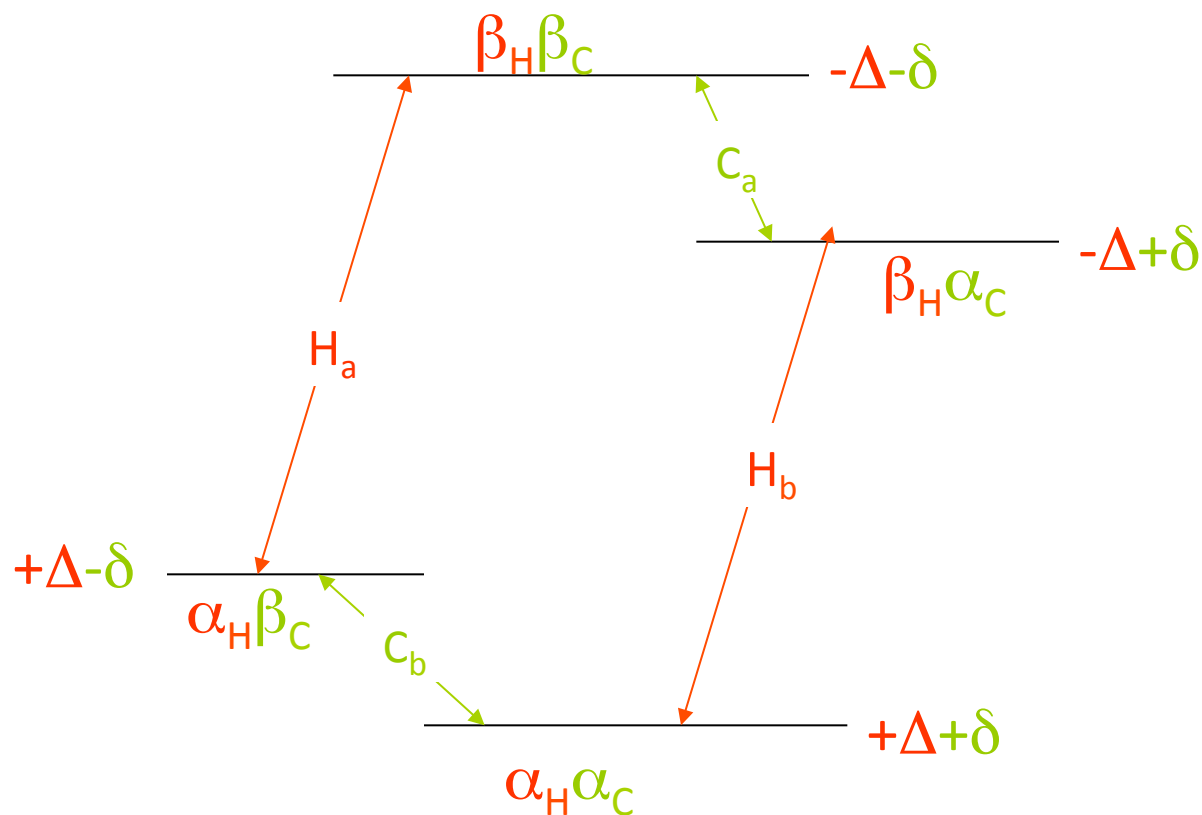


# Polarization Transfer through Bonds in the Presence of Scalar Coupling

- ✓ Selective **P**opulation **T**ransfer
- ✓ Insensitive **N**uclei **E**nhanced by  
**P**olarization **T**ransfer
- ✓ Distortionless **E**nhancement by  
**P**olarization **T**ransfer

