Microfabrication technology for large LEKID arrays: from NIKA2 to future applications

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The Lumped Element Kinetic Inductance Detectors (LEKID) reached full maturity in the NIKA (New IRAM KID Arrays) instrument. These results allow to directly compare LEKID performance with other competing technologies (TES, doped silicon) in the mm and sub-mm range. A continuing effort is ongoing to improve the microfabrication technologies and concepts in order to satisfy the requirements of new instruments.

More precisely, future satellites dedicated to CMB (Cosmic Microwave Background) studies will require the same focal plane technology to cover, at least, the range of frequencies comprised between 60 and 600 GHz. Aluminium LEKID developed for NIKA have so far demonstrated, under real telescope conditions, performance approaching photon-noise limitation in the band 120-300 GHz. By implementing superconducting bi-layers we recently demonstrated LEKID arrays sensitive in the range 80-120 GHz and with sensitivities approaching the goals for CMB missions.

NIKA itself (350 pixels) is followed by a more ambitious project requiring several thousands (3000-5000) pixels. NIKA2 is in advanced stage of integration at the Institut Néel for installation at the IRAM 30-meters telescope in 2015. I will describe in detail the technological improvements that allowed a relatively harmless 10-fold up-scaling in pixels count without degrading the initial sensitivity, optimised in NIKA. In particular I will briefly describe the solutions put in place to attenuate the EM cross-talk effect and the resonances shuffling.

I conclude by giving hints about future ground-based experiments based on large arrays of millimetric LEKID, in particular concerning low-resolution spectroscopy. One example is the KISS spectrometer, being developed in Grenoble and installed at Tenerife.