

Theory of Superconductivity, Frühjahrsemester 2023

Preliminary outline

I. Introduction and phenomenology

I.1 Infinite conductivity and ideal diamagnetism

II. The Bardeen-Cooper-Schrieffer (BCS) theory

II.1 Cooper instability

II.2 Attractive interaction

II.3 The BCS ground state

II.4 Alternative method: Bogoliubov transformation

II.5 Thermodynamic quantities

II.6 Tunneling phenomena

II.7 Electrodynamics of superconductors

III. Ginzburg-Landau (GL) theory

III.1 GL free energy

III.2 The GL equation

III.3 The linearized GL equation; type I and type II superconductors

IV. The Josephson effects

IV.1 The Josephson equations

IV.2 The RCSJ model

IV.3 Josephson junctions and magnetic fields; the DC SQUID

IV.4 The Cooper pair box

V. Inhomogenous superconductors

V.1 The Bogoliubov - de Gennes equations

V.2 Andreev scattering

VI. Fluctuation effects

VI.1 Resistance of a thin superconducting wire
