

WHAT IS CLAIMED IS:

1. A qubit device comprising:
 - an elongated thin film uninterrupted by Josephson junctions;
 - a superconducting quantum interference device (SQUID) in electrical contact with a proximal end of the elongated thin film, wherein the SQUID comprises less than three Josephson junctions; and
 - a ground plane that is co-planar with the elongated thin film and is in direct electrical contact with a distal end of the elongated thin film;
 - wherein the thin film, the SQUID, and the ground plane comprise a material that is superconducting at a designed operating temperature.
2. The qubit device of claim 1, wherein the elongated thin film comprises a first side and a second opposite side and wherein each of the first side and the second side is separated from the superconducting ground plane by a respective gap.
3. The qubit device of claim 2, wherein a width of each respective gap is constant along the length of the elongated thin film.
4. The qubit device of claim 1, wherein each of the elongated thin film, the superconducting loop, and the ground-plane comprises aluminum or niobium.
5. The qubit device of claim 1, wherein the SQUID comprises a superconducting loop interrupted by at least one Josephson junction.
6. The qubit device of claim 6, wherein the SQUID comprises two Josephson junctions interrupting the superconducting loop.
7. The qubit device of claim 1, further comprising a substrate, wherein the elongated thin film, the ground plane and the SQUID are on a surface of the substrate.

8. The qubit device of claim 7, wherein the substrate is sapphire.
9. The qubit device of claim 1, wherein the elongated thin film comprises a first section extending along a first direction and a second section extending along a second different direction.
10. A qubit device comprising:
an elongated thin film uninterrupted by Josephson junctions and comprising a first section extending along a first direction and a second section extending along a second direction;
a quantum device in electrical contact with the elongated thin film at a position between the first and second section, wherein the quantum device comprises less than three Josephson junctions; and
a ground plane that is co-planar with the elongated thin film and is in direct electrical contact with the elongated thin film;
wherein the thin film, the quantum device, and the ground plane comprise a material that is superconducting at a designating operating temperature.
11. The qubit device of claim 10, wherein the quantum device is a superconducting quantum interference device.
12. A qubit control system comprising:
a qubit device comprising (a) an elongated thin film uninterrupted by Josephson junctions, (b) a superconducting quantum interference device (SQUID) in electrical contact with a proximal end of the elongated thin film, wherein the SQUID comprises less than three Josephson junctions, and (c) a ground plane that is co-planar with the elongated thin film and is in direct electrical contact with a distal end of the elongated thin film,
wherein the thin film, the SQUID, and the ground plane comprise a material that is superconducting at a designed operating temperature;
a qubit bias control device adjacent to the elongated thin film

such that the qubit bias control device is inductively coupled to the elongated thin film during operation; and

a SQUID bias control device adjacent to the SQUID of the qubit device such that the SQUID bias control device is inductively coupled to the SQUID during operation.

13. The qubit control system of claim 12, wherein the qubit bias control device is in electrical contact with the elongated superconducting thin film.

14. The qubit control system of claim 12, wherein the qubit bias control device comprises a current divider.

15. The qubit control system of claim 14, wherein the current divider comprises a plurality of inductors.

16. The qubit control system of claim 14, wherein the current divider comprises:

a center thin film trace; and

an outer thin film trace forming an open loop that circumscribes the center thin film trace and that is in electrical contact with the elongated thin film,

wherein an end of the center thin film trace is in electrical contact with the outer thin film trace at a plurality of different locations along the open loop.

17. The qubit control system of claim 12, wherein the SQUID bias control device comprises:

an inner thin film loop; and

an outer thin film loop that at least partially circumscribes the inner thin film loop and that is in electrical contact with the SQUID.

18. The qubit control system of claim 12, wherein the qubit bias control device has a mutual inductance with the elongated thin film of between about 0.1 pH and 0.2 pH.
19. The qubit control system of claim 12, wherein the quantum device bias control device has a mutual inductance with the quantum device of about 0 pH.
20. A quantum processor comprising:
a plurality of co-planar waveguide flux qubit devices, each co-planar waveguide flux qubit device comprising (a) an elongated thin film waveguide uninterrupted by Josephson junctions, (b) a quantum device in electrical contact with a first end of the elongated thin film waveguide, wherein the quantum device comprises less than three Josephson junctions and (c) a ground plane that is co-planar with the elongated thin film waveguide and is in direct electrical contact with the elongated thin film, wherein each co-planar waveguide flux qubit device is operatively coupled to each other co-planar waveguide flux qubit device in the quantum processor.
21. The quantum processor of claim 20 wherein the elongated thin film waveguide of each co-planar waveguide flux qubit crosses a plurality of elongated thin film waveguides associated with other co-planar waveguide flux qubits in the processor.
22. The quantum processor of claim 21, further comprising a plurality of inductive couplers, wherein each inductive coupler is arranged adjacent to a crossing between two elongated thin film waveguides associated with different co-planar waveguide flux qubits.
23. The quantum processor of claim 20, wherein the quantum device is a superconducting quantum interference device.