PH3521701 现代原子物理 **2019-03-19**

Lecture summary

- Fluorescence, angular distribution and polarization (revisit)
- Atomic parity non-conservation
- Wigner-Eckart Theorem
- Optical pumping
- Wigner's 6-j symbol

Homework

1. In the hydrogen atom, the $2^2P_{3/2}$ (F = 1, M_F = +1) state can decay to three possible states in the ground-level $1^2S_{1/2}$: F = 1, M_F = +1; F = 1, M_F = 0; F = 0, M_F = 0.
   a. Compute the branching ratios of all three decay channels using the 3-j, but not 6-j symbols.
   b. Compute the branching ratios of all three decay channels using both the 3-j and 6-j symbols.

$$< \mathrm{n}'\ F'\ M'\ J'\ I \left| r_q \right| n\ F\ M\ J\ I >$$
$$= (-1)^{J'+I-M_{F'}} \cdot \sqrt{(2F+1)(2F'+1)} \cdot \begin{Bmatrix} J' & F' & I \\ F & J & 1 \end{Bmatrix}$$
$$\cdot \begin{pmatrix} F & 1 & F' \\ M_F & q & -M_{F'} \end{pmatrix} \cdot < \mathrm{n}'\ J' \| r \| n\ J >$$

   c. Calculate the spatial distribution of the fluorescence emissions from this excited state.

Reading Assignments:

Putting a spin on light and atoms: how to build a better magnetometer
https://phys.org/news/2010-09-atoms-magnetometer.html