

Miroslav Grajcar, Slovak Academy of Sciences (SiUCs) - The quantum-limited detectors based on superconducting weak links

Thursday, 23 February 2023 15:00 (30)

In my talk I will present the design of two types of quantum-limited detectors of microwaves: a) travelling waves parametric amplifier and b) itinerant microwave photon detectors. Both designs are based on an array of superconducting nonlinear weak links.

The traveling wave parametric amplifiers are designed as coplanar waveguides with a central wire consisting of i) a high kinetic inductance superconductor, and ii) array of 2000 Josephson junctions. The standard coupled modes theory is modified by considering reflections due to impedance mismatches. This modification provides a simple analytical formula for gain and bandwidth for both 3-wave and 4-wave mixing. Predictions of the model are experimentally demonstrated on both types of TWPA.

Similarly, the design of an itinerant microwave photon detector is based on coplanar waveguide with a central wire consisting of an array of antiferromagnetically coupled superconducting flux qubits. The magnetization of such metamaterial, which can be simulated by Ising model, exhibits rapid transition to antiferromagnetic state driven by external magnetic field. The itinerant microwave photon could trigger this transition if the external magnetic field is set close to the phase transition of the metamaterial.