# Selective Population Transfer

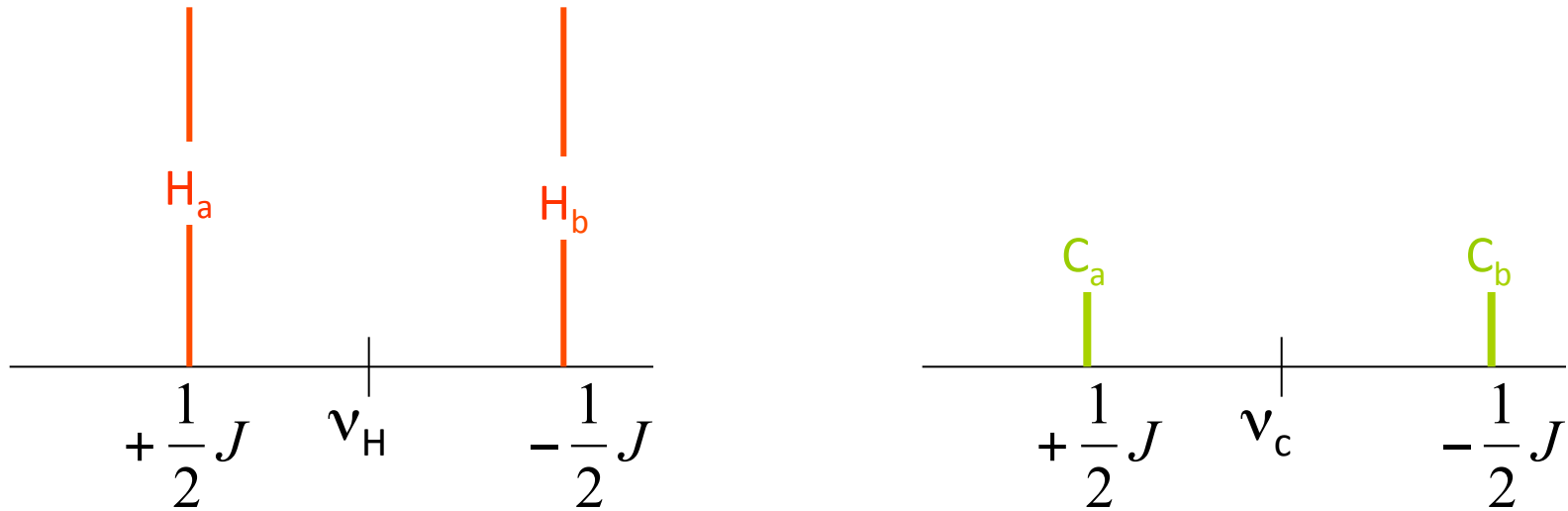


populations at equilibrium for a HC system

$\delta$  and  $\Delta$  are the deviations from the average values

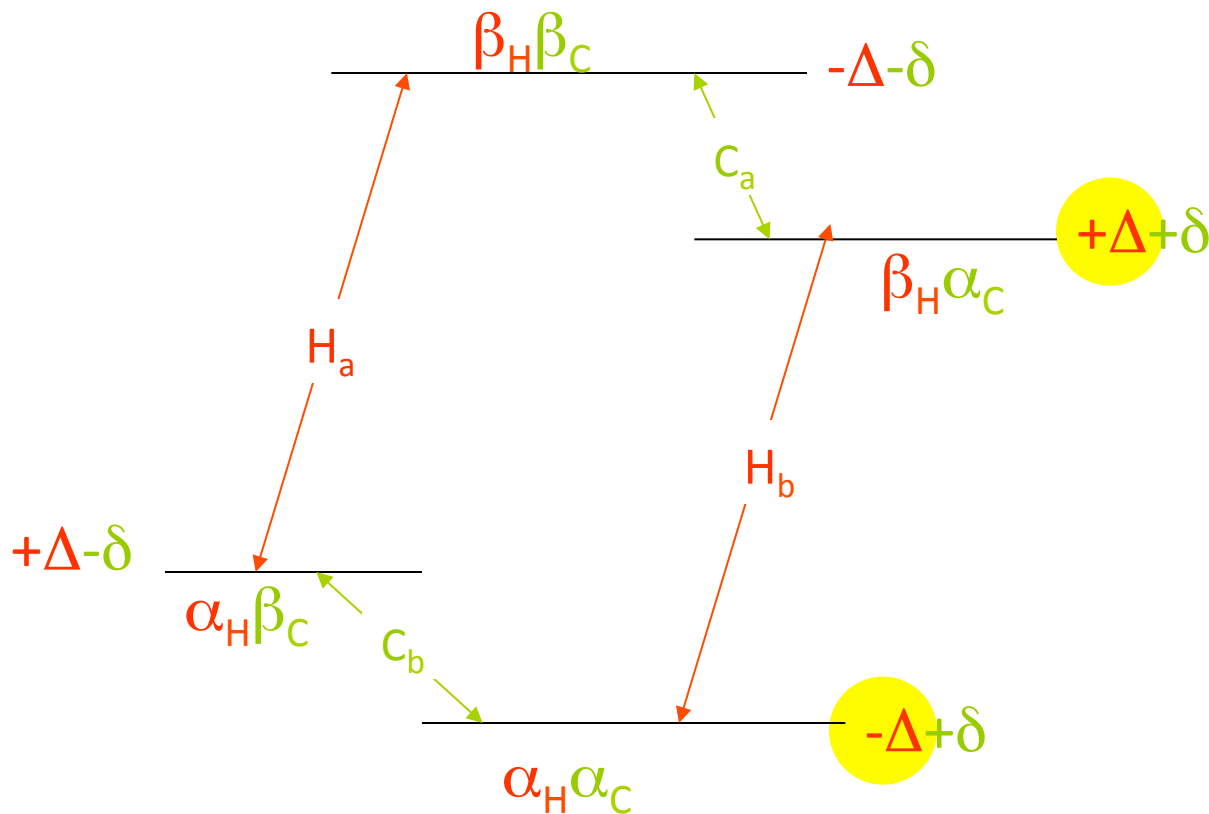
$2\Delta$  is the population difference across the two levels involved in a  $^1\text{H}$  transition,  $2\delta$  for  $^{13}\text{C}$

