# PHY 491 - 2013

## Atomic, Molecular, and Condensed Matter Physics

# Problem Set 7

1. Chapter 4, problem 6 (6 pt)

2. Chapter 4, problem 4(a) (4 pt)

3. Chapter 5, problem 1 (a) and (b) (4 pt)

4. Consider a diatomic molecule with nuclear masses $\sim M$ and the typical electron binding energy $E_e$. Consider the qubic term in the expansion of the potential energy in the relative displacement $\Delta R$ of the nuclei from the equilibrium position $\Delta U = K_3 (\Delta R)^3$. Estimate $K_3$ in terms of $E_e$ and the electron mass $m_e$. (3 pt) Using the second-order perturbation theory, estimate the shift of the lowest vibrational energy level $\propto K_3^2$ (3 pt).

**The solution is due on October 30.**