CH-314 Structural Analysis
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Jigsaw 3C

1. [Week 3 Slides 65-74] Consider the EXSY spectrum of a symmetrical 2 spin (A and B) system. The intensity of the four peaks are given by the following equations:

$$I_{AA}(\tau_m) = \frac{1}{2}[1 + \exp(-2k\tau_m)]\exp(-\tau_m/T_1)M_{A0}$$
$$I_{BB}(\tau_m) = \frac{1}{2}[1 + \exp(-2k\tau_m)]\exp(-\tau_m/T_1)M_{B0}$$
$$I_{AB}(\tau_m) = \frac{1}{2}[1 - \exp(-2k\tau_m)]\exp(-\tau_m/T_1)M_{B0}$$
$$I_{BA}(\tau_m) = \frac{1}{2}[1 - \exp(-2k\tau_m)]\exp(-\tau_m/T_1)M_{A0}$$

   a. Draw the 2D EXSY spectrum, taking into account the relative intensity of diagonal and cross peaks, at the following values of $k\tau_m$:

i. $k\tau_m = 0$ ii. $k\tau_m \ll 1$ iii. $k\tau_m \approx 2$ iiv. $k\tau_m \gg 2$

   b. For each plot in (a), explain what is happening to the peak intensity and why.

   c. 2D exchange spectroscopy is used to determine exchange in which motion regime? Explain why.

2. [Keeler Section 4.5] A spectrometer operates at a Larmor frequency of 500 MHz for ^{1}H and hence 125 MHz for ^{13}C. Suppose that a 90° pulse of length 8 μs is applied to the proton nuclei. Does this have a significant effect on the ^{13}C nuclei?