# $^1\text{H}$ and $^{13}\text{C}$ Spectra



The signals' intensities depend on the population differences:

$2\Delta$  for the **H** transitions and  $2\delta$  for the **C** transitions

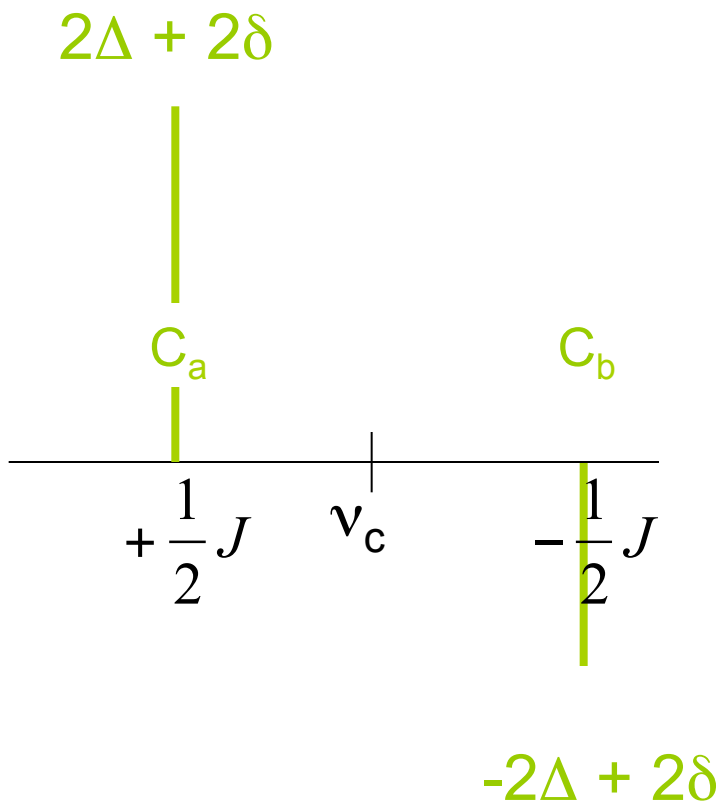


The populations of two levels connected by a  $^1\text{H}$  transition, e.g.  $H_b$ , are inverted by means of a selective pulse for that transition

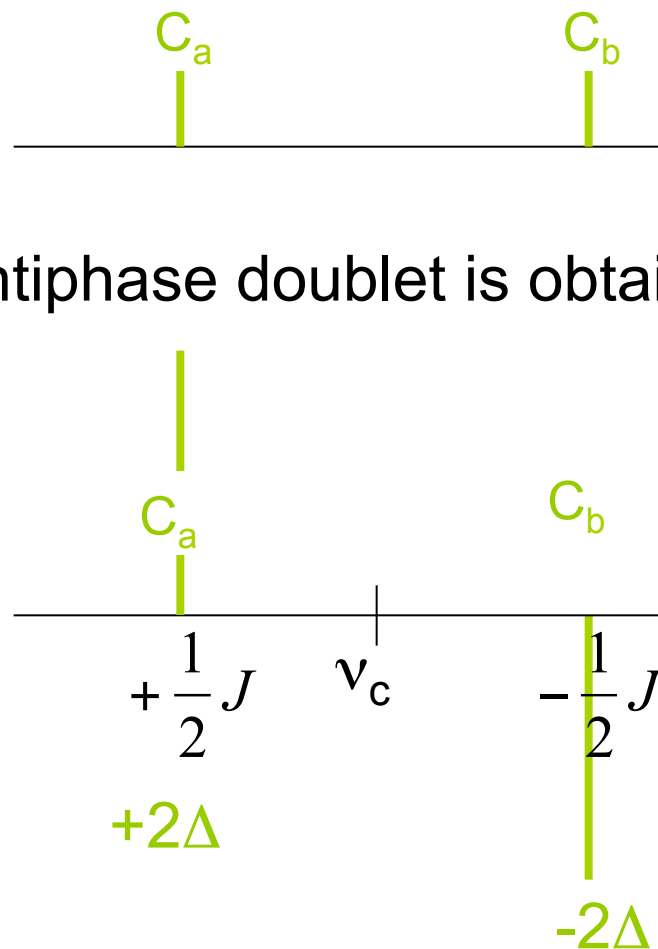
population difference for  $C_a$ :  $2\Delta + 2\delta$   
 for  $C_b$ :  $-2\Delta + 2\delta$

