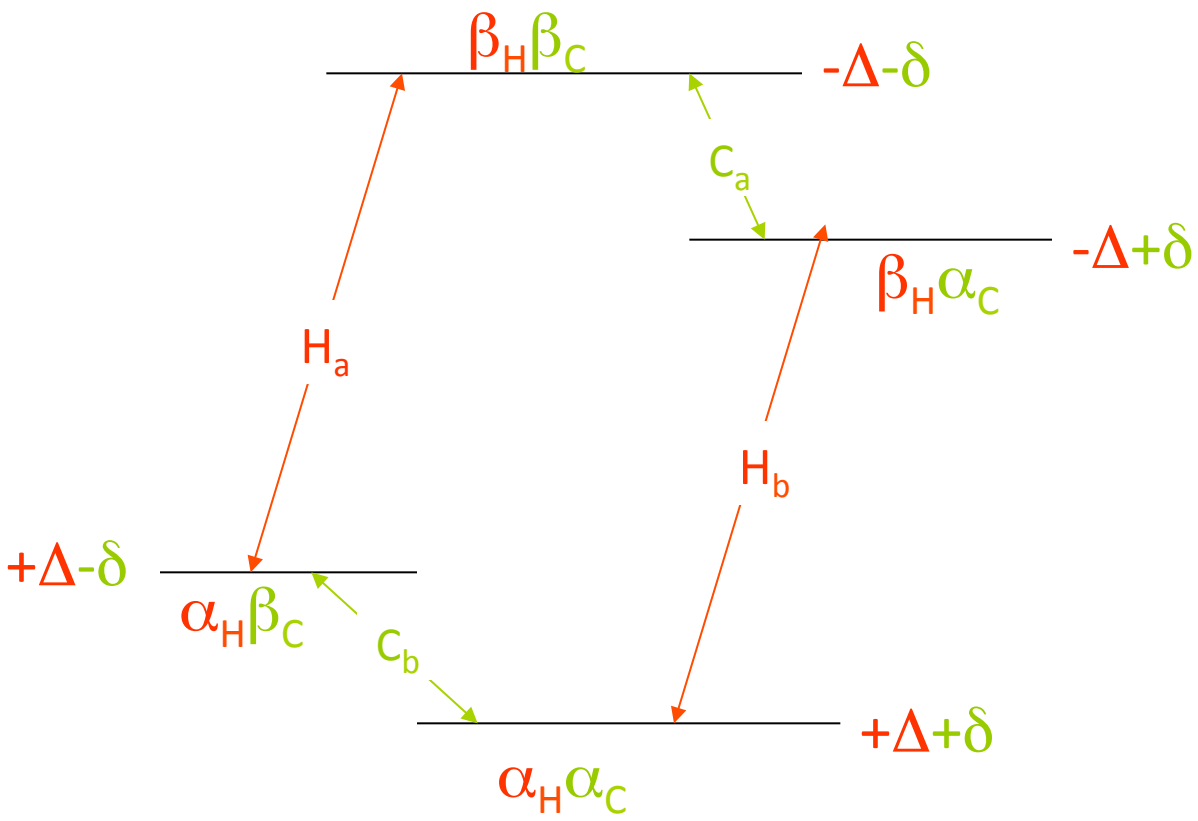
Polarization Transfer Through Bonds Mediated by Scalar Coupling

- ✓ Selective Population Transfer
- ✓ Insensitive Nuclei Enhanced by Polarization Transfer
- ✓ Distortionless Enhancement by Polarization Transfer

