Gap Superconductors
Imaging collective behavior in an rf-SQUID metamaterial tuned by DC and RF magnetic fields
Mode Structure in Superconducting Metamaterial Transmission-Line Resonators
Imaging Microwave Response of rf-SQUID Metasurface in dc Magnetic Field