Physics 451- Fall 2011

Homework #20

Due Thursday, Nov 15, by 7pm

Please place your assignment in the "Physics 451" slot across from N373 ESC.
Help sessions T Th 3 to 6pm N 337 ESC

List of problems (from the textbook):

4.18
4.19
4.21
4.22

Hints:

For problem **4.18**: The point where to start is to calculate the norm (or the norm square) of the vector $L_\pm f_l^m$ in order to determine the expression for A_l^m (or its square). By doing so, you will introduce the product $L_\pm L_\mp$ which you can replace by its expression in terms of L^2 and L_z (using equation 4.112). Use the fact that f_l^m are normalized.

For problem **4.21**, use a test function in order to apply all the successive derivations.
Trigonometric relationships: $\frac{d}{d\theta}\cot\theta = -\csc^2\theta = -\frac{1}{\sin^2\theta}$ and $\csc^2\theta = 1+\cot^2\theta$

Useful integral for problem **4.22**

$$\int_0^\pi \sin^{2l+1}\theta d\theta = 2\frac{2*4*6....(2l)}{1*3*5...(2l+1)} = 2\frac{\left(2^l l!\right)^2}{(2l+1)!}$$

For question c), remember the integral for angular normalization: $\int_{\theta=0}^{\pi}\int_{\phi=0}^{2\pi} \left|Y_l^m\right|^2 \sin\theta d\theta d\phi$