

**Problem#16**

Demonstrate that the Hartree contribution to the self-energy is a scalar. You can use the following decomposition of the Coulomb interaction to obtain this result

$$\frac{1}{|\mathbf{r} - \mathbf{r}'|} = \sum_{\ell=0}^{\infty} \frac{r_{<}^{\ell}}{r_{>}^{\ell+1}} P_{\ell}(\cos \theta), \quad (1)$$

where  $r_{<}$  ( $r_{>}$ ) is the smaller (larger) of  $r$  and  $r'$ , and  $\theta$  is the angle between  $\mathbf{r}$  and  $\mathbf{r}'$ .

We will discuss problems 14, 15 and 16 during the meeting on Monday, October 30, at 3pm. To motivate the preparation for these problems I propose to call on Paul to do #14, Karl #15, and Chris #16.