

## 4.1. Schrodinger Equation in Spherical Coordinates

- What is the standard Hamiltonian operator in three dimensions?
- We can write a general wavefunction as  $\Psi(\vec{r}) = R(r)\Theta(\theta)\Phi(\phi)$ . What differential equations do those three functions satisfy?
- Where do  $l(l+1)$  and  $m$  come from in the derivation?
- What is the solution of the  $\Phi$  equation?
- What is the solution of the  $\Theta$  equation?
- What are the restrictions on  $m$  and  $l$ ? Where do those restrictions come from?
- How are the spherical harmonics  $Y_l^m$  involved in all of this?
- What is the difference between  $Y_l^m$  and  $Y_l^{-m}$ ?
- In the solution to the radial equation, how does the effective potential differ from the potential  $V(r)$ ?
- What are the radial solutions  $R(r)$  for the infinite spherical well potential ( $V(r) = 0$  when  $r < a$ ,  $\infty$  otherwise).
- For the infinite square well, what is the full wavefunction  $\Psi$  when  $n = 1$ ,  $l = 2$ , and  $m = 1$ ?