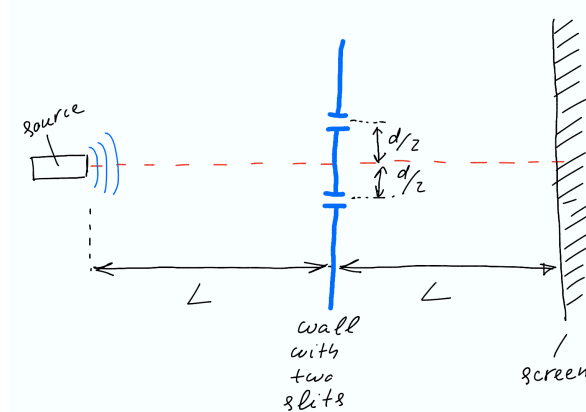


Selected topics in solid state physics 2

Exercise 4

I. DOUBLE-SLIT EXPERIMENT AND DISSIPATION



Recall the classical double-slit experiment (see Figure). Now consider a situation in which the interfering particles move in a weakly viscous medium and experience a weak Ohmic friction (i.e. the friction force proportional to the velocity).

Using the effective action derived in the class estimate the suppression of the interference pattern as compared to the situation without the dissipation. Namely, by what factor the amplitude of the interference fringes on the screen is reduced. Assume the particles of mass M are launched with kinetic energy E by the point-like source (e.g., an electron gun). The friction coefficient is of the medium γ and the temperature of the medium is T .

Some tips: 1) Consider motion in two dimensions (see Figure). 2) Generalize the Caldeira-Leggett model to two dimensions and assume the renormalization of the potential energy by the bath has been removed by the counter term as discussed in the class. 3) For simplicity, consider very weak dissipation, so that the quasi-classical trajectories are not modified. 4) Think how the two interfering trajectories relate to Keldysh contour.