Contribution ID: **109** Type: **"Rapid fire" talk**

Kinetic inductance circuits for quantum sensing

Monday, 17 March 2025 17:12 (7 minutes)

Recent particle physics experiments requiring excellent energy resolution involve cryogenic detector arrays composed of hundreds of detector pixels, such as Transition Edge Sensors (TESs). To preserve the intrinsically excellent energy resolution of these detector arrays while maintaining minimal system complexity, a broadband, multiplexed read-out chain, with minimal noise addition is required.
This goal can be achieved through the implementation of microwave multiplexing and quantum noise limited amplification, technologies that can be implemented exploiting the non-linearity of superconducting high-kinetic inductance circuits.
Microwave multiplexing of TESs can be realized with Kinetic Inductance Current Sensors (KICS), arrays of high-kinetic inductance resonators coupled to a common microwave feedline, whose resonance frequencies are modulated by the output signals of TESs coupled to them.
The resonance frequencies, and thereby the detector states, are probed with an adequate microwave frequency comb. The readout of the modulated frequency comb requires quantum noise limited amplification in order to maintain the excellent energy resolution. For this purpose Kinetic Inductance Traveling Wave Parametric Amplifiers (KI-TWPA) prove useful, achieving minimal noise addition for a broad range of frequencies, which is critical for the read out of a large number of detector pixels
In this contribution we will present our most recent results on the design, simulation, microfabrication and cryogenic characterization of KICSs and KI-TWPAs based on the high-kinetic inductance material NbTiN.

Primary author: BOGONI, Enrico (Istituto Nazionale di Fisica Nucleare)

Presenter: BOGONI, Enrico (Istituto Nazionale di Fisica Nucleare)

Session Classification: Quantum sensors and technologies