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Improving Qubit Quality Factors Through Exotic Materials VICTORIA NORMAN, University of Chicago — In the time since the first qubits were successfully fabricated, the coherence times of superconducting Josephson junction qubits have improved by several orders of magnitude. Yet as the quantum information and computation field moves forward, these coherence times still need further improvement. We are now finding that in some superconducting systems, non-thermal equilibrium quasiparticles are becoming the limiting factor in qubit lifetimes. For SIS superconducting qubits, the T1 and T2* values may be improved by the use of materials with higher superconducting band gap, E_G, for which low values may allow for quasiparticles to break up cooper pairs more easily, leading to a shorter lifetime. At this time, Al-Al_2Ox_3-Al transmons are very well characterized and understood and will therefore serve as an appropriate baseline with which to compare the more exotic junction materials. Using tantalum and niobium, which have E_g values of 3 times and 10 times that of aluminum respectively, we expect the T1 and T2* values to increase significantly for the Al-Al_2Ox_3-Nb, Al-Al_2Ox_3-Ta, and Ta-Ta_2Ox_5-Nb qubits.

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