Selective Population Transfer

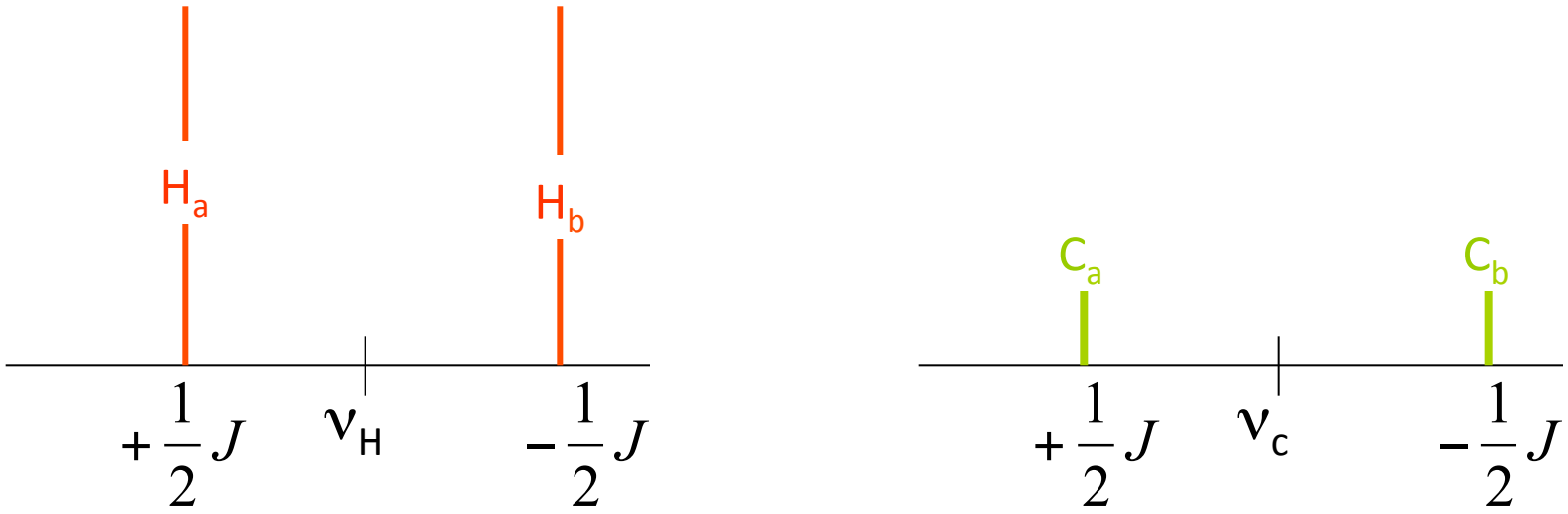


at equilibrium for a heteronuclear system HC

the deviations from the average values are reported

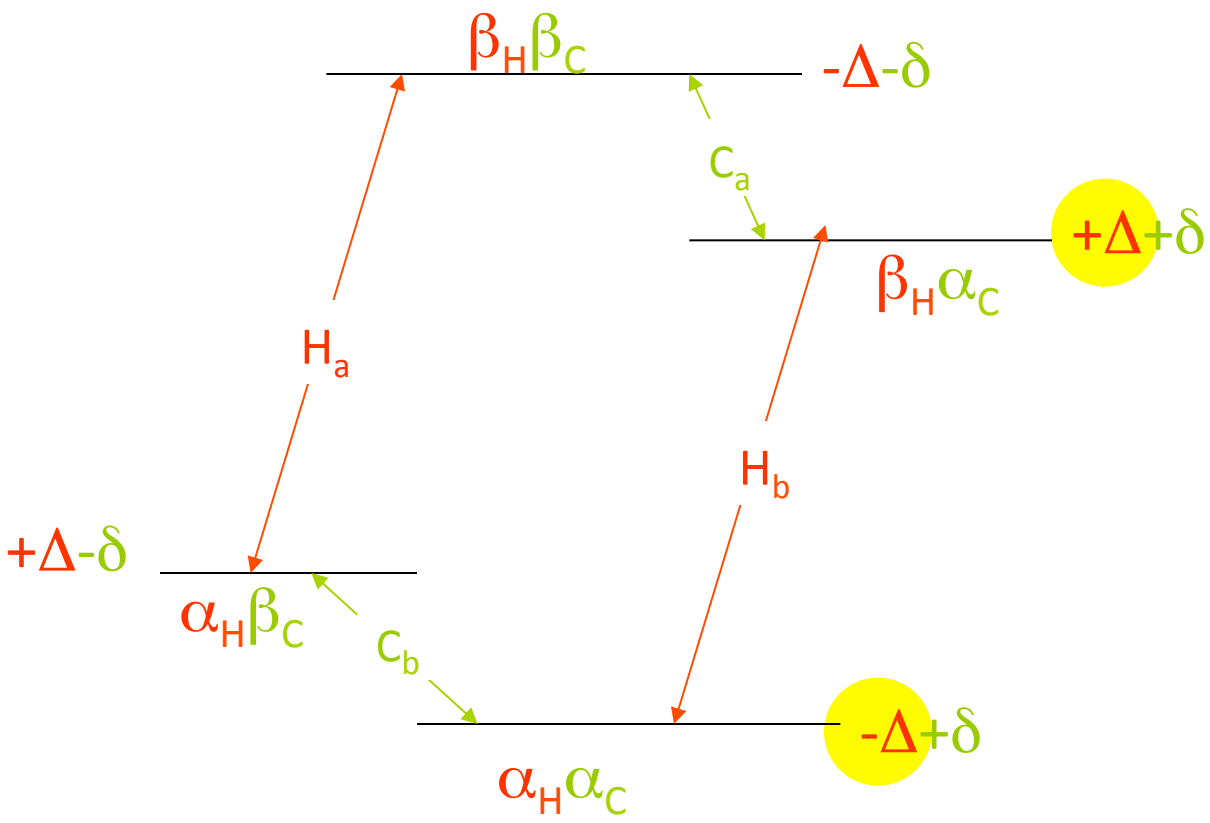
2Δ the population difference for proton across the two levels connected by the transition , 2δ for ^{13}C

