2D COSY (Correlation Spectroscopy)

- $^1$H to $^1$H Correlation via J Coupling
- Homonuclear Experiment: $F_2 = ^1$H, $F_1 = ^1$H
- Diagonal Line at $F_2 = F_1$ Shows the 1D $^1$H 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): $H_a$-C-C-$H_b$
  - Geminal (2-bond): $H_a$-C-$H_b$
  - Long-Range (4-5 bond): $H_a$-C=C-C-$H_b$, Aromatic
    “meta” Coupling, “W” Coupling
  - 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