CLAIMS

1. A device comprising:

a plurality of substrates comprising one or more troughs, wherein the plurality of substrates are disposed such that the one or more troughs form at least one enclosure; and

at least one superconducting layer covering at least a portion of the at least one enclosure,

wherein:

the at least one enclosure is configured to form at least one three-dimensional cavity resonator such that electromagnetic radiation at one or more frequencies resonates within the at least one three-dimensional cavity resonator.

2. The device of claim 1, wherein a Q factor of the at least one three-dimensional cavity resonator is greater than ten million.

3. The device of claim 1, wherein the at least one three-dimensional cavity resonator comprises a first three-dimensional cavity resonator and a second three-dimensional cavity resonator, wherein a Q factor of the first three-dimensional cavity resonator is greater than a Q factor of the second three-dimensional cavity resonator.

4. The device of claim 1, further comprising:

at least one superconducting qubit coupled to the at least one three-dimensional cavity resonator.

5. The device of claim 3, wherein the at least one superconducting qubit is a transmon qubit.

6. The device of claim 3, wherein the at least one superconducting qubit is a fluxonium qubit.

7. The device of claim 3, further comprising:

a superconducting wiring layer disposed on and/or in a first substrate of the plurality of substrates, the superconducting wiring layer configured to couple the at least one superconducting qubit to the at least one three-dimensional cavity resonator.

8. The device of claim 7, further comprising:

at least one aperture in the at least one superconducting configured to couple the superconducting wiring layer to the at least one three-dimensional cavity resonator.

9. The device of claim 7, further comprising:

at least one via connecting the superconducting wiring layer to at least one superconducting component of a second substrate of the plurality of substrates.

10. The device of claim 3, wherein the at least one superconducting qubit is disposed within the at least one three-dimensional cavity resonator such that the at least one superconducting qubit is configured to couple to the at least one three-dimensional cavity resonator via electromagnetic radiation.

11. The device of claim 1, wherein the one or more frequencies comprise at least one microwave frequency.

12. The device of claim 1, wherein:

the plurality of substrates comprises a first substrate and a second substrate;

the first substrate comprises a first trough of the one or more troughs;

the at least one superconducting layer comprises:

a first superconducting layer that covers at least a portion of the first trough; and

a second superconducting layer that covers at least a portion of a surface of the second substrate; and

the first substrate and the second substrate are disposed such that the first superconducting layer and the second superconducting layer are in direct contact and the first trough forms the at least one three-dimensional cavity resonator.

13. A device comprising a plurality of substrates comprising one or more troughs, wherein the plurality of substrates are disposed such that one or more troughs form at least one enclosure; and at least one superconducting layer covering at least a portion of the at least one enclosure, wherein:

the at least one enclosure is configured to form at least one electromagnetic shield such that external electromagnetic radiation is prevented from entering the at least one enclosure.

14. The device of claim 13, further comprising:

at least one superconducting component disposed within the at least one electromagnetic shield.

15. The device of claim 14, wherein the at least one superconducting component comprises at least one superconducting circuit.

16. The device of claim 14, wherein the at least one superconducting component comprises at least one qubit.

17. The device of claim 16, wherein the at least one superconducting component comprises at least one stripline resonator.

18. The device of claim 17, wherein:

the plurality of substrates comprises a first substrate and a second substrate;

the first substrate comprises a first trough of the one or more troughs;

the second substrate comprises a second trough of the one or more troughs

the at least one superconducting layer comprises:

a first superconducting layer that covers at least a portion of the first trough; and

a second superconducting layer that covers at least a portion of the second trough;

the first substrate and the second substrate are disposed such that the first trough and the second trough form the at least one enclosure; and

the at least one stripline resonator is disposed within the at least one electromagnetic shield.

19. The device of claim 18, further comprising:

at least one support layer suspended within the at least one electromagnetic shield, wherein the at least one stripline resonator is disposed on and/or in the at least one support layer.

20. The device of claim 19, wherein the at least one support layer comprises at least one material selected from the group consisting of silicon, silicon oxide, and silicon nitride.

21. The device of claim 17, wherein the at least one electromagnetic shield is configure to be a part of a circuit associated with the at least one stripline resonator.

22. The device of claim 1 or claim 13, wherein the plurality of substrates comprise a material with a crystalline structure.

23. The device of claim 22, wherein the material is silicon.

24. The device of claim 1 or claim 13, wherein the one or more troughs comprises a first trough with a first trough surface opposed to a second trough surface, wherein the first trough surface is not parallel to the second trough surface.

25. The device of claim 1 or claim 13, wherein at least one surface of the one or more troughs is atomically smooth.

26. The device of claim 1 or claim 13, wherein the at least one enclosure is evacuated to a pressure less than atmospheric pressure.