^{1}H and ^{13}C Spectra



The signal intensities depend on the population differences:

2Δ for H transitions and 2δ for C transitions

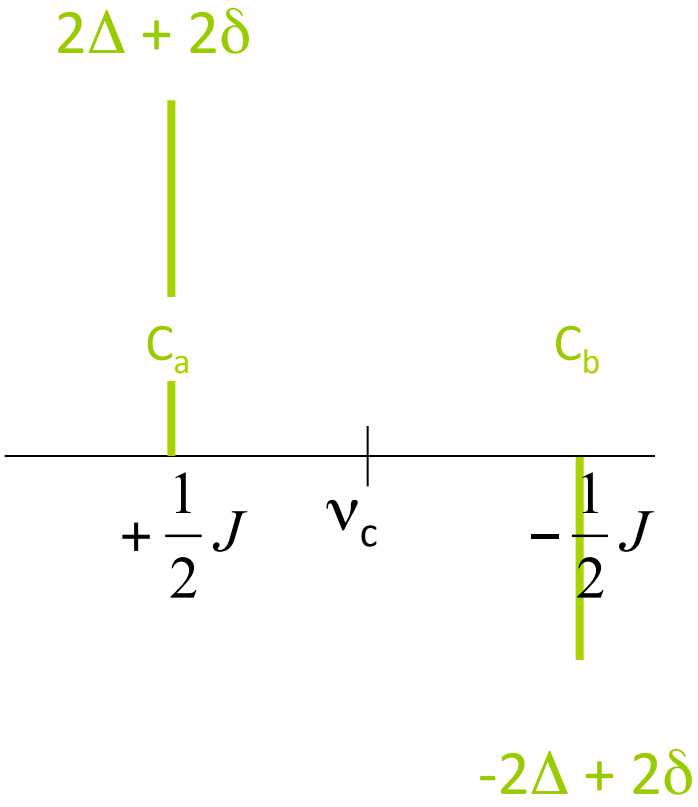


The populations of two levels connected by a proton transition are inverted, e.g the H_b, by means of a selective pulse for that transition

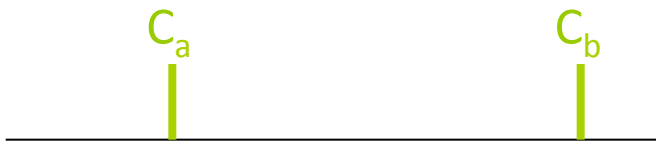
population difference for C_a: $2\Delta + 2\delta$

