CLAIMS

1. A device, comprising:

a superconducting bus resonator;

a first superconducting qubit; and

a second superconducting qubit, the first superconducting qubit and the second superconducting qubit respectively comprising:

a first superconducting pad;

a second superconducting pad;

a third superconducting pad;

a first Josephson Junction coupled to the first superconducting pad and the second superconducting pad; and

a second Josephson Junction coupled to the second superconducting pad and the third superconducting pad, wherein the first superconducting pad and the second superconducting pad of the first superconducting qubit and the second superconducting qubit are coupled to the superconducting bus resonator, and wherein the superconducting bus resonator entangles the first superconducting qubit and the second superconducting qubit based on receiving a control signal.

2. The device of any one of the preceding claims, wherein the first superconducting qubit operates in a first oscillating mode and a second oscillating mode.

3. The device of any one of the preceding claims, wherein the second superconducting qubit operates in a first oscillating mode and a second oscillating mode.

4. The device of any one of the preceding claims, wherein at least one of the first superconducting qubit or the second superconducting qubit comprises at least one of a tunable coupler qubit, a two junction qubit, a multimode qubit, a multimode two junction qubit, or a tunable qubit.

5. The device of any one of the preceding claims, wherein the first superconducting pad and the second superconducting pad of the first superconducting qubit and the second superconducting qubit are coupled to the superconducting bus resonator to suppress ZZ interactions between the first superconducting qubit and the second superconducting qubit and to reduce energy loss associated with the superconducting bus resonator, thereby facilitating at least one of: reduced quantum gate errors associated with at least one of the first superconducting

qubit or the second superconducting qubit; increased speed of a quantum gate comprising the first superconducting qubit and the second superconducting qubit; or at least one of improved fidelity, improved accuracy, or improved performance of a quantum processor comprising the device.

6. A device, comprising:

a superconducting bus resonator;

a first superconducting qubit; and

a second superconducting qubit, the first superconducting qubit and the second superconducting qubit respectively comprising:

a first superconducting pad;

a second superconducting pad;

a third superconducting pad;

a first Josephson Junction coupled to the first superconducting pad and the second superconducting pad; and

a second Josephson Junction coupled to the second superconducting pad and the third superconducting pad, wherein the second superconducting pad of the first superconducting qubit and the second superconducting qubit is coupled to the superconducting bus resonator, and wherein the superconducting bus resonator entangles the first superconducting qubit and the second superconducting qubit based on receiving a control signal.

7. The device of claim 6, wherein the first superconducting qubit operates in a first oscillating mode and a second oscillating mode.

8. The device of any one of claims 6 to 7, wherein the second superconducting qubit operates in a first oscillating mode and a second oscillating mode.

9. The device of any one of claims 6 to 8, wherein at least one of the first superconducting qubit or the second superconducting qubit comprises at least one of a tunable coupler qubit, a two junction qubit, a multimode qubit, a multimode two junction qubit, or a tunable qubit.

10. The device of any one of claims 6 to 9, wherein the second superconducting pad of the first superconducting qubit and the second superconducting pad of the second superconducting qubit are coupled to the superconducting bus resonator to suppress ZZ interactions between the first superconducting qubit and the second superconducting qubit and to reduce energy loss

associated with the superconducting bus resonator, thereby facilitating at least one of: reduced quantum gate errors associated with at least one of the first superconducting qubit or the second superconducting qubit; increased speed of a quantum gate comprising the first superconducting qubit and the second superconducting qubit; or at least one of improved fidelity, improved accuracy, or improved performance of a quantum processor comprising the device.