Karlsruher Institut für Technologie

Physikalisches Institut

Prof. Dr. Alexey Ustinov

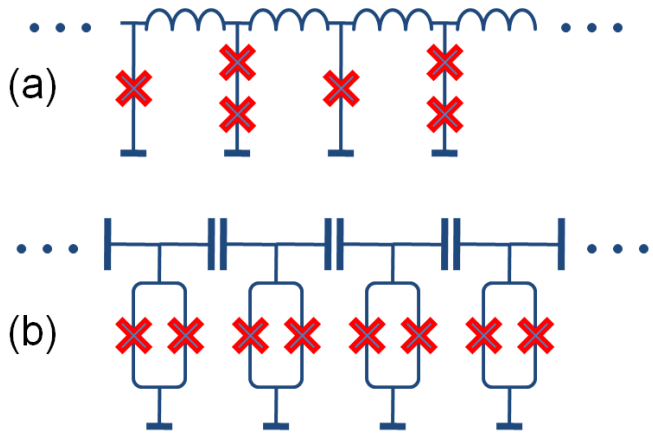
Wolfgang-Gaede-Str. 1
76131 Karlsruhe

KIT-Campus Süd | Postfach 6980 | 76049 Karlsruhe

Diploma Thesis

Josephson array based metamaterials

Metamaterials are artificially engineered metallic structures with electromagnetic properties that are unattainable in nature. Typically, this is achieved at frequencies that are close to internal resonances of the individual units that make up the structure – the 'meta-atoms' – so that the performance of the resulting systems is strongly limited by losses. We want to develop ultra-low loss electromagnetic metamaterials comprised of networks of superconducting elements. In contrast to ordinary metallic structures, superconducting metamaterial components can be miniaturized while still maintaining their low-loss properties. Moreover, superconductors offer an intriguing and unique possibility of exploring the quantum effects in metamaterials. The design flexibility of superconducting meta-atoms with Josephson junctions allows for utilizing small sizes down to the nanoscale while maintaining low loss properties and frequency tunability. In this thesis, you will design, fabricate and characterize first superconducting metamaterials composed of frequency-tunable resonators and Josephson junctions.



Examples of non-conventional Josephson transmission lines: (a) double sine-Gordon array; (b) capacitively coupled SQUID chain.

Contact: Susanne Butz (room 4.10), susanne.butz@pi.uni-karlsruhe.de
Philipp Jung (room 4.10), philipp.jung@pi.uni-karlsruhe.de
Prof. Dr. Alexey Ustinov (room 3.16), ustinov@kit.edu