## Abstract Submitted for the MAR14 Meeting of The American Physical Society

Quality factors of plasma resonances in Josephson junction chains THOMAS WEIßL, BRUNO KUNG, ÉTIENNE DUMUR, ALEXEY FEOFANOV, CÉCILE NAUD, OLIVIER BUISSON, WIEBKE GUICHARD, Institut Néel, CNRS and Université Joseph Fourier — One dimensional Josephson junction arrays (1DJJA's) have found application in a variety of superconducting circuits. They are used as tunable inductors in microwave resonators, as non-linear elements in parametric amplifiers and large inductors in quantum bits. 1DJJA's show internal resonances that are caused by the finite self capacitance of the superconducting islands. The self-capacitance couples the plasma resonances of the individual junctions leading to plasma modes extended over the entire array[1]. We present microwave measurements of plasma modes of a chain containing 200 squids with  $E_j/E_c \approx 10$ . Three of the plasma modes can be accessed directly in our experiment. By two-tone spectroscopy we observe the 14 lowest modes[2]. We observe quality factors that are strongly power dependent down to low signal levels. This power dependence is analyzed taking into account the low critical current of our arrays. The signal observed in the two-tone detection is higher than one would expect for a cross-Kerr coupling. We show that this sensitivity is due to the fact that the quality factor of a mode depends on the number of photons in all other modes in the array. [1] N. A. Masluk et al., Phys. Rev. Lett. 109, 137002 (2012). [2] T. Weißl et al. (in preparation).

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Date submitted: 15 Nov 2013

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