for C_b: $-2\Delta + 2\delta$

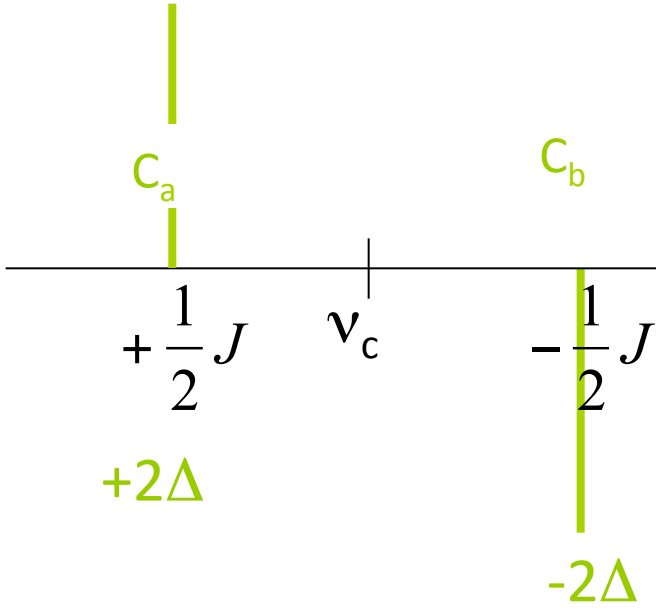
^{13}C Spectrum upon Proton Population Inversion across H_b



