306(5): H Spectrum with Left Circularly Polarized Probe Radiation

In this case the selection rules are:

$$\text{any } \Delta n, \quad \Delta l = \pm 1, \quad \Delta m = 1 \qquad (1)$$

Hα Line ($n' = 2$ to $n = 3$) at 15,241.4 cm^{-1}, Red.

There are five transitions possible compared with three in linear polarization ($\Delta m = 0$). They are:

a) $2s \rightarrow 3p$ ($n' = 2, l = 0, m = 0$ to $n = 3, l = 1, m = 1$).

b) $2p \rightarrow 3s$ ($n' = 2, l = 1, m = -1$ to $n = 3, l = 0, m = 0$).

c) $2p \rightarrow 3d$ ($n' = 2, l = 1, m = -1$ to $n = 3, l = 2, m = 0$)

d) $2p \rightarrow 3d$ ($n' = 2, l = 1, m = 0$ to $n = 3, l = 2, m = 1$)

e) $2p \rightarrow 3d$ ($n' = 2, l = 1, m = 1$ to $n = 3, l = 2, m = 2$)

Hβ Line ($n' = 2$ to $n = 4$) at 20,576 cm^{-1}, Blue

There are five transitions possible compared with three in linear polarization ($\Delta m = 0$). They are:

a) 2s to 4p ($n' = 2, l = 0, m = 0$ to $n = 4, l = 1, m = 1$).

b) 2p to 4s ($n' = 2, l = 1, m = -1$ to $n = 4, l = 0, m = 0$).

c) 2p to 4d ($n' = 2, l = 1, m = 0$ to $n = 4, l = 2, m = 1$)

d) 2p to 4d ($n' = 2, l = 1, m = -1$ to $n = 4, l = 2, m = 0$)

e) 2p to 4d ($n' = 2, l = 1, m = 1$ to $n = 4, l = 2, m = 2$)

2) Infra-red Line at 5,334.4 cm^{-1} ($n' = 3$ to $n = 4$)

There are eleven transitions compared with ($\Delta m = 0$). They are: five in linear polarization.

a) $3s \rightarrow 4p$ ($n' = 3, l = 0, m = 0$ to $n = 4, l = 1, m = 1$)

b) $3p \rightarrow 4s$ ($n' = 3, l = 1, m = -1$ to $n = 4, l = 0, m = 0$)

c) $3p \rightarrow 4d$ ($n' = 3, l = 1, m = -1$ to $n = 4, l = 2, m = 0$)

d) $3p \rightarrow 4d$ ($n' = 3, l = 1, m = 0$ to $n = 4, l = 2, m = 1$)

e) $3p \rightarrow 4d$ ($n' = 3, l = 1, m = 1$ to $n = 4, l = 2, m = 2$)

f) $3d \rightarrow 4p$ ($n' = 3, l = 2, m = -2$ to $n = 4, l = 1, m = -1$)

g) $3d \rightarrow 4p$ ($n' = 3, l = 2, m = -1$ to $n = 4, l = 1, m = 0$)

h) $3d \rightarrow 4p$ ($n' = 3, l = 2, m = 0$ to $n = 4, l = 1, m = 1$)

i) $3d \rightarrow 4f$ ($n' = 3, l = 2, m = -2$ to $n = 4, l = 3, m = -1$)

j) $3d \rightarrow 4f$ ($n' = 3, l = 2, m = -1$ to $n = 4, l = 3, m = 0$)

k) $3d \rightarrow 4f$ ($n' = 3, l = 2, m = 0$ to $n = 4, l = 3, m = 1$)

In the absence of any other factor these eleven transitions all occur at ~~the~~ same frequency, but the quantum theory of the Evans/Morris effect shows how they are split into eleven lines

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