PHYS 454
HANDOUT 5 – *Finite Potential wells*

1. Use the uncertainty relation to estimate the ground state energy of a particle in an infinite potential well.

2. Normalize the wave functions in the case of the finite square well.

3. Find approximate values for the energy eigenvalues in the case of a finite deep well. Discuss your results.

4. Find approximate values for the energy eigenvalues in the case of a finite shallow well. Discuss your results.

5. An electron is trapped in an one-dimensional finite potential well of depth $V_0 = 13.6$ eV and of width $a = 8\,\overset{0}{A}$. Calculate the number of bound states.

6. An electron is trapped in an one-dimensional finite potential well of depth $V_0 = 20$ eV and of width $a = 10\,\overset{0}{A}$. Is it a deep or shallow well? Calculate its energy eigenvalues in eV.

7. You are given the following potential:

$$V(x) = \begin{cases} \infty & -\infty < x < 0 \\ 0 & 0 < x < a \\ V_0 & x > a \end{cases}$$

Solve the time independent Schrödinger equation for the bound states.

8. Solve the Schrödinger equation for the potential $V(x) = -g\delta\left(x\right)$.

9. You are given the following potential:

$$V(x) = \begin{cases} \infty & x < 0 \\ -g\delta\left(x - a\right) & \\ \infty & x > 2a \end{cases}$$

Solve the time independent Schrödinger equation for the bound states.