# $^{13}\text{C}$ Spectrum with Population Inversion across the $\text{H}_b$ Transition

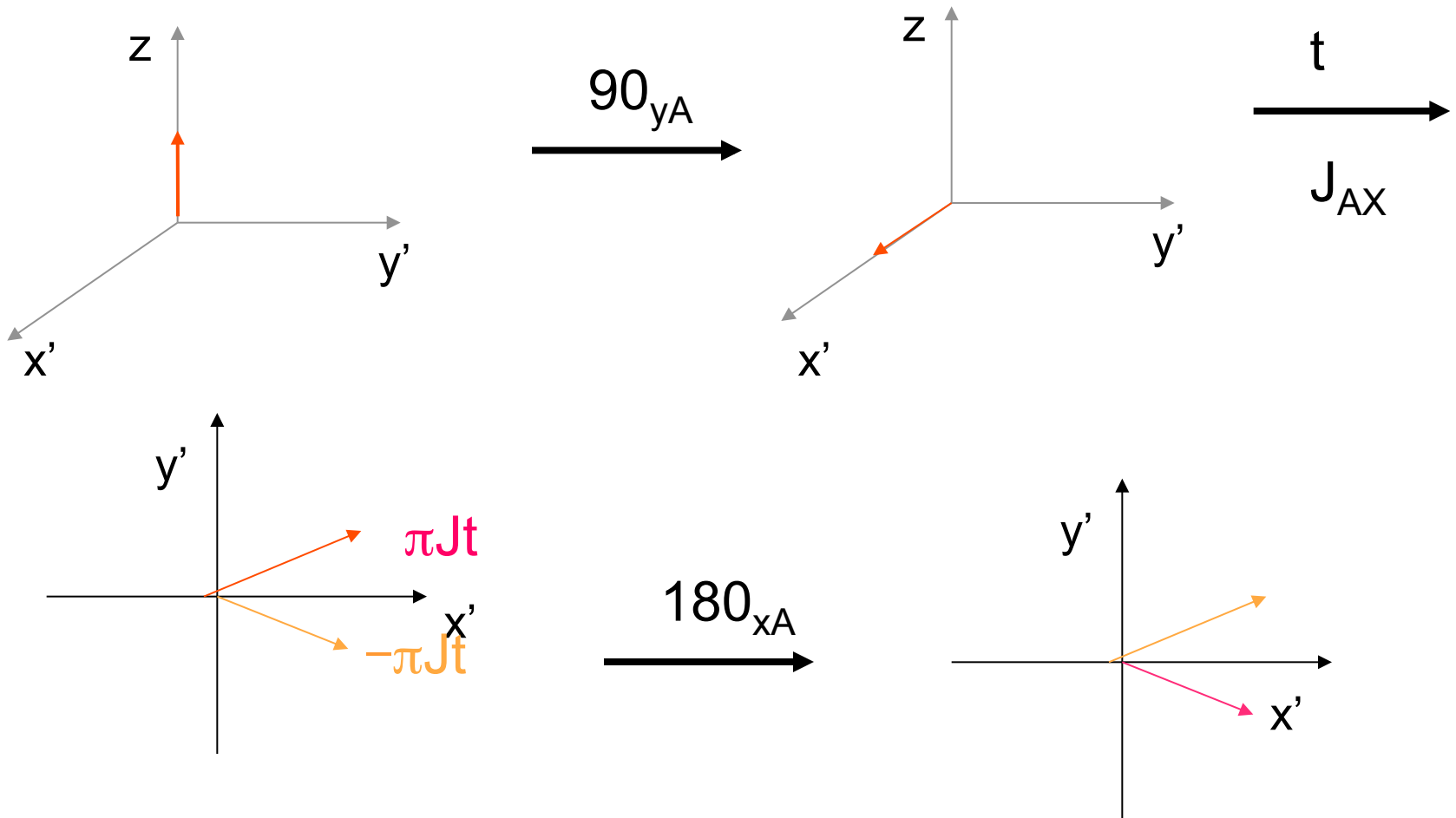
subtracting the usual spectrum



