QUANTUM MECHANICS I

PHYS 516

Problem Set # 3

Distributed: January 27, 2014

Due: February 3, 2014

1. Phonons: In one dimension, 100 particles of equal mass m are connected to their nearest neighbors by identical springs with spring constant k. The first and last particles are anchored to unmoveable brick walls ("brick wall boundary conditions).

a. Draw a sketch.

b. Compute the dispersion relation.

2. Finite Nuclear Size:

a. Compute the effect of the finite proton size on the energy of the $2s$ state of the hydrogen atom.

b. A μ^- meson is captured by a lead ion and cascades down to its lowest available state. Compute the effect of the finite nuclear size on the meson's ground state energy. Provide answer in eV.