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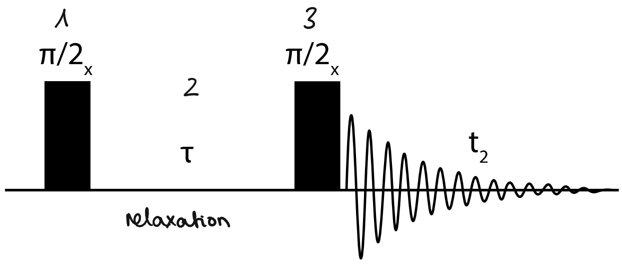
Jigsaw 3A

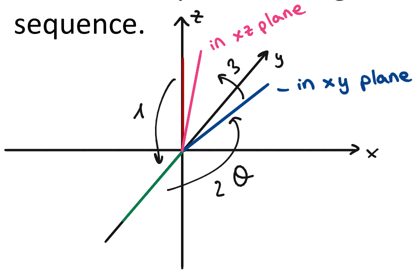
1. * [Keeler Sections 4.7-10] A pulse sequence is shown below.



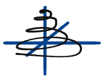
Good!
the therms of \alpha(t) is assuming relaxation. Those can be set to 0 assuming there is no relaxation

   a. Use vector diagrams to predict the outcome of the sequence when applied to equilibrium magnetization. In your answer, set up a table describing the values of x-, y- and z- magnetizations after each element of the pulse sequence.

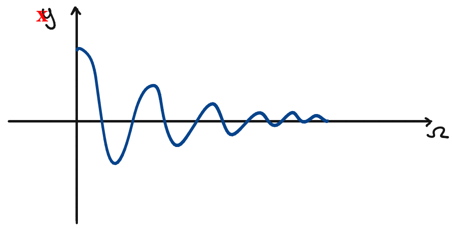
1.75/2

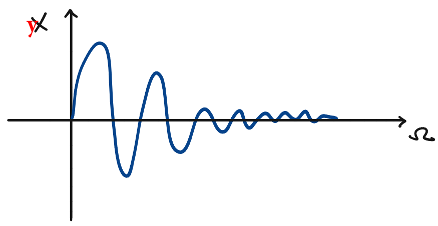


$M_x = 0$, $M_y = 0$, $M_z = M_0$ $\xrightarrow{1}$ $M_x = 0$, $M_y = -M_0$, $M_z = 0$ $\xrightarrow{2}$ $M_x = M_0 \sin(\Omega\tau)$, $M_y = -M_0\cos(\Omega\tau)$, $M_z = \alpha(\tau) M_x$ $\xrightarrow{3}$ $M_x = M_0\sin(\Omega\tau)$, $M_y = -\alpha(\tau) M_x$, $M_z = -M_0\cos(\Omega\tau)$



   b. For a fixed delay, sketch a graph of the x- and y-magnetization as a function of the offset during t_2. Ω = offset





   c. At what values of $\Omega\tau$ do any nulls occur?

$$\begin{cases} \Omega\tau = \pi k \\ \Omega\tau = \pi k + \pi/2 \end{cases} \quad k \in \mathbb{N}$$

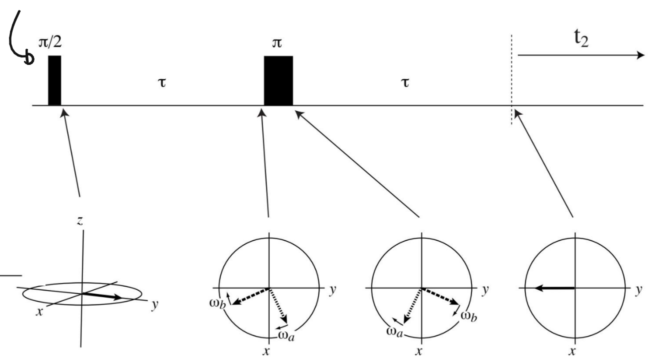
2/2

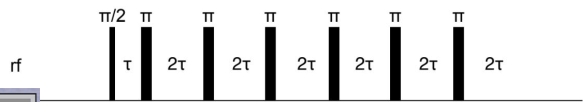
2. [Keeler Section 4.9] What happens to net magnetization after a 90° pulse? How can we measure T_2? Draw the pulse sequence and the resulting vector model for two spins. *See also: Jigsaw 3D.2*

