Lecture 4. Problems[1].

1. Show that if under transformation of the coordinates the wave functions transform as (13), then the operators will transform as (14).

2. A system is invariant with respect to the group $\mathbf{D}_4$ and its eigenstates can be classified according to the irreducible representations of this group. What will be the degeneracy of the states?

3. Consider a system having the symmetry $\mathbf{O}$. Suppose a perturbation is applied which reduces the symmetry to $\mathbf{D}_4$. How will the 2-fold and 3-fold degenerate levels will be splitted?

4. Consider an atom of ^{4}He placed in a crystal of tetrahedral symmetry $\mathbf{T}_d$ symmetry. Classify two-electron wave functions.

[1]For all the problems the tables of characters for the point symmetry group will be necessary.