Physics 525 – Homework # 9

Due Apr. 24, 2024

9.1 (5 points) Write down the Schrödinger equation.

9.2 (5 points) Write down a wavefunction for an electron moving in an empty space and having a momentum p.

9.3 (5 points) Write a formula which shows how magnetic field decays inside superconductor. Suppose superconductor take half-space $x > 0$.

9.4 (10 points) Consider a SQUID. It is a superconducting loop with two JJs. Assume that the gauge-invariant phase difference on the first junction is zero. Assume the magnetic flux in the SQUID loop is 10% of the flux quantum? What is the gauge-invariant phase difference on the second JJ? Assume also the system is in the lowest possible energy state.

9.5 (10 points) A transmon qubit is made of a capacitor C and a JJ with the critical current I_c. Calculate the qubit excitation energy.