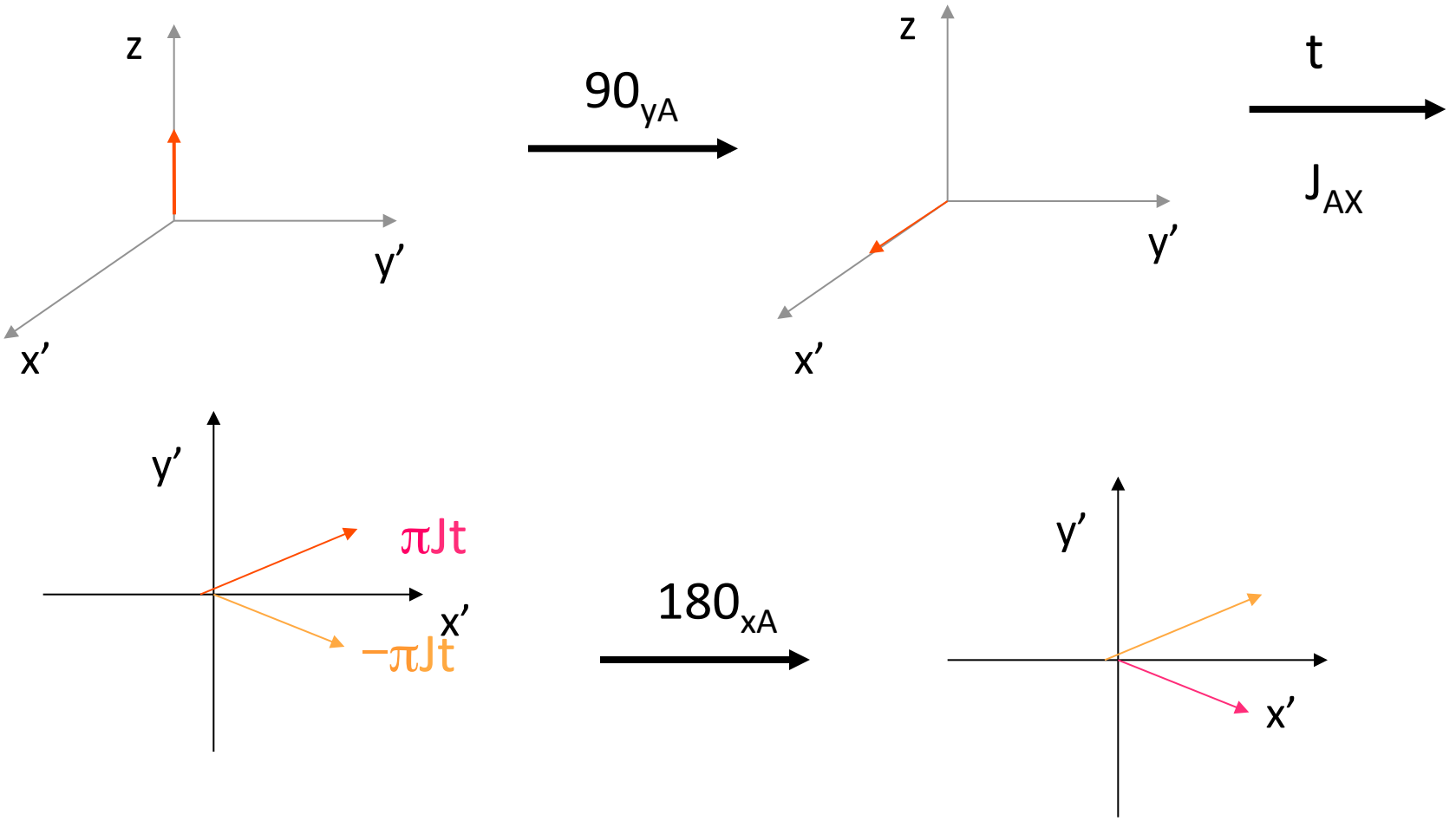
subtracting the pristine spectrum



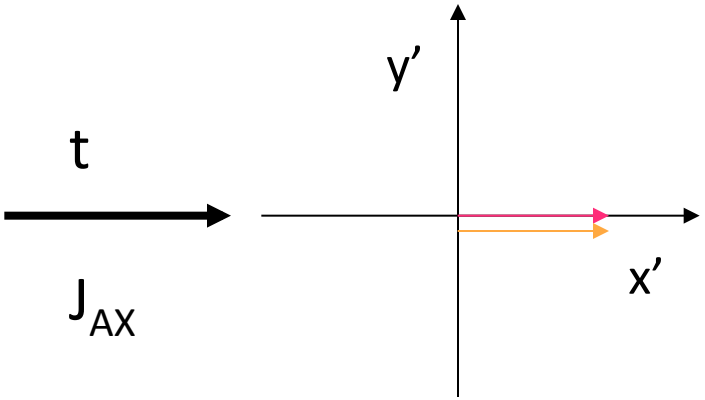
an antiphase doublet is obtained



Spin Echo for an AX Spin System



Heteronuclear AX Spin System



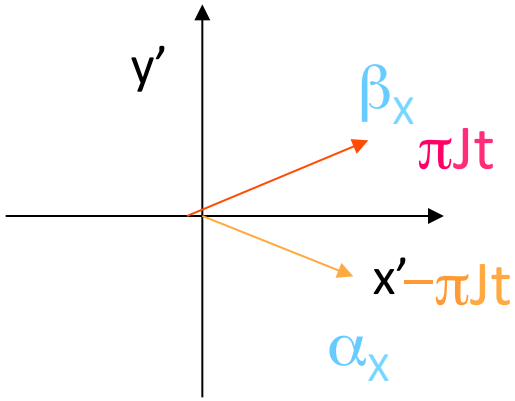
refoccusing

Homonulear AX Spin System with A Selective π pulse

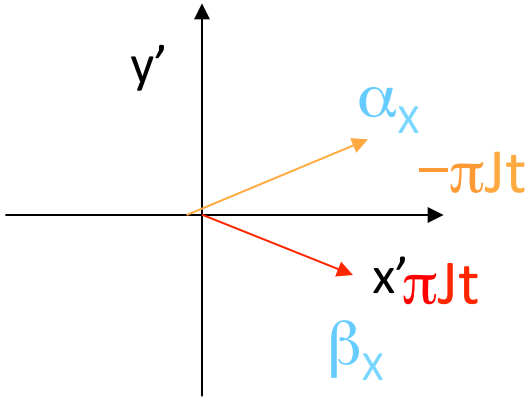
analogously to the heteronuclear case:

