

2D COSY (Correlation Spectroscopy)

- ^1H to ^1H Correlation via J Coupling
- Homonuclear Experiment: $F_2 = ^1\text{H}$, $F_1 = ^1\text{H}$
- Diagonal Line at $F_2 = F_1$ Shows the 1D ^1H Spectrum
- Crosspeaks are Symmetrical on Both Sides of Diagonal
 $F_2 = H_a, F_1 = H_b$ and $F_2 = H_b, F_1 = H_a$
- Crosspeak Intensity is Proportional to J Value
- J Can Be Due to All Types of Coupling Relationships:
 - Vicinal (3-bond): $\text{H}_a\text{-C-C-H}_b$
 - Geminal (2-bond): $\text{H}_a\text{-C-H}_b$
 - Long-Range (4-5 bond): $\text{H}_a\text{-C=C-C-H}_b$, Aromatic
“*meta*” Coupling, “W” Coupling
- DQF-COSY (Double-Quantum Filtered) Is the Modern Version: Cleaner, Weaker Diagonal, Less “Streaks”
 - Gradients Can Be Used to Enforce the “DQ Filter”
- COSY Can Be Used to “Walk” Through a Spin System
- COSY Crosspeaks Are Positive and Negative (Antiphase)
- Fine Structure of Crosspeaks Contains J Value Information: Active Coupling is Antiphase