

Physics 115a

Homework 2 (due April 12 at start of class)

Assigned April 5

2.1) Problem 1.10 from Griffiths

2.2) Show that $\langle \hat{\psi}_1(t) | \hat{\psi}_2(t) \rangle = \langle \hat{\psi}_1(0) | \hat{\psi}_2(0) \rangle$. You may assume time evolution is given by Eqn 3.24 or 3.26 of the notes (use notes posted after 10pm on April 5 to match the equation numbering) with \mathbf{H} Hermitian. One of these equations will make things easier than the other. *Note: I believe this problem will be simplest when using the methods of section 3.4 of my lecture notes. The one difference between this and the discussion in section 3.4 is that we are dealing here with the inner product between two different states. You might notice that this problem is very similar to problem 1.16 in Griffiths. If you prefer you can do problem 1.16 in Griffiths for this problem using the methods of Griffiths chapter 1 and assuming that time evolution is given by Eqn 1.1 in the text.*

2.3) Problem 1.9 from Griffiths

2.4) Use equation 1.39 from Griffiths to estimate the De Broglie wavelength λ for each of the of the three following objects (*Rough estimates, getting close to the right order of magnitude are fine*)

a) You walking to class (in the reference frame at rest with UCD)

b) The planet earth (in a reference frame at rest with the Sun)

c) An electron with kinetic energy equal to $13.6eV$ (the binding energy of the ground state electron in the Hydrogen atom).

d) Compare your answer to c) with the Bohr radius (which is roughly the “size” of a Hydrogen atom).