

# MRI Physics Basics

## Nuclear magnetic resonance

Hydrogen protons align in magnetic field

## Gradient fields

Spatial encoding of signal

## K-space

Frequency domain data representation

## Relaxation times (T1, T2)

Tissue-specific signal recovery

## Signal equation

$$S \propto \rho \cdot (1 - e^{(-TR/T1)}) \cdot e^{(-TE/T2)}$$

### No Magnetic Field



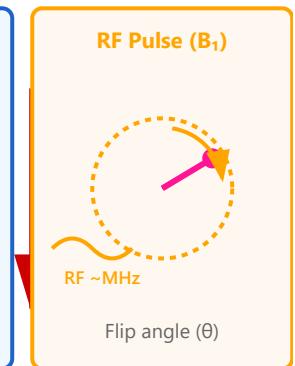
Random orientation

### B<sub>0</sub> Field Applied



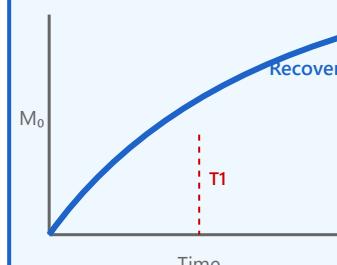
Net magnetization M<sub>0</sub>

### RF Pulse (B<sub>1</sub>)



Flip angle ( $\theta$ )

### T1 Relaxation



### T2 Relaxation

