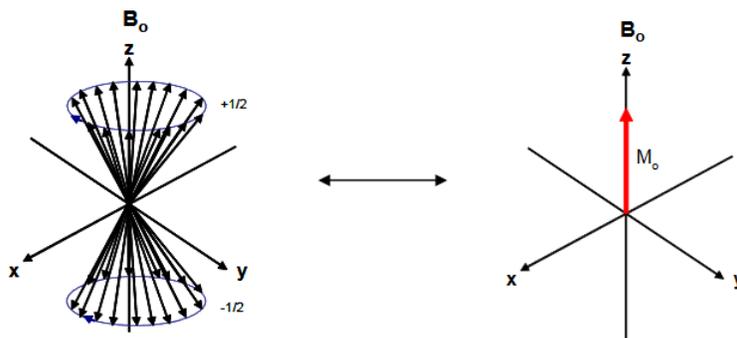


## 1.6: How does precession generate the macroscopic magnetization ( $M_0$ )?

If we now examine what we would expect for an ensemble of nuclei, the magnetic moments of the  $+\frac{1}{2}$  spins will be aligned with the applied magnetic field, while the moments of the higher energy  $-\frac{1}{2}$  spin state will be opposed to  $B_0$ . However, all the spins in our sample will be precessing randomly about  $B_0$  at their Larmor frequency as illustrated in the figure below. Because slightly more of our nuclei are in the lower energy  $+\frac{1}{2}$  spin state, if we take the vector sum of all the magnetic moments we will realize a single vector pointing in the direction of the applied magnetic field called the macroscopic magnetization,  $M_0$ . The macroscopic magnetization then provides a way to visualize the population difference of our spins. It is this macroscopic magnetization vector that is manipulated in the NMR experiment.



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