PH 653 Quantum Mechanics 1 April 2016

Homework 1

Due Wednesday 13 April

1. 15.1.1, p. 405 from Shankar

2. 15.1.2, p. 407 from Shankar

3. Consider a system of two angular momenta with $j_1 = 1$ and $j_2 = \frac{1}{2}$.

   a) Write down all the possible states of this system in the product basis (uncoupled basis) $\left| j_1 m_1 \, j_2 m_2 \right\rangle$.

   b) What are the allowed values of the coupled angular momentum quantum numbers *j* and *m* for this system?

   c) Write down all the possible states of this system in the total-*j* basis (coupled basis) $\left| jm \right\rangle$.

   d) Use the Clebsch-Gordan coefficients to express the total-*j* basis (coupled basis) states $\left| jm \right\rangle$ in terms of the product basis (uncoupled basis) states $\left| j_1 m_1 \, j_2 m_2 \right\rangle$.

   e) Use the Clebsch-Gordan coefficients to express the product basis (uncoupled basis) states $\left| j_1 m_1 \, j_2 m_2 \right\rangle$ in terms of the total-*j* basis (coupled basis) states $\left| jm \right\rangle$.