

# NMR Prelab

1) What are  $T_1$  and  $T_2$ ? Why are they important values to know when conducting NMR experiments?

$T_1$  is the time it takes for energy from spin to be lost to the surrounding areas.

$T_2$  is the time it takes for precessing nuclei to fall out of sync with one another, at which point they stop producing a signal.

We need to know  $T_1$  because the system should reach equilibrium between pulses, which means we need to allow a time at least  $T_1$  between pulses.

$T_2$  can also be thought of as the time it takes for the plane in which the observed particles are in to demagnetize. It is always less than or equal to  $T_1$ . This relates to the state of the material as well as the time we would use in a spin-echo pulse measurement.

2) What affects  $T_1$  and  $T_2$  time lengths?

$T_1$  is determined by measuring the magnetization as a function of delay time; this function also requires the equilibrium magnetization.

$T_2$  is determined by measuring the x-y magnetization as a function of delay time; this function also requires the equilibrium magnetization.

$T_1$  and  $T_2$  are dependent both on the material and its state.  $T_1$  is also dependent on the composition of the sample's surroundings, as well as the sample and its surroundings' temperatures. Electric fields may also affect  $T_1$ .

3)  $T_1$  is longer than  $T_2$  because  $T_1$  is affected by other nuclei, but  $T_2$  deals only with forces within a singular nucleus.

4-7) are after data has been taken.