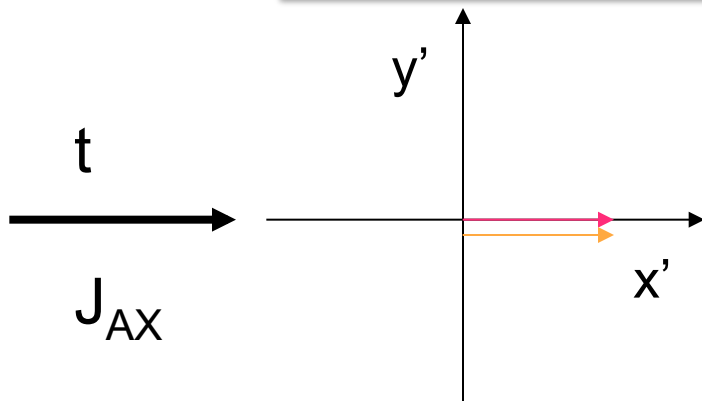
an antiphase doublet is obtained



# Spin Echo for a AX Spin System



## Heteronuclear AX System



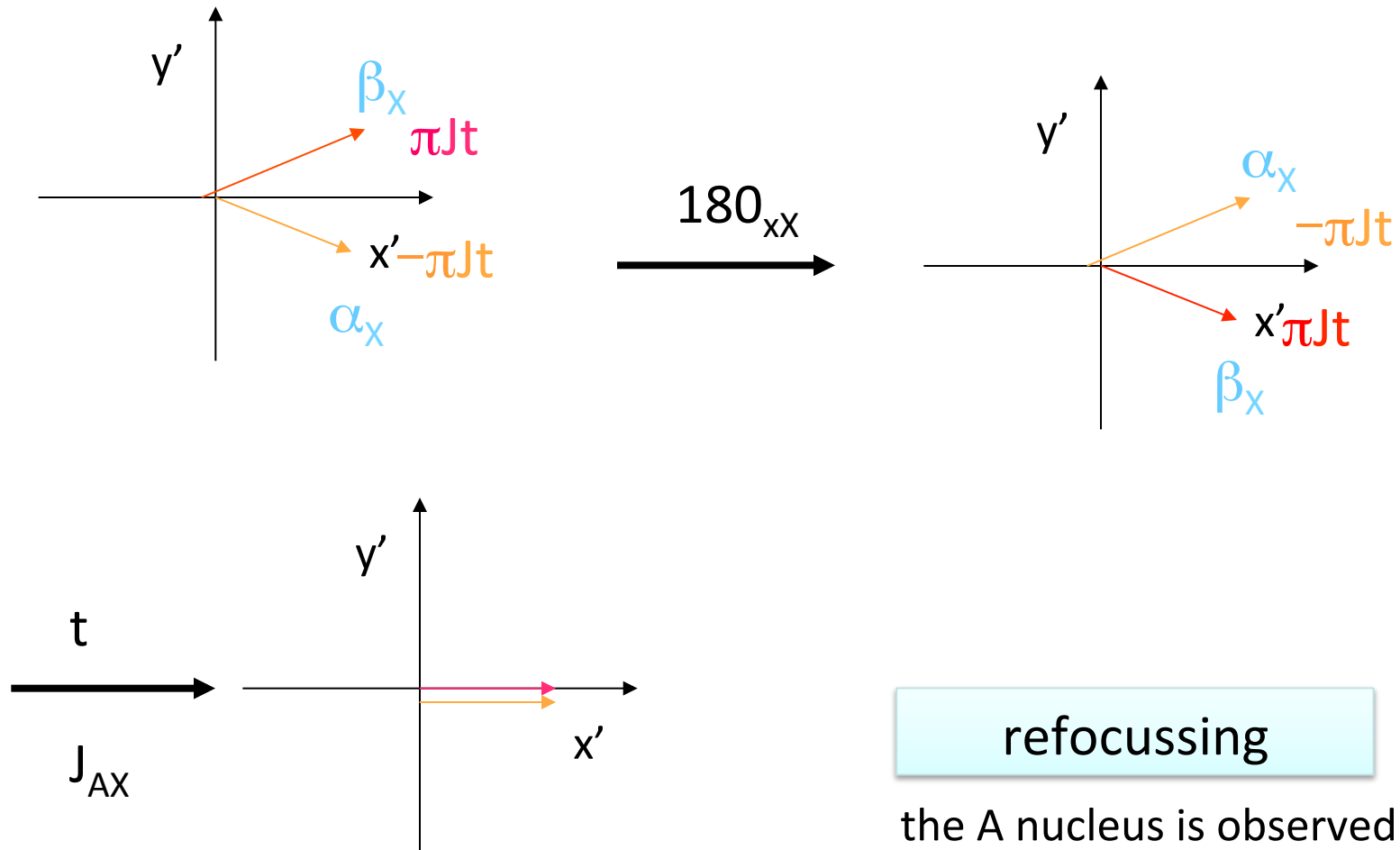
