Development of Parallel Capacitor Based Kinetic Inductance Detectors (KIDs)

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Abstract—We are developing low TLS (Two-Level System) noise Lumped Element KIDs. It is well established that KIDs feature an excess noise due to TLSs generated in dielectrics, particularly the amorphous ones. TLSs are generated in the whole LC circuit but it would be predominant in the capacitive portion [1]. In this study, we propose to replace the standard interdigitated capacitance by a parallel plate capacitor by means of which it is possible to reduce the TLS in two ways. One way consists in the use of very thin films featuring a high dielectric constant (ε_r=9-11). In this case, according to the theoretical model [2], TLSs can be lowered thanks to the high electric field that can be set inside the capacitor through the power driving the resonators. The second approach consists in freeing the capacitor from dielectric by implementing vacuum gap capacitors. These concepts can be applied for a wide range of wavelengths from Submillimeter/THz through to near IR. We will present designs, simulations and the first detector realizations.

[1] P. Noroozian et al., "Two-level system noise reduction for Microwave Kinetic Inductance Detectors", AIP Conference Proceedings 1185, 148-151 (2009).
[2] J. Gao et al., "Experimental evidence for a surface distribution of two-level systems in superconducting lithographed microwave resonators", Appl. Phys. Lett. 92, 152505, 2008.