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Microwave Reentrant Cavities for Quantum Devices[1] NATALIA C. CARVALHO, JEREMY BOURHILL, DANIEL CREEDON, MAXIM GORYACHEV, ARC Centre of Excellence for Engineered Quantum Systems, The University of Western Australia, SERGE GALLIOU, FEMTO-ST Institute, MICHAEL TOBAR, ARC Centre of Excellence for Engineered Quantum Systems, The University of Western Australia — A microwave reentrant cavity is a device able to provide a very sensitive high-Q microwave mode. Its design can be highly advantageous for electromechanical devices and quantum measurements. In this sense, a tuneable device based on a narrow-gap superconducting reentrant cavity is under development. The resonant frequency is able to be fine-tuned over a range larger than 500 MHz at 10 mK with an electrical Q-factor of 10^5. Such a cavity could possibly accommodate a transmon qubit to control and manipulate its quantum state. We are also working on the investigation of bulk acoustic wave (BAW) resonators in microwave reentrant cavities. BAW resonators offer a promising way to process quantum information through the coupling between microwaves and acoustic phonons. Thus, we are developing a device able to excite phonons through non-linearities and the piezoelectricity of the plano-convex quartz crystal. We will detail our experiments that work towards cooling gram scale phonon resonances to the quantum ground state.

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