

PHY-851 QUANTUM MECHANICS I

Homework 8, 30=10+20 points

October 31 - November 7, 2001

One-dimensional motion; variational method; periodic potential.

Reading: Merzbacher, Chapter 8, sections 1, 2, 7; Chapter 6, section 5.

1. /10/ *Midterm, Problem 2.* The potential consists of an infinitely high wall at $x = 0$ and a narrow well $-g\delta(x - a)$; g and a are positive constants.
 - a. Find the bound states of the particle of mass m in this potential and dependence of a number of such states on the parameters of the problem.
 - b. For the scattering problem with the same potential find the solution that has the form $\sin(kx + \alpha)$ at distances $x > a$ and determine the phase shift α as a function of energy.
 - c. Is it possible to find the bound states from the solution of the scattering problem? /Consider the analytic continuation of the scattering wave function to complex values of the wave vector and assume that at some complex value $k = i\kappa$ the phase $\alpha(i\kappa) \rightarrow -i\infty$./

Please write the solution of this problem separately from other problems; this will be considered as make-up for the midterm.

2. /9/ Merzbacher, Exercises 8.1, 8.2, 8.3.
3. /5/ Merzbacher, Problem 5, p. 177.
4. /6/ Merzbacher, Exercise 8.29.