穆斯堡尔效应实验数据处理

[redacted]

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1 实验结果

1.1 v = 7 s

By the experiment's data, we have $N_1$to N_6, which are respectively equal to the table

We get the aisle increase k,

$$k\bigg|_{v=7} = \frac{V_6-V_1}{N_6-N_1} = 0.03608(mm/CH\cdot s)$$
$$k\bigg|_{v=8} = \frac{V_6-V_1}{N_6-N_1} = 0.04719(mm/CH\cdot s)$$

Then we can use the formula $\frac{V_6-V_0}{N_6-N_0} = k$ to get the aisle siteN_0, simplified it,

$$N_0\bigg|_{v=7} = N_6 - \frac{V_6-V_0}{k} = 250.987$$
$$N_0\bigg|_{v=8} = N_6 - \frac{V_6-V_0}{k} = 250.473$$

Also, by the equation $\delta = \frac{V_1+V_2+V_5+V_6}{4}$,and k we can get V_2 = -4.41098 mm/s and V_5 = 3.67096 mm/s, V_4 = 0.45984 mm/s and V_3 = -1.41632 mm/s(above all are v = 7); and the algorithm with v = 8 are the same as the v = 7

Maximum velocity	1	2	3	4	5	6
7	57	138	221	273	362	445
8	81	151	224	276	349	420

Maximum velocity	1	2	3	4	5	6
7	-5.18	-4.41098	-1.41632	0.45984	3.67096	5.21
8	-5.53	-3.87361	-1.25273	1.33071	3.13365	5.48

(KeV)	ΔE	ΔE_g	ΔE_e	ΔE_Q
7	-8.886×10^{-12}	2.3306×10^{-10}	1.4382×10^{-10}	1.941×10^{-10}
8	-8.886×10^{-12}	2.4998×10^{-10}	1.2589×10^{-10}	-1.6829×10^{-10}

print its as a table.

The goal of the next part is to find the velocity corresponding to the Fe's hexapeak, and determine the ΔE, ΔE_Q, ΔE_e, ΔE_g, then calculate the Landé g-factor for ^{57}Fe ground state(g_{ne}) and the first excited state(g_{ng})

At the previous part, we get the velocities(V_1 to V_6), so we can use some equations $\delta = \frac{c}{E_y}\Delta E$, $\Delta E_g = \frac{E_y}{c}(V_4 - V_2)$, $\Delta E_e = \frac{E_y}{c}(V_3 - V_2)$, $\Delta E_Q = \frac{E_y}{c}\frac{(V_6-V_5)-(V_2-V_1)}{2}$, $E_y = 14.41KeV$, we use above equations to find the Landé g-factor for ^{57}Fe ground state(g_{ne}) and the first excited state(g_{ng})

The Landé g-factor can be calculated by:

$$\Delta E_{e,g} = \mu_n g_n H$$

where μ_n and H are known constant.

The life time and energy resolution

$$\tau\Big|_{v=7} = /frac\hbar 4223.6374 - 3912.6663 = 3.39 \times 10^{-37}$$
$$\tau\Big|_{v=8} = /frac\hbar 4231.6416 - 3935.8731 = 3.56 \times 10^{-37}$$
$$Energyresolution\Big|_{v=7} = /frac 4231.6416 - 3935.873114.41K = 2.15\%$$
$$Energyresolution\Big|_{v=8} = /frac 4231.6416 - 3935.873114.41K = 2.05\%$$

Landé g-factor	g_{ne}	g_{ng}
7	0.136	0.148
8	0.153	0.162

2 Thinking

1.

(1)No. The ultra fine structure parameters are both related to nucleus and the environment

(2)Select a radiation source with a γ photon source with a larger recurring fraction. It is best to reach room temperature when the Musburg effect can be achieved. (Most isotopes can only be achieved at low temperatures.)

2.The sample must contain the same Musburg core as in the source, but the difference is that the Musburg core in the sample is in the ground state. Therefore, metal ^{57}Co(different isotopes) and ^{56}Fe(different elements) are different from the nucleus of the radioactive source, so they cannot.

3.No. Different atom have different energy level, so the spectral line are different.

4.It select the signal which related to Mößbauer-Effekt, and send these signal to the equipment.

3 appendix-code

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test
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Listing 1: 0.1s