

Combining Shaped Pulses and Gradients

- A 90° Selective Pulse Gives Poor Results – Gradients Can Improve Selectivity and Peak Shape
- “Gradient Echo” Destroys NMR Signal and Brings it Back Again:
 - A Gradient “Twists” the Net Magnetization into a Helix from Top to Bottom of the Sample
 - A Second Gradient of Opposite Sense (Lower Field at Top of Sample) “Untwists” the Net Magnetization

$$90^\circ - G_z - -G_z - \text{FID}$$

- A 180° RF Pulse Between Gradients Reverses the Sense of the Helix, so the Second Gradient Must be of the Same Sign as the First to Untwist:

$$90^\circ - G_z - 180^\circ - G_z - \text{FID}$$

- If the 180° RF Pulse in the Center is Missing, the Second Gradient Doubles the Twist and No Signal Is Observed in the FID