Quantum Superconducting circuit

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1. Introduction of superconducting

The superconducting state is a phase of matter or, more precisely, a second-order phase transition of matter at a temperature T_c that induces different properties. The historical property is the low resistance ($R < 10^{-5}\Omega$) discovered by Heike Kamerlingh Onnes.

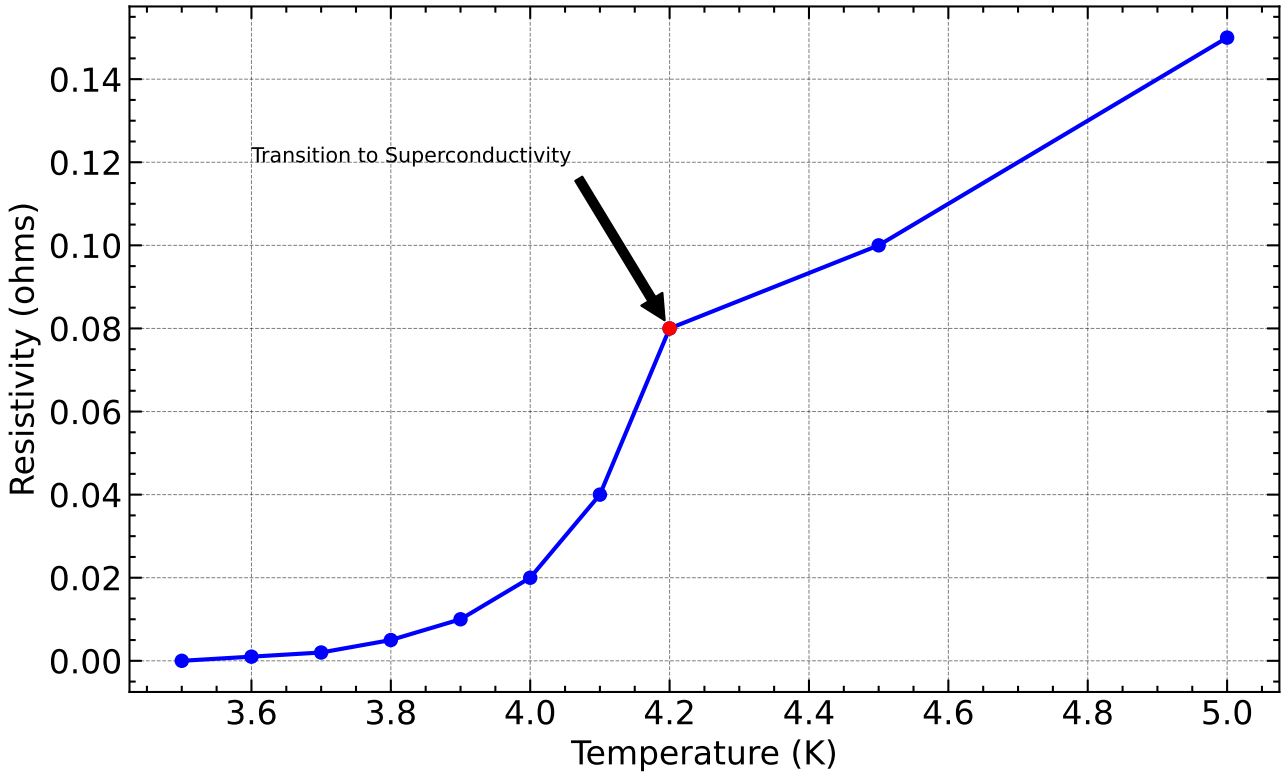

Figure 1.1: Mercury superconducting transition

In 1933, in Berlin, Walther Meissner and Robert Ochsenfeld showed that the magnetic field B is "expelled" from superconductors. This means that when subjected to an external magnetic field, superconductors divert the field lines so that the magnetic field vanishes inside. The superconducting material behaves as a perfect diamagnet [2] p.20.

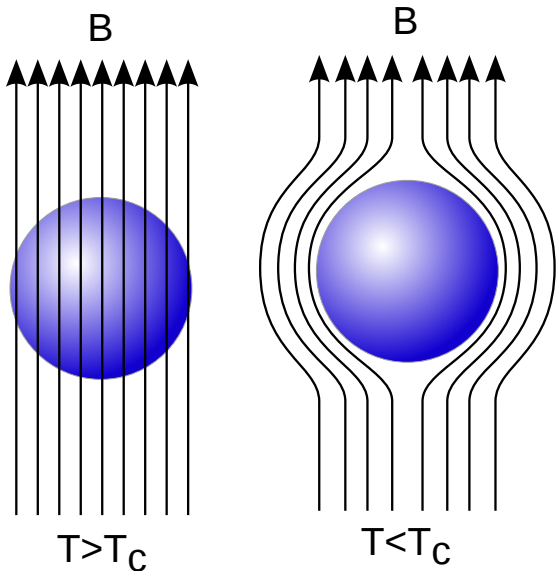

Figure 1.2: Diagram of the Meissner-Ochsenfeld effect. Magnetic field lines **B**, represented as arrows, are excluded from a superconductor when it is below its critical temperature T_c [1].

References

[1] Meissner effect, April 2024. Page Version ID: 1221494481.

[2] Philippe Mangin and Rémi Kahn. *Superconductivity*. Springer International Publishing, Cham, 2017.