Exercises: Tutorial 18.12.2015

1. Given wave-functions (states) of two-electron system in jj coupling scheme:

$$\left| s_{1/2} d_{3/2} : J = 2 \right\rangle$$
$$\left| p_{3/2} f_{5/2} : J = 3 \right\rangle$$

re-write them in the LS-coupling scheme.

2. By using the 6-j Wigner's symbols express the wave-functions of the state $\left| j_1 j_2 (J_{12}), j_3 : J \right\rangle$ in terms of the wave-functions, corresponding to the following coupling schemes:

$$\mathbf{j}_2 + (\mathbf{j}_1 + \mathbf{j}_3), \quad \mathbf{j}_1 + (\mathbf{j}_3 + \mathbf{j}_2), \quad (\mathbf{j}_2 + \mathbf{j}_1) + \mathbf{j}_3$$

3. Let $\hat{s}_i = \hat{\sigma}_i / 2$ are operators of spin (s=1/2) projection on axes x,y,z of the coordinate system *S*. Find the operators $\tilde{\hat{s}}_i$ of the spin projection on the axes $\tilde{x}, \tilde{y}, \tilde{z}$ in new coordinate system $\tilde{S}$ which is obtained from *S* by rotation around y-axis by angle β.