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Decoupling a superconducting qubit from dielectric loss and other sources of linear dissipation YEN-HSIANG LIN, BAOLONG NGUYEN, NICK GRABON, JON MIGUE, VLADIMIR MANUCHARYAN, University of Maryland - College Park — The inter-well "fluxon" transition of a fluxonium circuit has a dipole matrix element that decreases drastically as the ratio EJ/EC becomes large due to a weak overlap of wavefunctions localized in the two Josephson wells. Thus naturally suppresses all linear energy relaxation mechanisms, such as dielectric loss. Despite the vanishing transition dipole of such a qubit, there is still a finite dispersive shift due to the presence of strongly-coupled intra-well "plasmon" transitions in the circuit. By tuning EJ/EC ratio with an external magnetic flux we observed a factor of 100 enhancement of qubit lifetime from about 20 microseconds to over 2 millisecond for a nearly the same transition frequency. Our experiment demonstrates that a highly-decoupled, long-lived qubit can still be coherently manipulated and read out in a multi-level superconducting circuit

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