(Planar) Superconducting Resonators: Kinetic Inductance Detectors (KID) and Other Applications

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Abstract - Kinetic Inductance Detectors (KID), proposed in 2003 by the Caltech-JPL group, are now reaching maturity. In Grenoble, a collaboration coordinated and driven by the Institut Néel has developed the NIKA (New IRAM KID Arrays) instrument, showing state-of-the art performances at the 30-meters telescope at Pico Veleta. NIKA has been the first example of instrument based on this new technology open to the international astronomical community via competitive semester calls. We are now developing NIKA2, a 1-ton scale instrument with base temperature of 100mK and containing very large arrays of KID. NIKA2 will map large portions of the sky simultaneously at 150 and 250 GHz, and be able to measure the linear polarization of the incoming radiation. I will present the technological details of the NIKA2 instrument, and a sample of the scientific results obtained by NIKA, i.e. clusters of galaxies mapped with unprecedented sensitivity/resolution, primordial galaxies, Pluto observations etc. I will spend a few minutes to explain our innovative readout scheme, allowing a real-time self calibration of the resonators response. I will conclude giving a quick overview of the activities ongoing in our collaborations, including superconducting resonators for superfluid helium hydrodynamics studies, the use of KID for x, gamma and cosmic rays imaging, new materials and configurations allowing to produce KID sensitive down to 50GHz photons, fundamental superconductivity studies based on our detectors etc.

Keywords (Index Terms) – Photon, detector, kinetic inductance detector, telescope, radiation imaging.