refocussing

## Homonuclear AX System with a $\pi$ Selective Pulse for A

is equal to the heteronuclear pulse and  
occurs

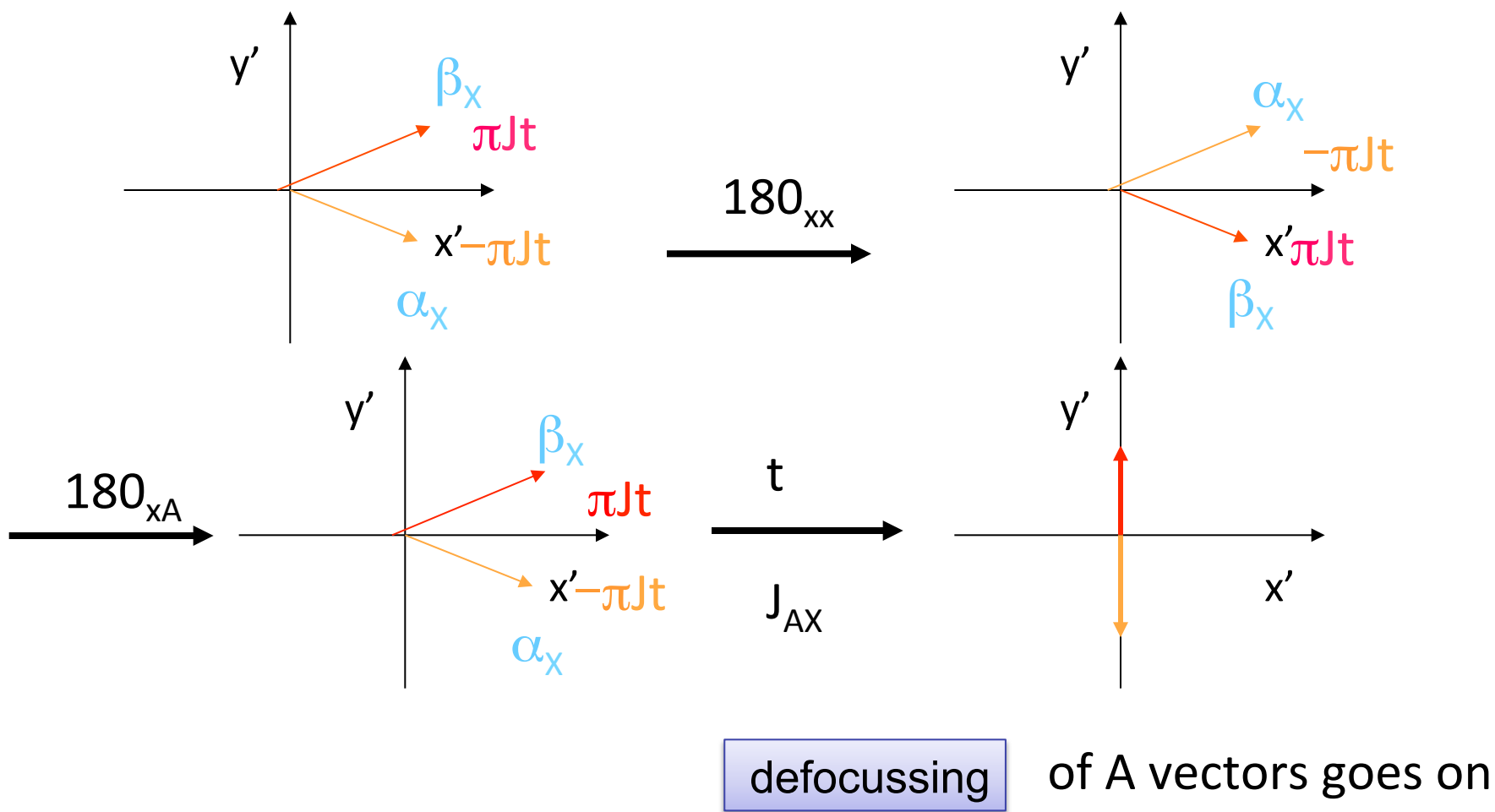
