

PHY 6646 Spring 2002 – Homework 8

Due by 5 p.m. on Wednesday, April 3. No credit will be available for solutions submitted after 5 p.m. on Thursday, April 4. Solutions will be available shortly after 5 p.m. on Thursday, April 4.

Answer all questions. To gain full credit you should explain your reasoning and show all working. Please write neatly and include your name on the front page of your answers.

1. Merzbacher Exercise 13.6: If the potential V is real-valued, prove that $\psi_{\mathbf{k}}^{(+)}(\mathbf{r})$ and $\psi_{-\mathbf{k}}^{(-)}(\mathbf{r})$ are mutually time-reversed scattering-state solutions of the Schrödinger equation. Interpret this result.

2. Shankar Exercise 19.3.2.

Also answer the following additional part (based on Sakurai Problem 7.3):

(3) Suppose that the energy is raised slightly from the case considered in (2). Show that the angular distribution can be written as

$$\frac{d\sigma}{d\Omega} = A + B \cos \theta.$$

Obtain an approximate expression for B/A .

3. Merzbacher Exercise 13.11: If $V = C/r^n$, obtain the functional dependence of the Born scattering amplitude on the scattering angle. Discuss the reasonableness of the result qualitatively. What values of n give a meaningful answer?
4. Shankar Exercise 19.5.3.
5. Shankar Exercise 19.5.4.