refoccusing

Homonuclear AX System with a X Selective π Pulse

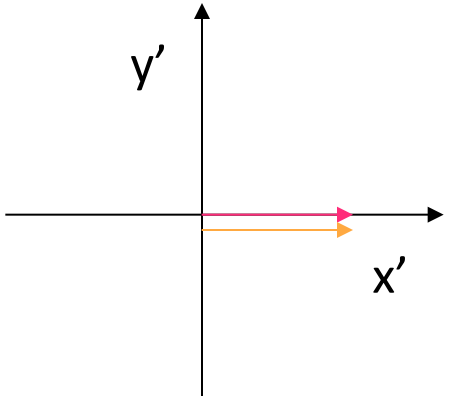


180_{xX}



t

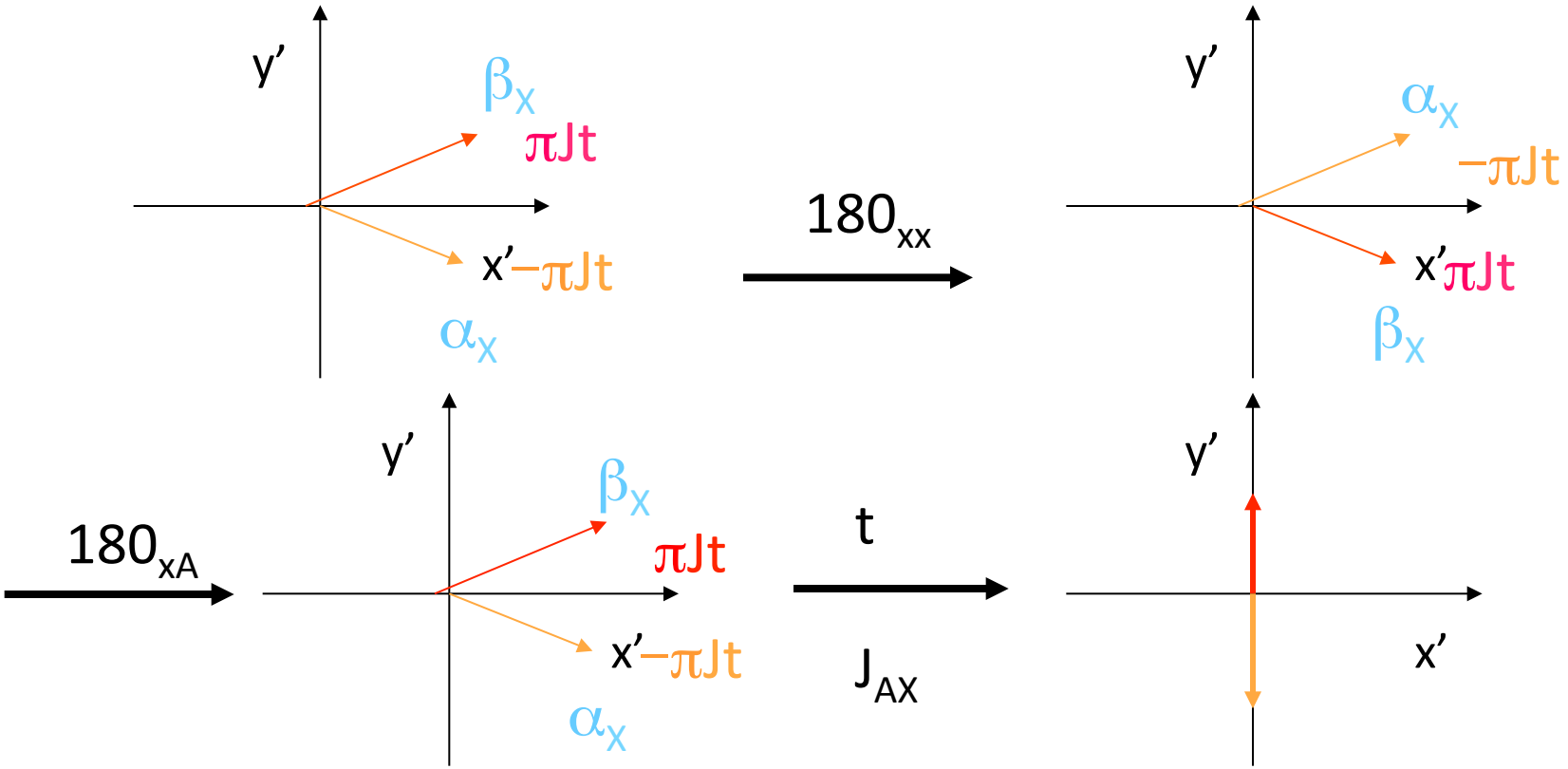
J_{AX}



