(33) Determine the expectation value of the kinetic energy for $N$ particles in terms of the relevant single-particle matrix elements by using the Slater determinant for the antisymmetric $N$-particle wave function (Eq. (1.56) in the handout).

(34) Derive all the anticommutation relations for fermion addition and removal operators.

(35) Work out the second-quantized form of

1. the charge density operator (use coordinate space)
2. the electrical current density operator (use a mixed basis of coordinate and momentum space)
3. the $z$-component of the spin density operator (coordinate space)

in the indicated single-particle basis.

(36) Consider antisymmetric two-particle states for the two $p$-shell electrons in $^{12}$C atoms. Determine all the allowed states for these two particles in the $p$-shell using

1. LS-coupling
2. jj-coupling.