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Characterization of superconducting accelerator cavity at millikelvin temperature for use in quantum computation
BING LI, YANG GE, University of Chicago, ALEX ROMANENKO, LANCE COOLEY, Fermi National Laboratory, DAVID SCHUSTER, University of Chicago — Quantum computation using 2D superconducting circuits has been advancing rapidly but has been limited to coherence times of a few microseconds. On the other hand, 3d superconducting cavities for accelerators routinely achieve quality factors exceeding ten billion, corresponding to coherence times exceeding one second. With the recent demonstration of coupling a superconducting qubit to a 3d resonator [1], it should be possible to take advantage of this advanced accelerator technology. However, accelerator cavities are typically used above 2 K and at 1 W input powers. The ultimate residual resistance of accelerator cavities is not yet well understood and it is unclear if they will maintain their exceptional properties at millikelvin temperatures and ultra-low powers. We present measurements of a 3.9 GHz accelerator cavity from 2K-20mK and at powers less than one attowatt. [1] Paik, et. al. arXiv:1105.4652

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