

## Homework 4 (10 points all but 4)

1. Derive Unvertainty Principle. Obtain also the uncertainty relations for momentum and coordiante operators

2. Calculate 1 kg, 1 m and 1 sec in natural units.

3. Derive the expression for the generator of space translation acted on the state vector.

4. (5 points) Calculate  $\langle \psi_p | \psi_p \rangle$ , where  $|\psi_p\rangle$  is the eigenstate of the momentum operator

5. For  $\psi(x) = A e^{-\frac{a^2 x^2}{2}}$  calculate  $\varphi(p)$  - wave function in the momentum space. Express A through a.

6. For  $\psi(x) = A e^{-\frac{a^2 x^2}{2}}$  check the Heisenberg uncertainty principle for  $\hat{x}$  and  $\hat{p}$ .

7. Show that if two operators commute the have common eigenstates.

8. (10 points) Derive continuity equation. From Shroedinger equation and the condition for the total normalization to be a constant.