Physics 7502: Homework Set No. 12

Due date: Tuesday, April 26, 2016, 5:00pm
in PRB M2039 (Bowen Shi's office)

Total point value of set: 100 points

Problem 1 (5 pts.): Exercise 19.6.2 (Shankar, p. 561)

Problem 2 (5 pts.): Exercise 19.6.3 (Shankar, p. 561)

Problem 3 (15 pts.):

If only $\delta_0(E)$ and $\delta_1(E)$ are nonzero in the scattering of a particle of mass m_1 from an initially stationary particle of mass m_2, what does the angular distribution of scattered particles look like in the CM frame? Sketch this distribution (as a polar plot using contour lines) for the special case $\delta_0 = \delta_1$.

Problem 4 (20 pts.):

Consider an experiment in which slow neutrons of momentum $\hbar\boldsymbol{k} = \hbar k \boldsymbol{e}_z$ are scattered by a diatomic molecule; suppose that the two atoms are infinitely heavy, and the molecule is aligned along the y axis, with the two atoms located at $y = \pm a$. Assume that each atom acts with a repulsive δ-function potential of strength V_0 on the incoming neutrons.

Calculate in Born approximation the angular distribution of the scattered neutrons.

Problem 5 (10 pts.): Exercise 8.6.1 (Shankar, p. 234)

Problem 6 (10 pts.): Exercise 8.6.2 (Shankar, p. 234)
Follow the chain of arguments in Sec. 8.3 and calculate the action of the classical path following the hints in Exercise 2.8.7, p. 105.

Problem 7 (25 pts.): Exercise 8.6.3 (Shankar, p. 234)

Problem 8 (10 pts.): Exercise 8.6.4 (Shankar, p. 234)