refocussing

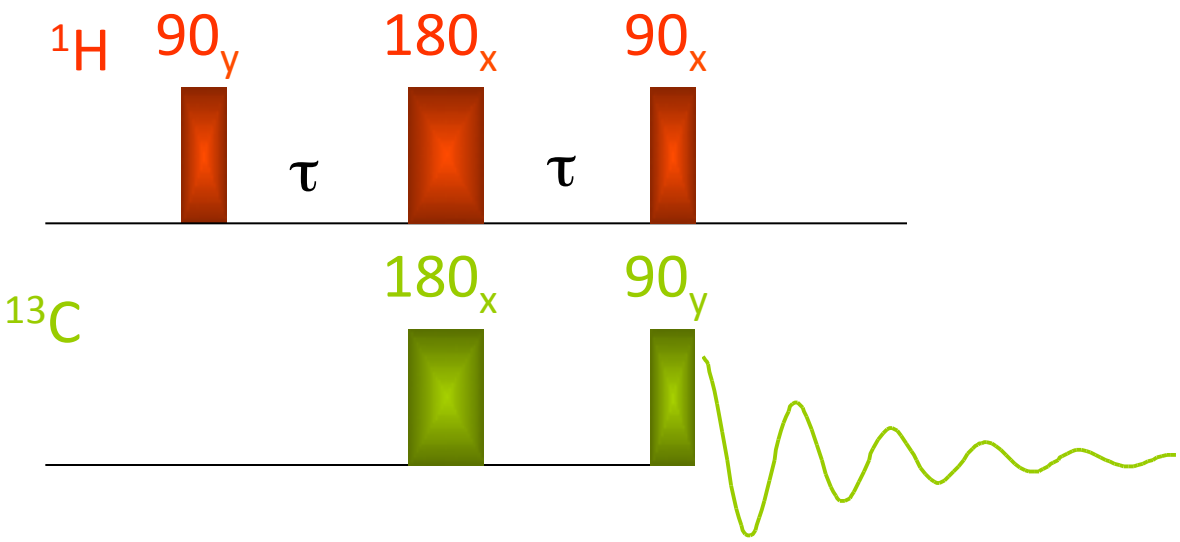
we are observing the nucleus A

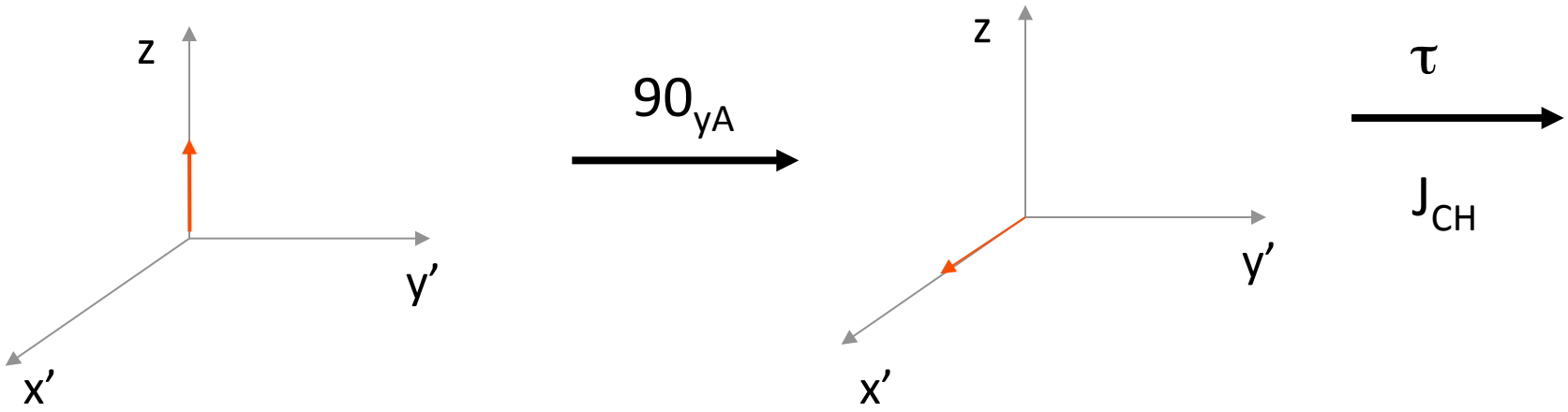
Homonulear AX Sytem with a Non Selective π Pulse



