

Homework 3

1. (50 points) Obtain the Radial part of the Schroedinger equation for spherically symmetric potential. Show that it can be reduced to the form of one dimensional Schroedinger equation.

2. (50 points) Derive the limiting expressions for radial wave function in $r \rightarrow 0$ and $r \rightarrow \infty$ limit, for the situation in which the potential energy disappears at infinity and increases at $r \rightarrow 0$ slower than $1/r^2$

3. (50 points) Show that the classical Runge - Lentz vector is a conserved quantity.

4. (50 points) Show that

$$\hat{A} = \frac{1}{2} (\hbar \mathbf{L} \times \mathbf{p}) - \frac{1}{2} (\mathbf{p} \times \hbar \mathbf{L}) + \frac{k m \vec{r}}{r}$$
 is a hermitean operator, where $k = Ze^2$.