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Recent progress of the fluxonium qubit[1]

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Superconducting artificial atoms are all based on the purely dispersive non-linearity of a Josephson tunnel junction, which provides anharmonicity for a microwave oscillator mode. In the fluxonium qubit [1], the microwave oscillator crucially involves a superinductor, built with a linear array of several tens of "large" Josephson junctions. As the flux threading the loop formed by the superinductor and the tunnel junction is swept from zero to half a flux quantum, the g-e transition frequency varies between a sweet spot around 10GHz and another sweet spot at a few hundreds of MHz. By optimizing the fabrication and parameters of this superinductor [2], we have eliminated spurious phase slips through the array, and ensured that its self-resonance frequency lies above the frequency of the qubit. The improved relaxation times of this multi-junction circuit are promising for the design of a novel mesoscopic artificial atom, in which large anharmonicity, long coherence times and fast coupling rate to a cavity bus would all be compatible.

[1] Manucharyan et al., Science 326, 113 (2009) and Phys. Rev. B 85, 024521 (2012).
[2] Masluk et al., Phys. Rev. Lett. 109, 137002 (2012).

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