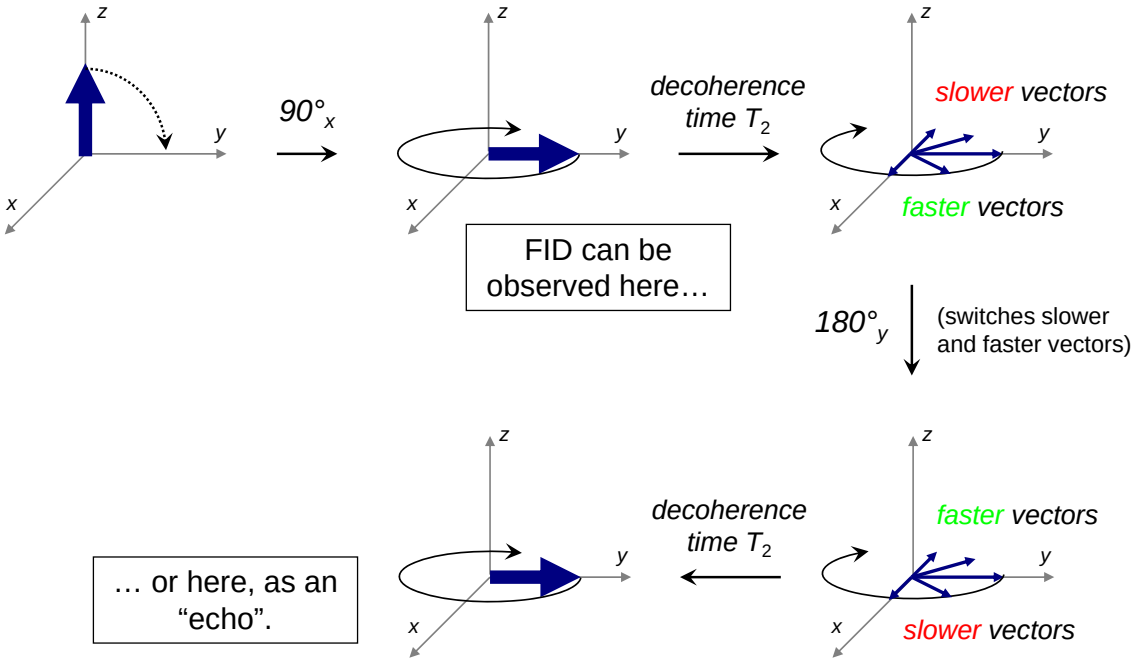
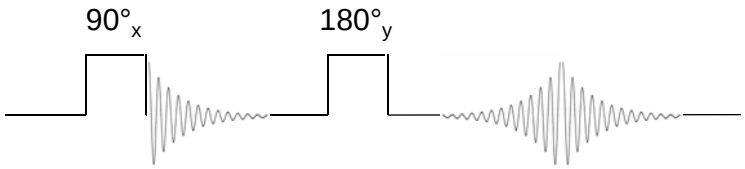
# Spin-Echo Methodology



