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Protected Flux Pairing Qubit[1] MATTHEW BELL, WENYUAN ZHANG, Rutgers University, LEV IOFFE, Rutgers University, LPTHE CNRS France, MICHAEL GERSHENSON, Rutgers University — We have studied the coherent flux tunneling in a qubit containing two submicron Josephson junctions shunted by a superinductor (a dissipationless inductor with an impedance much greater than the resistance quantum [1]). The two low energy quantum states of this device, $|0\rangle$ and $|1\rangle$, are represented by even and odd number of fluxes in the loop, respectively. This device is dual to the charge pairing Josephson rhombi qubit [2]. The spectrum of the device, studied by microwave spectroscopy, reflects the interference between coherent quantum phase slips in the two junctions (the Aharonov-Casher effect). The time domain measurements demonstrate the suppression of the qubit's energy relaxation in the protected regime, which illustrates the potential of this flux pairing device as a protected quantum circuit.

[1] M. Bell et al., "Quantum Superinductor with Tunable Nonlinearity," PRL 109, 137003 (2012).
[2] S. Gladchenko et al., "Superconducting Nanocircuits for Topologically Protected Qubits," Nature Physics 5, 48 (2009).

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