

Physics 7502: Homework Set No. 6

Due date: Tuesday, Feb. 23, 2016, 5:00pm
in PRB M2039 (Bowen Shi's office)

Total point value of set: 100 points

Problem 1 (5 pts.): Under which conditions does $\hat{L} + \alpha \hat{\sigma}$ ($\alpha \in \mathbb{R}$) commute with $\hat{L} \cdot \hat{\sigma}$?

Problem 2 (30 pts.): What are the energy eigenvalues for s states in an attractive central potential $V(r) = -V_0 e^{-r/a}$? Make a model for the deuteron which has only one bound state with binding energy of 2.226 MeV. Estimate the value of V_0 assuming a range $a \sim 1.5\text{--}2$ fm for the strong interaction.

Problem 3 (10 pts.): Exercise 17.2.1 (Shankar, p. 457)

Problem 4 (10 pts.): Exercise 17.2.2 (Shankar, p. 457)

Problem 5 (10 pts.): Exercise 17.2.3 (Shankar, p. 457)

Problem 6 (10 pts.): Exercise 17.2.4 (Shankar, p. 457)

Problem 7 (5 pts.): Exercise 17.2.5 (Shankar, p. 457)
This is easy if you use the work from Problem 3 in HW5.

Problem 8 (10 pts.): Compute $|n^2\rangle$ and E_n^3 for a harmonic oscillator in a constant external electric field.

Problem 9 (10 pts.): Exercise 17.2.7 (Shankar, p. 463)