A review of the basic physical principles underlying MRI. The origin of nuclear magnetism and the concept of resonance will be introduced. Basic methods for manipulating nuclear magnetism using radio frequency magnetic fields, as used in nMR instruments, will be presented. Simple calculations using the Larmor equation and gyromagnetic ratio will be related to RF excitation and RF detection of spin populations. Relaxation processes, T1 and T2, will be introduced. Dependence of T1 and T2 on magnet field strength and temperature will be presented.

Educational objectives:

This lecture is designed to introduce the clinical medical physicist to the basic physical principles underlying MRI.

Upon completion of this lecture, participants will be prepared to:

1. Describe the origin of nuclear magnetism
2. Site examples of resonant phenomena
3. Apply the Larmor equation and gyromagnetic ratio in simple examples
4. Use simple models from classical mechanics and quantum mechanics to describe MRI phenomena
5. Describe a simple nMR RF excitation and RF detection experiment
6. Describe two basic relaxation mechanisms inherent to MRI
7. Predict changes in T1 that occur with magnetic field strength and temperature