refocussing

# Homonuclear AX System: Selective $\pi$ Pulse for X

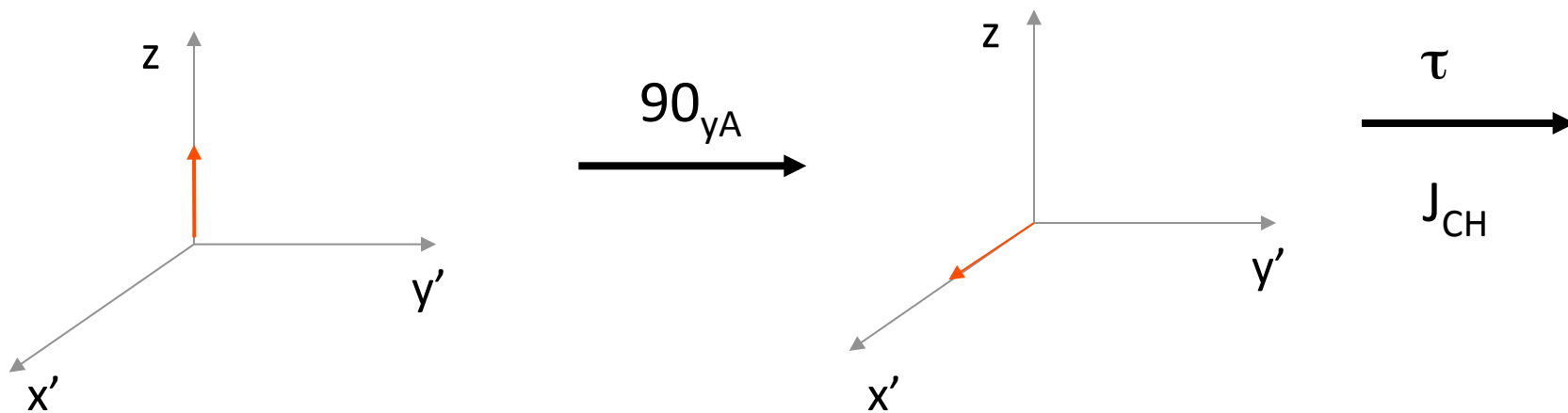
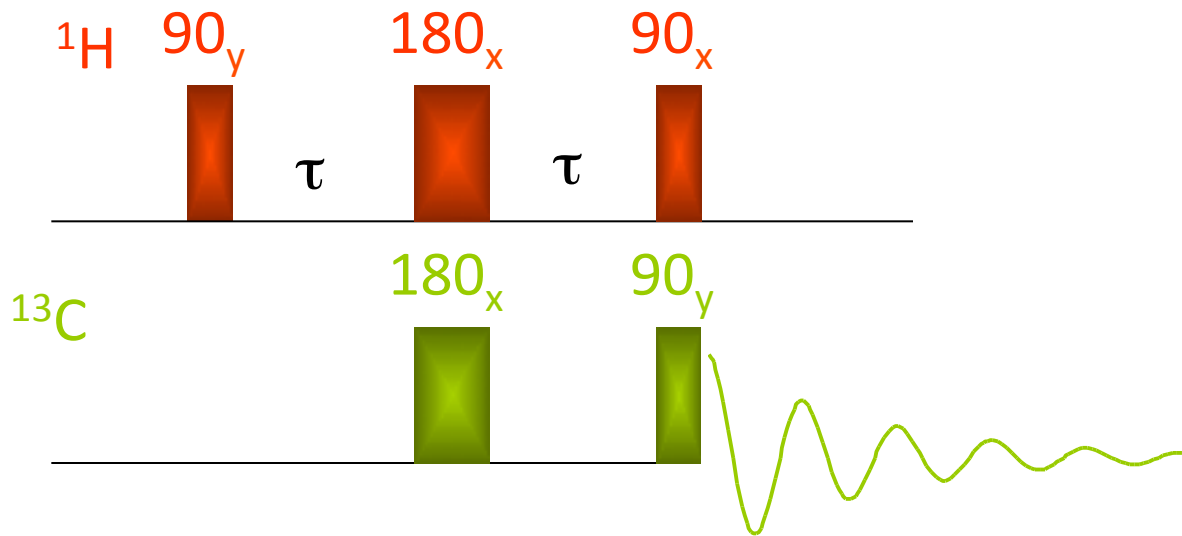