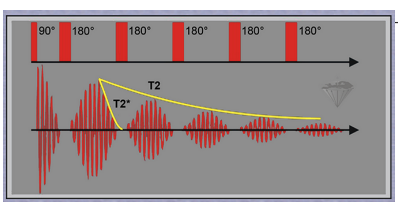
↳ goes into xy plane, and then relaxation

T_2 = how fast it decays in the xy plane

↳ do the spin echo sequence to measure T_2:







We would fit the max for the sequence of spin echos

CH-314 Structural Analysis
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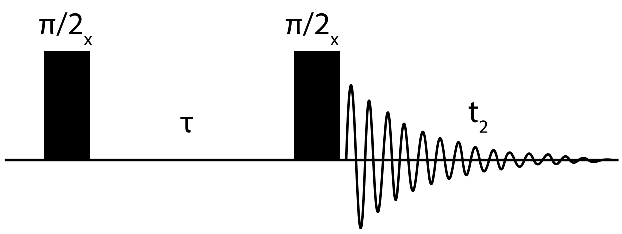
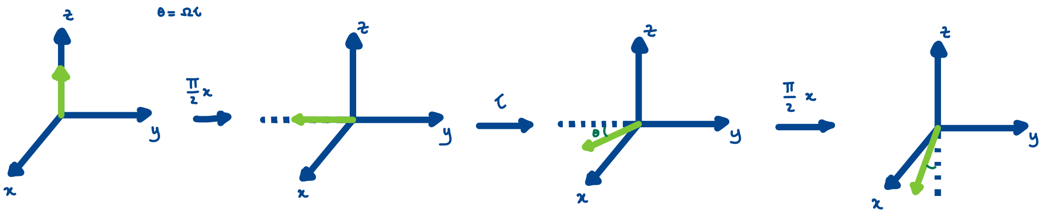
Jigsaw 3A

1. * [Keeler Sections 4.7-10] A pulse sequence is shown below. 2/2



a. Use vector diagrams to predict the outcome of the sequence when applied to equilibrium magnetization. In your answer, set up a table describing the values of x-, y- and z- magnetizations after each element of the pulse sequence.

Good!

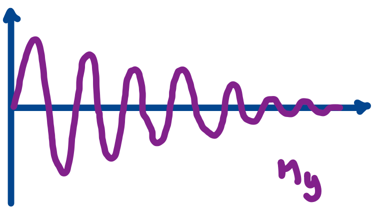


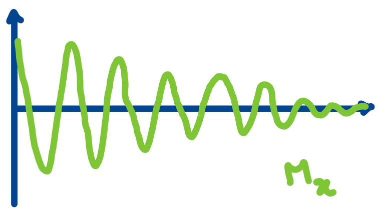
	x-magnetization	y-magnetisation	z-magnetization
Start	0	0	M_0
After $\frac{\pi}{2}x$	0	$-M_0$	0
After τ	$M_0 \sin(\theta)$	$-M_0 \cos(\theta)$	0
After $\frac{\pi}{2}x$	$M_0 \sin(\theta)$	0	$-M_0 \cos(\theta)$

b. For a fixed delay, sketch a graph of the x- and y-magnetization as a function of the offset during t_2.

If the offset is 0 or $k\pi$, the magnetization will be 0 for both since it goes back to the z axis after $\frac{\pi}{2}$ pulse

If the offset is negative, the functions would be inverted





c. At what values of $\Omega\tau$ do any nulls occur?

For M_y:

$\theta = \Omega\tau = k\pi$ w/ $k \in \mathbb{Z}$

For M_x:

$\theta = \Omega\tau = \frac{\pi}{2} + k\pi$

2. [Keeler Section 4.9] What happens to net magnetization after a 90° pulse? How can we measure T_2? Draw the pulse sequence and the resulting vector model for two spins. *See also: Jigsaw 3D.2* 1.75/2

After 90° pulse there's no magnetization on the z-axis. T_2 can be measured using the spin echo.

The magnetization is flipped on the transverse plane XY

But <u>how</u> can it be measured? The spin echo is right though. Here down an example where the decay of the maximim signal in th eexho can be fitted by an exponential whtat will lead to T2.