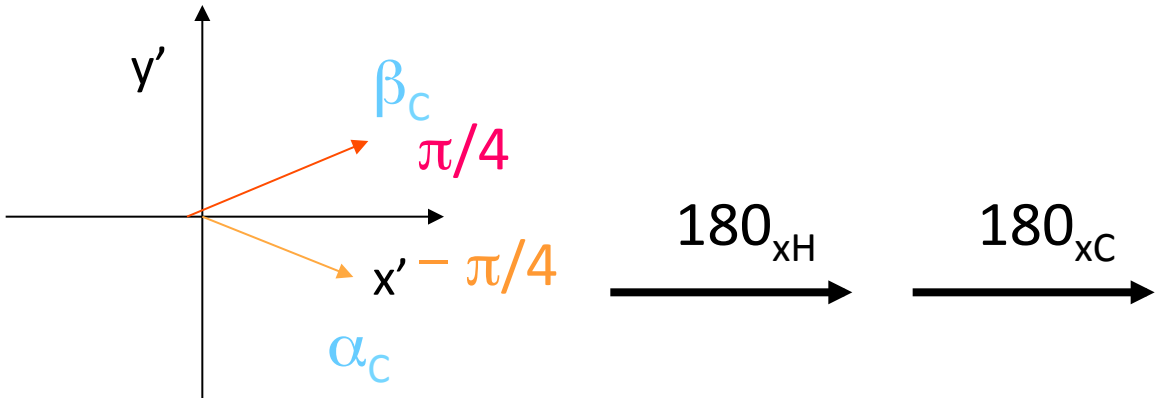
the defocussing of the vectors of nucleus A is going on

INEPT



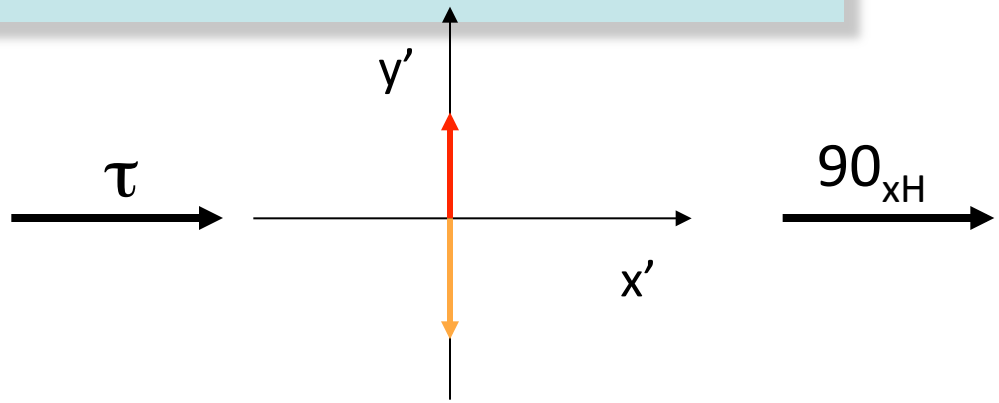


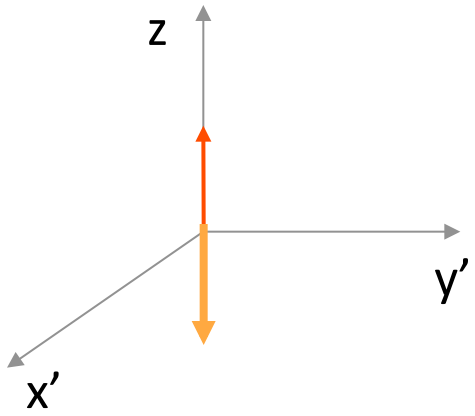
$$\tau = \frac{1}{4J}$$



the overall effect of the two π pulses on C and H is the same as that of a non selective π pulse for a homonuclear system

the defocussing is going on, however the ^{1}H chemical shifts are refocussed and therefore the sequence results non selective





In this way the inversion of only one component of the doublet has been accomplished for all protons, irrespectively of their chemical shift

Now the ^{13}C spectrum is acquired and it displays a sensitivity increase due to the polarization transfer

In this case the signal increment is

that for ^{13}C corresponds to 4

and for ^{15}N is as high as 10

$$\frac{\gamma_H}{\gamma_C}$$