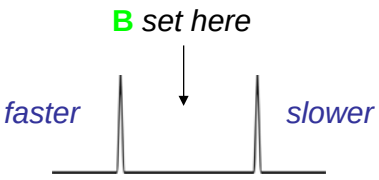

# Spin-Echo Methodology

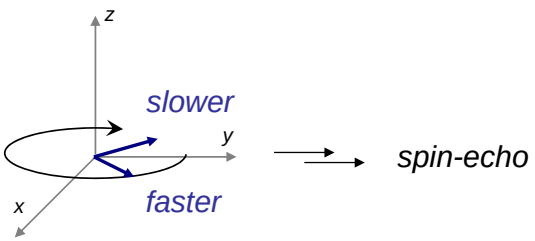



*normal FID*

*“spin-echo”*
*(recoherence)*

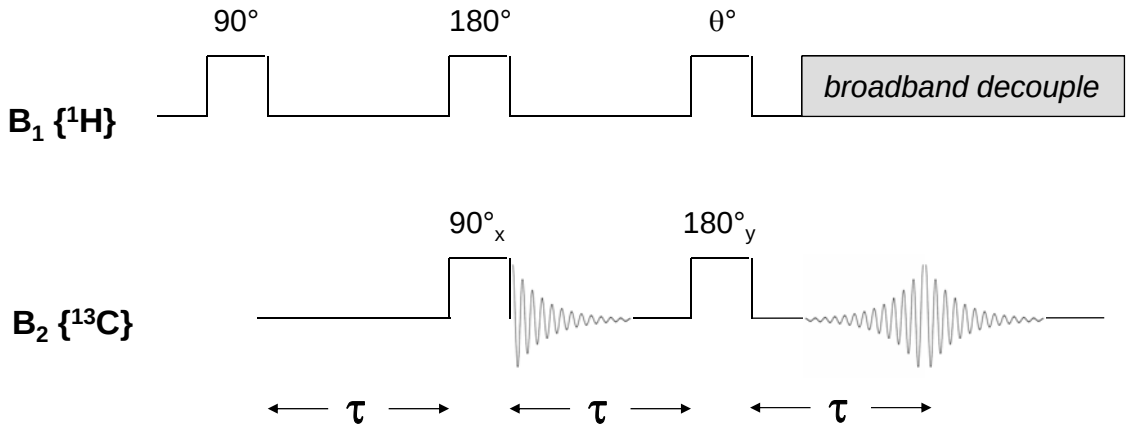
Also occurs with multiplets:



# Applying Spin-Echo: Dimensionless Enhancement by Polarization Transfer (DEPT)

- Spin-echo applied most frequently to $^{1}$H-coupled, $^{13}$C spectra.
- Multiplets in coupled $^{13}$C NMR correspond to number of attached protons: singlet (C); doublet (CH); triplet ($CH_2$); quartet ($CH_3$).





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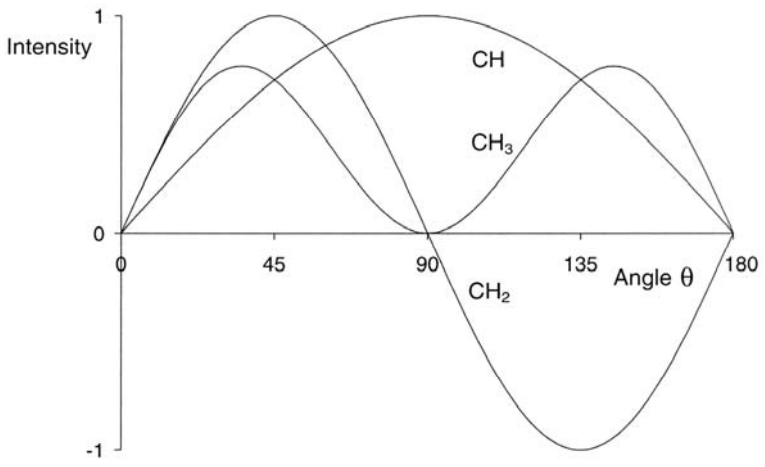
- Different multiplets in $^{13}$C give different spin-echo intensities with different pulse angles θ. (Details of how spin-echo is done in this case are not important.)



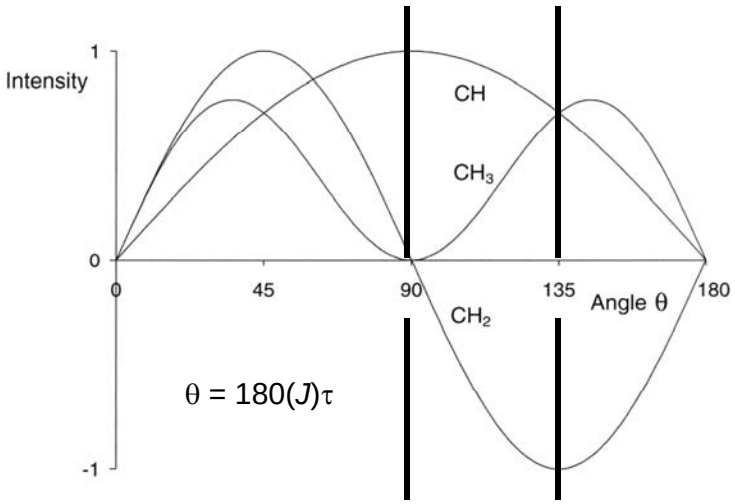
# Applying Spin-Echo: Dimensionless Enhancement by Polarization Transfer (DEPT)

DEPT-135 Intensities:

