

A Hands on Introduction to NMR

22.920

Lab and Problem Set #3

Magnetization Gradients, k-space and Molecular Diffusion

1. Record a high resolution spectrum of water, and then repeat the measurement in the presence of a z-gradient. knowing that the length of the rf coil is 13 mm, calibrate the gradient field and comment on the line-shape.
2. Repeat the above measurement for and x-gradient (using the shim coils), why is the line-shape different?
3. Using the gradient coils, observe a gradient echo. If you fourier transform this, there is a modulation, where does this originate from? Notice that a simple magnitude calculation returns the correct spin density projection.
4. Change the sample to chloroform and shim reasonably well. Compare the height of the gradient echo to the decay envelope of the FID, for a gradient echo in a 10 G/cm gradient with a 200 ms echo time. From this estimate the diffusion constant.
5. Why do we use a gradient echo to measure the diffusion constant and not the variation in the shape of the FID with a gradient on?

6. What is meant by a magnetization grating?