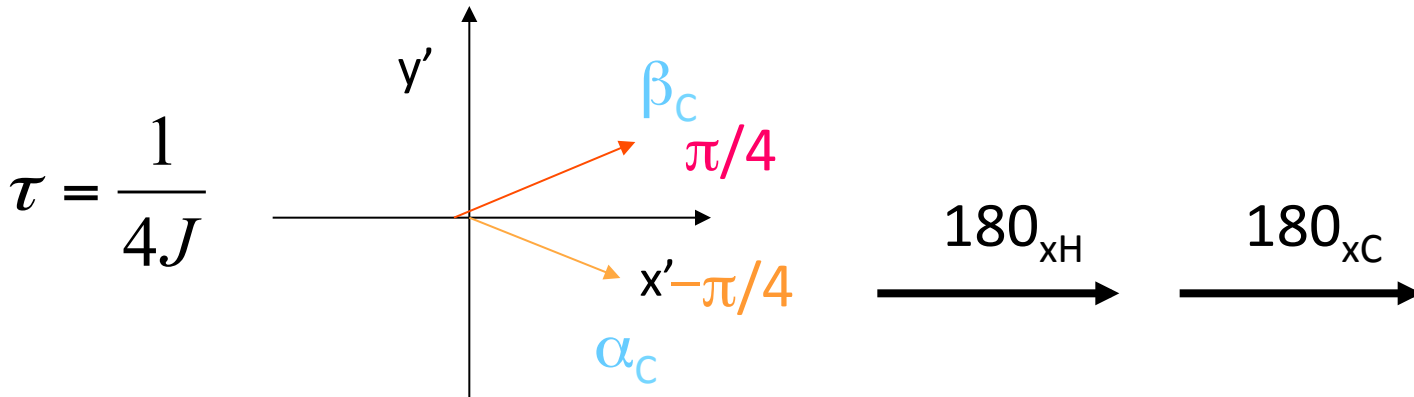


# Homonuclear AX System Non Selective $\pi$ Pulse

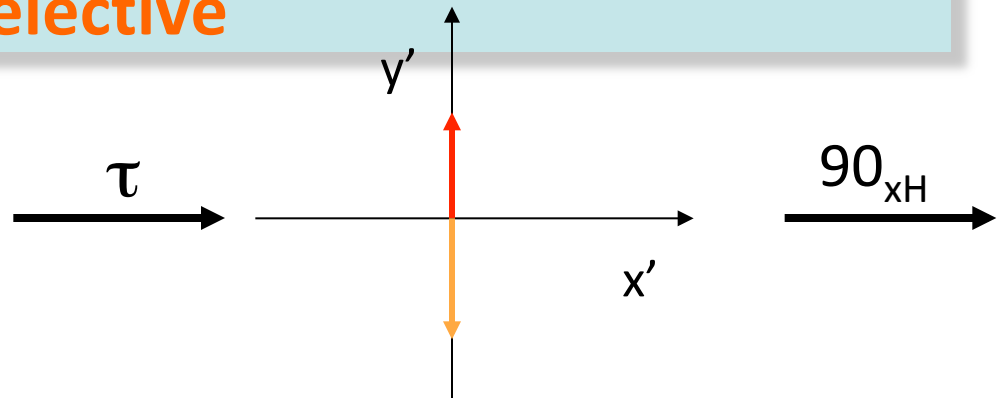


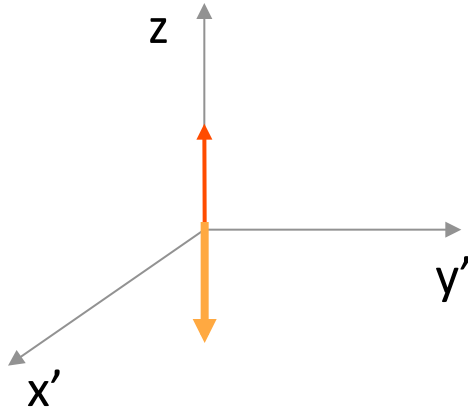
# INEPT





- the overall effect of both  $\pi$  pulses on H and C is that of a non selective  $\pi$  pulse on a homonuclear system
- the defocussing continues, but the chemical shifts of protons are refocussed, thus the sequence is **not selective**





The inversion of one component of the doublet has been accomplished for all protons, independently of their chemical shifts

Soon after, the  $^{13}\text{C}$  signal is acquired. The  $^{13}\text{C}$  spectrum displays the gain in intensity originated by the polarization transfer through bonds

in this case the signal increment

for  $^{13}\text{C}$  is 4

for  $^{15}\text{N}$  is 10

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

irrespectively of the motional regime