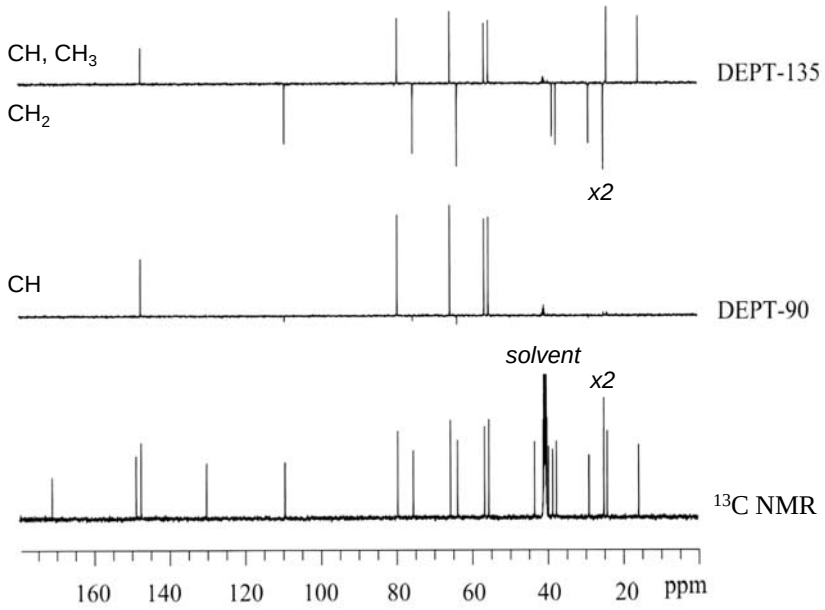
$CH_3$: **+**
$CH_2$: **-**
CH: **+**
C: **0**

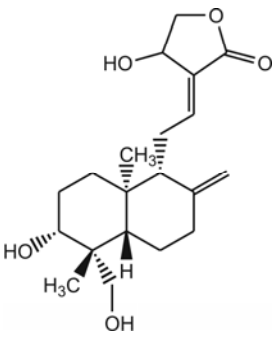
DEPT-90 Intensities:

$CH_3$: **0**
$CH_2$: **0**
CH: **+**
C: **0**



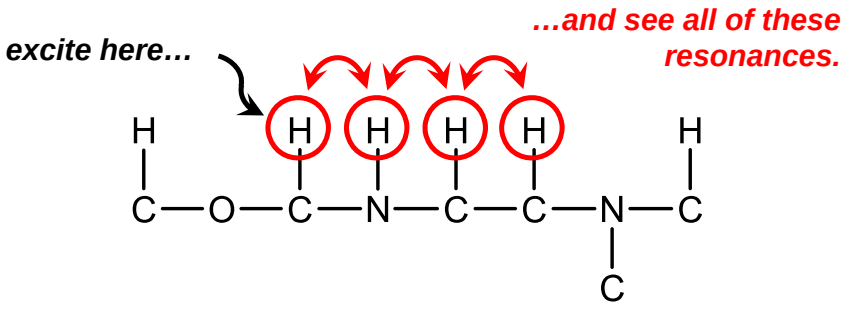

# DEPT Example



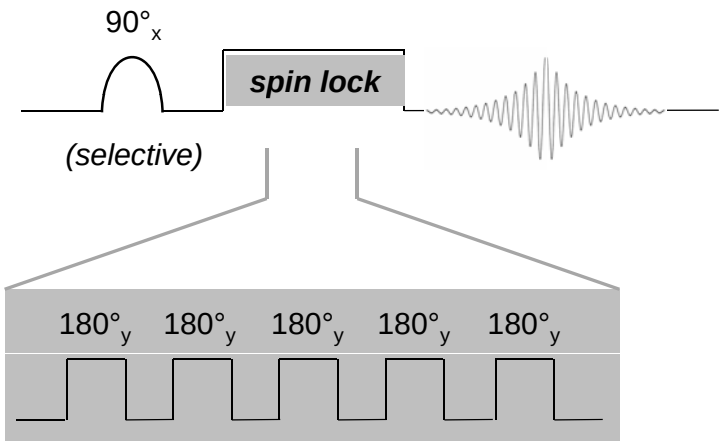
# Total Correlation Spectroscopy (TOCSY)

Irradiation of a resonance under ***spin lock*** leads to excitation of all resonances in a coupled chain.




***Spin lock:*** A series of 180°, spin-echo pulses designed to transmit coherence excitation via scalar coupling.

# Spin Locking in TOCSY




180° pulses maintain spin echo, while transmitting excitation via coupling.

# Selective 1D TOCSY

Similar to 2D TOCSY (which you'll learn about later), but involves single-frequency irradiation.

Experimentally cheaper than 2D for medium-sized molecules.