

**PHY-851 QUANTUM MECHANICS I**  
**Homework 4**, 40 points  
*September 24 - October 1, 2003*  
**One-dimensional motion;**  
**coordinate and momentum representations.**  
Reading: *Messiah*, Chapters II-IV.

1. /8/ *Messiah*, Problem 3, p. 160.
2. /8/ *Messiah*, Problem 4, p. 160.
3. /9/ *Messiah*, Problem 5, p. 161.
4. /15/ An electron is moving in the potential formed by the infinitely high potential wall at  $x = 0$  and a well of depth  $W$  and width from  $x = a$  to  $x = b > a$ . Show that the well not always supports a bound state. Explain qualitatively how the changes of parameters  $W$ ,  $a$  and  $c = b - a$  influence the existence of bound states. Find a distance  $a$  between the wall and the left edge of the well, which corresponds to the first appearance of a bound level in the well if  $W = 0.25$  eV and the width of the well  $c = b - a = 1$  Å.