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Quantum Devices Bonded Beneath a Superconducting Shield: Part 1 C.T. EARNEST, C.R. MCRAE, A.O. ABDALLAH, J.H. BÉJANIN, T.G. MCCONKEY, Z. PAGEL, M. MARIANTONI, University of Waterloo — Scalability is crucial for the progression of fault-tolerant quantum computing, as error correction requires a large array of quantum bits (qubits). In the superconducting circuit imple- mentation, growth in circuit size necessitates an increase in chip size, which introduces a host of practical issues including box and slot modes. One solution is to bond a tunneled, metallized shielding layer above the circuit, which would also act as a solution to cross-talk and provide a platform for cold on-chip electronics. In this talk, we propose the use of aluminium superconducting circuits coated in indium, shielded by isotropically etched indium tunnels, and bonded thermocompressively in vacuum. We elucidate the design and fabrication of both the bottom device chip and top shield chip, and divulge details of the novel bonding method used to attach the two in- dium thin films. We also consider the effect of the bonding conditions on Josephson Junctions, and propose a precise indium removal method that would leave behind clean aluminium devices.

Carolyn Earnest
University of Waterloo

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