

## Applications of Group Theory

Dr. Andrea Donarini

Lectures

Exercises

9.2.01, Mondays, 14:15

7.1.21, Fridays, 10:15

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**Sheet 10**

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**1. Character tables of double groups**

1. Construct the character table of the group  $\bar{D}_2$
2. Consider the group  $D_4$  and find the classes of the associated double group  $\bar{D}_4$  (Hint: make use of the Opechowski's rules)
3. Which is the number of irreducible spinor representations in  $\bar{D}_2$ , and in  $\bar{D}_4$ ?
4. Complete now the character table of the double group  $\bar{D}_4$ .

**2. Geometry of rotations**

1. Prove that all the  $C_3$  operations of the octahedral group  $O$  (group of the cube) are conjugate, but that this is not so for the  $T$  group (group of the tetrahedron). Discuss the corresponding classes in these groups. Hint: make use of the concept of pole.
2. Prove that

$$R(\lambda; \mathbf{\Lambda})\mathbf{r} = (1 - 2\Lambda^2)\mathbf{r} + 2\lambda(\mathbf{\Lambda} \times \mathbf{r}) + 2(\mathbf{\Lambda} \cdot \mathbf{r})\mathbf{\Lambda}$$

where  $R(\lambda; \mathbf{\Lambda})$  is a rotation in terms of the Euler-Rodrigues parameters and  $\mathbf{r}$  is a generic space vector.

**Frohes Schaffen!**